

The Language of Botany

C.Debenham

The Language of Botany

..... has evolved through a history of changing viewpoints. In infancy, the phase of pure description of plants, an education in classical Latin seemed a necessary prerequisite for its following. As the other sciences gave to botany meaningful purpose, so developed a vocabulary staggering in its proportion.

Since observation, experiment, and interpretation are the real tenets of a science, time lost in misinterpretation of its language is indeed regrettable. In communication, a frequent omission by the communicant is failure to explain the meaning of a term used in context on the basis that, in his opinion at least, the term is one 'everyone knows'. To ensure that the meaning of elemental terms can be known by readily available reference, is an aim of this present work.

Because of the need for selection among many thousands, the choice of terms must be arbitrary. However, the selection is based on the author's own reading over many years. Additionally, some attention has been given to the stems of taxonomic names. Again, a selection is necessary.

To the printer and proof reader for their conscientious handling of a difficult manuscript, an expression of appreciation is due. For his enthusiasm, patience, and ability to prepare for publication, special appreciation is due to the editor, Mr. W. Payne.

C.Debenham

a:-. an- Gk.: as in **abiogenesis, asexual, anhydrous**, not; without.

-a: a suffix with several uses, e.g. in such latin nouns as **alga, gemma**, and latinised nouns as **cypsel**a (from Greek **kypsele**), the suffix indicates singular number, feminine gender. When the plural of such nouns is intended, **-ae** substitutes for **-a** (hence **algae, gemmae, cypselae**). When forming the plural of a noun suffices by **-a** but of direct origin from the Greek (e.g. **chromonema, sterigma, stoma**), **-ata** is often the substitute suffix (hence **chromonemata, sterigmata, stomata**).

For nouns suffixed by **-um** to indicate neuter gender, singular number (e.g. **bacterium, flagellum, sporangium**), a substituted **-a** forms the plural (hence **bacteria, flagellus, sporangia**). For the nomenclature of taxonomic groups at the levels of division and class, the name-endings recommended by the International Code are **-phyta** and **-opsida** (e.g. Division **Pteridophyta**, Class **Pter(id)opsida** of conservative classifications), the names being treated as neuter plural.

As an ending to a generic name (a noun in singular number) and a specific epithet (an adjective qualifying the noun) when in agreement in gender, **-a** indicates the feminine, e.g. **Angophora costata**.

ab- (abs- before c and t): L.: as in **abaxial, abscendens, abscise**, away, remote from.

ABAXIAL: remove, or turned away, from the axis. cf. adaxial.

ABERRANT: differing from the normal; atypical.

ABORTIVE: undeveloped; imperfectly developed.

abr(os) Gk.: as in **abrophyllum**, soft; delicate.

ABRUPT: cut off sharply; truncate.

ABRUPTLY ACUMINATE: with an obtuse apex from which arises a point.

ABRUPTLY PINNATE: of a pinnate leaf (q.v.) when ending with a pair of leaflets. Paripinnate. cf. unequally pinnate; imparipinnate.

ABSCISSION: the falling away or separation of a part from the parent of supporting structure. **Abscission later**: a layer formed by one or more series of cells which initiate abscission through their rupture or dissolution. **Abscise**: to undergo abscission. **Abscissile**: relative to, or undergoing, abscission.

ABSORPTION: of a substance or form of energy, the taking-up, or taking in, by a substance, e.g. the uptake of water and mineral solute from the soil by a root-system, the intake of quanta or light by chlorophyll. **Absorption spectrum**: see under light.

ABUNDANCE: for the structure of a community, the relative frequency of a component, the qualitative degree usually expressed as abundant, frequent, common, occasional, rare, very rare.

ABYSSAL: of the lowest depths of the ocean, i.e. below 300 fathoms (1800 feet). Also abysmal. From Gk. **abyssos**, unfathomed.

ac- (before c and q) L.: as in **accedens**, towards; near.

ACANACEOUS: relative to, or like, prickles; prickly. From Gk. **akanos**, a thistle.

acanth(a) Gk.: as in **acanthifolia, acanthocarpus, acanthus**, a prickle or spine.

ACAULESCENT: with a stem developing so slowly as to appear stem-less or almost so.

ACAULINE: without a stem; stemless.

ACCESSORY: additional or supplementary to.

ACCESSORY BUD: a bud accessory to the normal axillary bud, capable of developing as an accessory shoot when the normal bud is inhibited in growth or destroyed.

ACCESSORY FRUIT: a fruit possessing a part accessory to the matured gynaecium, e.g. the capsule of a eucalypt which has a hardened receptacle accessory. Also composite fruit.

ACCLIMATIZATION: a process through which, by cross-breeding and modification of its genetic system, a species attains tolerance to a changed environment (i.e. acclimatizes). Also acclimation.

ACCRESCENT: increasing in size with age, as fruit and floral parts when enlarging after or during the flowering period.

ACCRETION: of growth, the addition of new layers to already existing layers.

ACCUMBENT: leaning or turned towards a structure. cf. incumbent. Of cotyledons when their edges are turned towards the axis of the embryo.

-aceae, -aceae, -aceus, etc. L.: suffixes indicating an adjective, as in **herbaceous**, **acinaceous** (relative to, or resembling). In the compounding of a name for a family from the name of its type genus, the suffix **-aceae** indicates a plural adjective, e.g. (**Plantae**) **myrtaceae**, myrtus-like plants. The m=name **Myrtaceae** (and other names of families so-derived) is taken, however, as a plural noun, i.e. The **Myrtaceae** include the eucalypts, tea-trees, etc. As a suffix of epithets, the adjective, e.g. acinaceous, in singular number and agreeing with the gender of the generic name becomes **acinaceus** (when masculine), **acinacea** (feminine), **acinaceum** (neuter).

acer L.: sharp; biting to taste. Masculine gender (Feminine **acris**; neuter **acre**).

ACEROSE: pointed or shaped like a needle.

ACERBATE: occurring in a mass.

acet(um) L.: as in **acetyl**, vinegar (hence the radical $\text{CH}_3\text{CO}-$ of acetic acid).

ACHENE: a dry, indehiscent, one-seeded fruit with a leathery or membranous pericarp, formed from a superior monocarpellary ovary. From Gk.: **a**, not; **chainein**, opening.

ACHENIAL FRUIT: a dry, indehiscent, one-seeded fruit including the achene, caryopsis, cypsela, samara, nut, utricle.

ACHLAMYDEOUS: of a flower when not developing a perianth.

ACHLOROPHYLLOUS: without chlorophyll, as a non-green tissue or plant.
achn(e) Gk.: as in **achnophora**, a chaff or husk.

ACHROMATIC: in general, without colour. Of a lens system when corrected so that there is minimum dispersal of light into its component wavelengths (chromatic aberration) registered as colours.

ach(u)r(on) Gk.: as in **achyranthes**, chaff.

acicul(a) L.: as in **acicular**, **aciculate**, **aciculare**, a small needle.

ACICULAR: pointed, like a needle.

ACICULATE: finely striated by minute, needle-like bristles (**aciculae**).

ACID: in general, a substance capable, on solution in water, of forming hydrogen ions (or strictly hydroxonium ions H_3O^+ from an instant combination with molecules of water), and in a chemical reaction capable of donating one or more positively-charged ions (protons), the proton-acceptor being a base. From L.: **acidus**, sour. See also amino acid, fatty acid, nucleic acid, organic acid.

ACIDITY: the degree to which a substance in solution dissociates its hydrogen ion (H^+) the content, the gradient expressed in values of pH scale which decreases numerically from 7.0 (at neutral) towards zero with an increase in the degree of acidity.

ACIDOPHILOUS: preferring or tolerating acid soils or acidic conditions.

ACID SOIL: a soil which, when forming a suspension in water, gives an acidic reaction (from 6.0 to barely below 4.0 on the pH scale) due to the dissociation of hydrogen ions in excess adsorbed by its clay fraction. Factors determining this excess include nature of the parent rock, e.g. quartz or silica from granite or sandstone, leaching of bases by excessive rainfall or water, effect of certain fertilizers such as ammonium sulphate. See also krasnozem, lateritic, podzol.

ACINACEOUS: curved or shaped like the short sword of the orient, a scimitar. Also acinaciform.

acoce Gk.: as in **spermacoce**, a point.

aconiti- Gk.: as in **aconitifolium**, of the monkshood **Aconitus napellus** (the generic name derived from Acone, an ancient town when once plentiful).

ACQUIRED CHARACTER: a non-hereditary character acquired as a direct response to the environment, e.g. the cushion habit adopted by certain plants perpetually exposed to strong winds.

acris L.: sharp; bitter in taste; acrid. Feminine gender.

acr(os) Gk.: as in **acrogenous**, a tip or point.

ACRODROMOUS: of venation when the veins unite at the apex of leaf.

ACROGENOUS: developing at the tip.

ACROPETAL: of development when directed from a lower to a higher level of an axis, as in a racemose inflorescence where the latest-formed flowers are at or closest to the tip of the shoot.

actin(is) Gk.: as in **actinophylla**, a ray (hence with ray-like or radiating leaves).

ACTINIC: in general, relative to a radiation. Of the rays of sunlight.

ACTINODROMOUS: of venation when the veins radiate from the base of the leaf.

ACTINOMORPHIC: radially symmetrical, i.e. regular in all planes passing through the centre. cf. zygomorphic.

ACULEATE: furnished with prickles; prickly.

ACUMINATE: with the apex acute and tapered to a point.

ACUTE: with the apex forming a sharp angle. cf. obtuse.

ad- L.: as in **adpressus**, to; near.

-ad: as in **dyad**, **tetrad**, a group of (two and four respectively). **Monad:** a unit.

ADAPTATION: a feature, usually in the nature of a modification in structure or condition of growth effected by some physiological factor, of value in surviving the conditions of the environment.

Such a feature may be fixed genetically and hence, of organic evolution, also the process of acquiring, through natural selection, adaptive features.

ADAXIAL: adjacent to, or turned towards, the axis, as the upper surface of a leaf in relation to the stem, cf. **abaxial**.

ADELPHOUS: of stamens when grouped in bundles, or of filaments when coherent. **Adelphy**: the condition of adelphous stamens.

aden Gk.: as in **adenophora**, a gland (hence bearing a gland or glands). **Adenoid**: gland-like.

ADHERENT: attached to, but not fused with, another part of unlike kind. cf. coherent. **Adhesion**: the adherent condition.

ADIABATIC: relative to the vertical displacement of air without loss or gain of heat.

adiant(os) Gk.: as in **adiantum**, dry.

adin(os) Gk.: as in **adina**, clustered.

ADNATE: fused (organically united) with another part of unlike kind from the beginning of its inception, e.g. the ovary of a eucalypt fused with its receptacle. **Adnation**: the adnate condition.

ADP: adenosine diphosphate. See under phosphorylation.

ADPRESSED: pressed against; in close contact with.

ADSORPTION: of particles, their attraction to (by physical or chemical forces), and adhesion on, the surface of a solid or liquid, usually as a monomolecular layer, e.g. the adsorption of mineral ions by colloids of humus-rich soils.

ADUNCATE: hooked; bearing a hook-like process.

adjust(us) L.: scorched.

advect(us) L.: as in **advection**, carrying away; conveying (hence the horizontal transfer of energy (e.g. thermal energy) in the atmosphere.

ADVENTITIOUS: arising from a source additional or incidental to regular order.

ADVENTITIOUS ROOT: a root when not produced by the direct and persistent elongation of the radicle of the embryo (as in the primary or tap root typical of dicots and gymnosperms). A secondary root (system) formed adventitiously.

ADVENTIVE: of distribution or dispersal of a plant when introduced to a locality, as (e.g.) an escapee from cultivation. Also (as a noun) a plant when so incidentally dispersed.

-as L.: as in **algae**, **cypselae**, **gemmae**, a suffix indicating the plural of a feminine noun. Also in common use as a suffix indicating a taxonomic group at the level of a class, e.g. **angiospermae** of division **Spermatophyta** or, in more modern systems, classes **Dicotyledonae** and **Monocotyledonae** of division **Anthophyta**.

aegi-: as in **aegiceras**, of a goat. From Gk. **aix**. (hence appearing like a goat's horn).

aemul(us) L.: emulating; comparing with.

AEOLIAN: brought or formed by the action of atmospheric wind.

aer L.: as in **aerosol**, the atmosphere or air (hence a dispersion or suspension of colloidal particles in air).

AERATION: the exchange or circulation of air. For many plants, a poorly aerated soil is a limiting factor of growth, a correction possible when the air (highly charged, e.g. with carbon dioxide) is exchanged by air at an optimum in content of oxygen.

AERENCHYMA: a parenchymatous tissue with large intercellular spaces within which gases may be stored and diffused. A tissue frequent in aquatic plants and providing buoyancy, and in the roots of marsh plants providing an air supply.

AERIAL ROOT: a root normally exposed to the atmosphere, as one adventitious from a trunk (e.g. a prop-root) or a stem (as of epiphytes), or one projected above soil-level (e.g. a pneumatophore).

AEROBIC: in the presence of gaseous or molecular oxygen. **Aerobe:** an organism requiring aerobic conditions for growth, i.e. obtaining energy from the oxidation of organic or inorganic compounds with oxygen as the oxidising agent. cf. anaerobic, anaerobe.

AERUGINOSE: with the colour of verdigris (the basic carbonate, chloride, or acetate of copper), i.e. blue-green. From L. **aerugo**.

AESTIVAL: relative to the season of summer. From L. **aestivus**, of summer.

AESTIVATION: of morphology, the arrangement of floral parts (sepals, petals) within bud in regard to the placement of the individual parts considered independently, and the placement of the parts of the one series in relation to one another. Of ecology, dormancy through summer drought.

affine, affinis L.: showing relationship; neighbouring.

AFFINITY: of taxa, a relationship based on either phenotypic or genotypic similarities.

AFTER-RIPENING: of seed-dormancy, a process necessary for the completion of certain metabolic changes before germination is possible. See also stratification.

ag- (before g) L.: as in **agglomerate, agglutinate**, to, near to.

AGAMOSPERMY: see under apomixis.

agast(os) Gk.: **agastachys (aga(sto) stachys)**, admirable.

agath(os) Gk.: as in **agathosma, agathosmoides**, pleasant; good.

AGGLOMERATE: clustered together.

AGGLUTINATE: adhered in a mass by some glutinous (sticky) substance, as of certain pollen grain.

AGGREGATE FRUIT: see under fruit.

AGGREGATION: of soil, the cohesion of particles to more or less distinct units, soil aggregates.

-ago L.: as in **medicago, ventilago**, likened to, or connected with (hence **medica**-like, **medica** being the Latin name of a lucerne or a clover, and connected with the wind respectively). Feminine gender.

agari(us), agrest(is) L.: as in **agrarian, agrestal**, rural.

ago(os) Gk.: as in **agropyron**, field or land (hence **agros**, field; **pyron**, wheat: field what, i.e. 'wild wheat').

AGRICULTURE: the science and art of utilizing soil for the production of field crop or, as in 'farming from the sea or tidal water', other produce. The rearing of cattle and other livestock (animal husbandry) usually is considered part, as also certain aspects of horticulture (q.v.).

AGRONOMY: the science concerning the economic aspects of agriculture as, e.g. the productive potential, management and utilization of soils and crops.

AGROPHILOUS: of plants when developing in pastures or on agricultural land but not as sown crops.

agrost(is) Gk.: as in **agrostis**, **agrostifolia**, grass.

AGROSTOLOGY: the science of the grasses, especially from the aspect of their establishment and management as pastures.

agyr(is) Gk.: as in **agyrophylla**, a cluster.

ALATE: bearing a flattened, wing (ala)-like expansion, as a stem or seed with a prominent ridge or crest. e.g. the stem of **acacia alata** where each phyllode forms a decurrent wing.

albat(us) L.: clothed in white.

albic(o) L.: as in **albicans**, to become white.

albid(us) L.: whitish; somewhat white. Also **albul(us)**.

alb(us) L.: white.

ALCOHOL: an organic compound, a colourless liquid or solid, reactant with an acid to form an ester, having one or more of its carbon atoms linked with a hydroxyl (-OH) group, e.g. the simplest, methanol (methyl or wood alcohol) CH_3OH , ethanol (ethyl alcohol) $\text{C}_2\text{H}_5\text{OH}$ with single hydroxyl groups are aliphatic monohydric alcohols. Dependent on the positions of the hydroxyl group, may be primary, secondary, or tertiary, e.g. a primary alcohol has a $-\text{CH}_2\text{OH}$ and on oxidation yields an aldehyde, a secondary $-\text{CH}(\text{OH})$ group on oxidation a break-down product with fewer carbon atoms. When more than one hydroxyl group are concerned, the alcohol may be dihydric (the glycols), or trihydric (e.g. glycerol or glycerine $\text{C}_3\text{H}_5(\text{OH})_2$) or polyhydric. Aromatic alcohols occur, e.g. the simplest benzyl alcohol $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$, while much more complex are the many alcohols of essential oils, e.g. the terpenic derivatives menthol, geraniol, citronellol, terpineol.

When unqualified, usually indicates ethanol, of natural occurrence as a product of fermentation of carbohydrates by the yeasts of **Saccharomyces**. Industrially, grains (see cereal) and molasses (a by-product from the sugar industry) are the chief raw materials while further contribution is made by the sugars from the sulphate waste liquors of wood-conversion to cellulose or pulp.

ALCOHOLMETRIC: relative to the strength of aqueous solutions of (ethyl) alcohol, e.g. for purposes of customs and exise, the volumetric unit used for alcoholic beverages is the proof gallon, i.e. the amount of alcohol contained by a gallon of proof spirit, proof spirit being taken at 57.1 percent by volume at 60°F.

For industrial and scientific use, the mean concentration of the fractionated distillate is about 95 percent - this is rectified spirit or S.V.R. ('rectified spirit of wine'). Further rectification yields Absolute Alcohol at about 99 percent or better (according to its exposure to moisture of the air). When denatured by the addition of crude wood spirit (methanol) or other denaturant (hence tax free under special permit), rectified spirit yields methylated or industrial spirit (S.V.M.). Tax-free methylated spirits is about 90 percent of the rectified spirit together with wood alcohol and other adulterants (especially pyridine).

ALDEHYDE: an organic compound containing the group $\text{C}(\text{OH})$ linked directly with another carbon atom, e.g. acetaldehyde CH_3CHO which may be prepared by the oxidation (with chromic acid) of ethyl alcohol (hence the derivation of the term al(cohol) and dehyd(rogenation). May be aliphatic or aromatic, and usually a colourless liquid (formaldehyde, the simplest of the group, is a gas and otherwise atypical) with a characteristic odour.

-ale, -ales, -alis L.: suffixes indicating an adjective, e.g. the epithets **autumnale**, **occidentalis**, relative to. When terminating the type name of a family, as in **Myrtales**, indicates a plural adjective, relative to families (or a family) making up an order, and like the name of a family, is treated as a plural noun, e.g. **Myrtales**, the name of an order made up of families of which the family **Myrtaceae** is a member.

aleurites Gk.: of meal or flour (Gk. **aleurion**).

ALEURONE GRAIN: a granule of protein in certain endosperm, frequently (as in the grasses) dispersed in a localised aleurone layer.

ALGA: (plural algae) a plant which, although rarely differentiated to specialised organs and is in exchange with the environment by superficial diffusion of solutes and gases through unlocalised regions, utilises the energy from sunlight to a greater degree (especially as a component of pelagic plankton) and higher efficiency than the terrestrial plant, and has a physiology in most respects not fundamentally different from plants of higher organization. Its structure varies from a simple microscopic cell to the complexity of a higher seaweed.

In addition to light-fixing chloroplasts, other plastids, **chromophores**, usually provide accessory photosynthetic pigments, the colour often masking the green of chlorophyll. The accessory pigment is either a water-soluble, strongly fluorescent proteinaceous compound, **phycobilin**, or a **carotenoid** (q.v.) of an orange or yellow colour. Phycobilins include such pigments as the blue **phycocyanin** and the rose-red or violet-red **phycoerythrin**. The pigmentation is a heritable character, fixed early in evolution and possibly determined by the amount of light energy available to the ancestor at the time; it provides a most useful basis for classification.

Blue-green algae: mostly epiphytic plants of soil, fresh water, or seas (e.g. **Nostoc** and **Anabaena** of nitrogen-fixation, fresh water plankton and 'water-bloom'). When unicellular, may be solitary or form filamentous or plate-like colonies, and when multicellular usually forms filaments composed of ensheathed cells (trichomes). In addition to chlorophyll-a and certain carotenoids, the accessory pigment usually is **phycocyanin** but this may occur also with **phycoerythrin**, or the latter may occur alone; such pigments never and confined in chromatophores. The 'blue-greens' have certain features of some bacterial groups, e.g. a primitive nucleus, reproduction by amitotic cell division, food reserve a starch-like **glycogen**, enclosure of cells in a gelatinous sheath. In common also is the ability of certain members to reduce atmospheric nitrogen and to withstand temperatures intolerant to most other organisms.

In recent classificatory schemes, the position of the blue-green algae (as a class **Cyanophyceae**) is with the bacteria to form a division (**Schizophyta**). Among algae they are unique in the absence of a highly organised nucleus.

Red algae: in common with the 'blue-greens', the red algae have phycobilins as the pigments accessory to chlorophylls (the chlorophylls are a and d), usually **phycoerythrin** alone, less frequently phycocyanin with or alone, store a starch (floridean starch) chemically related to glycogen, and are without motile cells. Unlike them, most red algae are sexually reproductive and the pigments are always localised in chromatophores. Life cycles often are complex and unique (e.g. **Polysiphonia**, **Nemalion**), with a regular alternation of generations, the generations being almost identical: dioecism also is frequent. Essentially deep water members of tropical to polar seas, predominant of the seaweeds in Australian waters (see also nullipore), and some are littoral or above high tide limit where they attach to rocks by disc-like 'hold-fasts' or systems of hair-like rhizoids, while others are of fresh water (e.g. **Batrachospermum**). Fewer again are terrestrial, some of these endozoic. Many are epiphytic (e.g. on kelps) or epizoic (e.g. on hydroids). They range from microscopic and unicellular up to about 2 metres in length, the structure typically a multicellular thallus which may be a simple filament or (more usual) a frond flat or cylindrical, sometimes branched and shrub-like with a stem-like stipe. As sources of polysaccharides (**phycocolloids**) are of high economic interest. Phycocolloids disperse in water to form colloidal systems of use as emulsifying, gelling, and thickening agents. Chiefly **Gelidium** and **Gracilaria** spp. for agar, the well-known biological culture medium, **Chondrus crispus** (Irish Moss) and **Gigartina** spp. for carrageenin, **Iridophycus** spp. for iridophycin. As a food for human consumption, **Porphyra** spp. are well-known to the 'phycophages' of the orient.

Red algae are treated either as a division **Rhodophyta** or as a class **Rhodophyceae** according to the particular scheme.

Green algae: algae with chloroplasts grass-green from a predominance of chlorophylls a and b largely are of fresh or brackish water or moist soil, but quite a few are marine either as pelagic plankton or attached in the littoral zone. A cell wall of cellulose or pectin is usual, while starch is the principal reserve food. When unicellular, the structure may be simple and microscopic (e.g. **Chlorella**) or elaborately developed as in the marine **Caulerpa** where a creeping rhizome-like surculus of indefinite growth develops along its length geotropic rhizoids or holdfasts and assimilatory green fronds of diverse form. Again, the single cell (or coenocyte) may be bladder-like as in some **Codium**. When multicellular, single rows of cells may remain simple (as in **Spirogyra**) or branch as filaments (e.g. **Chaetophora**), or the filaments may unite laterally to form a single or double-layered membrane (as in the Sea Lettuce **Ulva**) or a simple (**Chaetomorpha**) or branched (**Cladophora**). Life cycles throughout show an alternation of generations which may be cytological, only the sporophyte conspicuous (e.g. **Codium**) and more a feature of those marine or of fresh water periodically exposed to the atmosphere. Often flagellate stages are present. When a morphological difference, the sporophyte and gametophyte may be similar (mainly marine, e.g. **Enteromorpha**) or the gametophyte dominant, the sporophyte represented by the zygote (fresh water, e.g. **Spirogyra**, **Oedogonium**).

Green algae have received particular attention from the aspect of their highly efficient synthesis of organic compounds, coupled with an adaptability of unicells (e.g. **Chlorella**) to a large-scale culture. Such features have applications to the world food problem in addition to control of carbon dioxide and oxygen exchange, e.g. in spacecraft and atomic submarines. Some of the major problems of physiological processes (e.g. photosynthesis) have been elucidated through studies of their group.

Modern treatments place the 'greens' as a class, **Chlorophyceae**, under a division **Chlorophyta**. The calcium carbonate extracting stoneworts **Chara** and **Nitella** of brackish or fresh water have strong links with, or have been derived from, the green algae and have been treated as a second class (**Charophyceae**) of the **Chlorophyta**. The stonewort thallus is multicellular and an elaboration of an erect stem-like structure (up to 1 metre long) from which arise verticels of branches; the plant is attached to the soil by rhizoids. Remains of **Chara** accumulated over a large number of years have led to the formation of limestones.

Euglenoids: some of the most primitive green algae are unicells motile by two flagella (e.g. **Chlamydomonas**). Also possessing green chloroplasts and a flagellum are the euglenoids, considered as a direct derivation from the flagellate green algae. Euglenoids are asexual unicells lacking a rigid wall and one the threshold of the plant-animal divergence. The reserve food is a starch-like **paramylum**. A distinctive feature is the invagination (a narrow canal or gullet) of the periplast (the elastic pellicle or outer surface), leading from which is a single (rarely 2) flagellum and at its base a red pigment spot (stigma). Orientation to light is possible through the shading effect of the stigma to a light-sensitive swelling (photoreceptor) at the base of the flagellum. The major genus **Euglena** has members found in ponds rich in organic matter, others epiphytic on plankton, or endobiotic to plants or animals.

The status of the euglenoids has been considered divisional (as **Euglenophyta**).

Yellow-green algae and allies: algae with a carotenoid pigment masking the chlorophyll generally are either motile unicells, some with a tendency to form filaments, or non-motile multicells, filamentous and with a tendency to elaborate structure. The first group is of universal distribution, with many members on the threshold of the plant-animal divergence, nutritionally **holozoic**. The carotenoid pigments, or **xanthophylls**, differ among the various families reserve is either a starch (or starch-like compound or a polysaccharide, **leucosin**, in addition to fatty oils. The storage of starch usually is associated with a deposition of cellulose within the cell wall (when present) but there is no tendency to the use of silica, although a sculptured envelope is common. This association is found in the dinoflagellates (the much larger group, the members especially of plankton) and the cryptomonads, both mostly marine.

With storage of leucosin there is a greater tendency for the cells to form colonies or filaments, or be coenocytic, and when a cell wall is present, silica is the main building substance. The pigment **fucoxanthin** may be present to give a golden-brown colour, the cell then either flagellate and without a wall (the chrysomonads), or without flagella and with a wally highly silicified and composed of two closely overlapping parts, valves, usually of intricate design (the diatoms, whose fossils have contributed to the formation of petroleum in addition to forming the diatomaceous earths providing the diatomite or kieselguhr of commerce used in filtration, face and polishing powder manufacture, and as an absorbent of nitroglycerine in the manufacture of dynamite). When **fucoxanthin** is absent, the chromatophores mostly are yellow-green, the plants either unicellular flagellates without cell walls (the chloromonads) or unicellular non-flagellates with cell walls (the yellow-green algae).

Of these diverse groups, present treatment affords divisional status collectively to the dinoflagellates and cryptomonads (**Pyrophyta**), and to the chrysomonads, diatoms, chloromonads, and yellow-greens (**Chrysophyta**).

Brown algae: the more complex olive-brown (fucoxanthin) pigmented (additional to chlorophylls a and c) algae possess cell walls of cellulose, commonly store the polysaccharide **laminarin** and the alcohol **mannitol** as the food reserves. They form from simple or branched filaments or membranes to multi-layered systems of cells differentiated to internal conducting and storage tissues and external absorbing and assimilating tissues. Life-cycles in the main follow the lines of the green algae, the male gametes being flagellate. Very few of the brown algae are of fresh water; as marine plants mainly of temperate and polar waters, they commonly form marked littoral zones. Many (e.g. **Ecklonia**, **Sargassum**, **Macrocystis**) develop a basal hold-fast, a stem-like stipe bearing leaf-like segments, and a petiole-like inflated vesicle or **pneumatocyst** which displays the lamina above in vertical position.

Prominent among the brown algae are the kelps, a group of the order **Laminariales** which reach gigantic size (e.g. **Macrocystis pyrifera** recorded in Australian waters up to 30 metres long) and make up submarine 'forests'. While only **Ecklonia** and **Macrocystis** are of general occurrence around the Australian (southern) coast, the kelps overseas have provided sources for iodine, potash, acetone, but present attention is given to the extraction and utilization of the phycocolloid sodium alginate or **algin** in such diverse fields as foods, drugs, cosmetics, paints, textiles. Although containing more than 95 percent water, the use of kelps as fertilizers is long established. See also coenobium, lichen, photosynthesis.

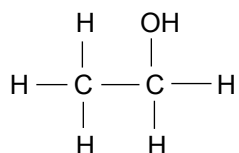
ALGICOLOUS: living in association with algae, e.g. as many hydroids.

ALGOID: resembling an alga.

ALGOLOGY: phycology, i.e. the science of the algae.

ALIFORM: in the shape of a wing (L. ala).

ALIPHATIC: of an organic compound when the carbon atoms of its molecular structure are linked in an unbranched, open chain, e.g. ethanol $\text{CH}_3\text{CH}_2\text{OH}$. cf. cyclic.



alis- (Celtic): as in **alisma**, water.

ALKALI: a basic substance (a hydroxide) soluble in water and dissociating to form hydroxyl (OH^-) ions. From Aracia: **al₂** the; **qali**, ash.

ALKALINE SOIL: a soil which, when forming a suspension in water, gives an alkaline reaction (from 8.0 upwards on the pH scale) due to the dissociation of anions reactant with water to form free

hydroxyl ions, the anions being released from salts (namely sodium, magnesium, calcium) adsorbed by the clay fraction. See black earth, red-brown earth, soil.

ALKALINITY: the degree to which a substance in solution dissociates hydroxyl ions. Substances releasing an excess of OH⁻ ions to H⁺ (hydrogen) ions are bases, their alkalinity expressed by a pH value which increases numerically from 7.0 at neutral to 14.0 as the alkalinity increases. cf. acidity.

ALKALOID: a nitrogenous organic compound synthesised by plants but with an unknown significance, usually in the form of salts of organic acids and in combination with other alkaloids. Chemically a nitrogenous base, soluble in dilute acid to form salts, usually crystalline when pure (nicotine, a volatile liquid, is an exception) and having the nitrogen in an amino (NH₂) group or linked with carbon in a cyclic structure.

The reactions of alkaloids with physiological processes of animals are of high pharmacological interest, hence their preparation as drugs, narcotics, and insecticides. Distribution throughout the plant kingdom appears at random but research has concentrated on the flowering plants where less than half the families screened have some members positive. While the type of alkaloid for a species appears genetically fixed, there is some variation including the percentages of the component alkaloids and yields of the extract. The alkaloid content may be confined (at least in quantity) to a certain part of the plant, e.g. root (reserpine from **Rauwolfia serpentina**), bark (quinine from **Cinchona** spp., tubocurarine from **Chondrodendron tomentosum** one of several species yielding the curare of South American Indians) stem (ephedrine from **Ephedra** spp.), leaf (cocaine from **Erythroxylon** spp., most of the solanaceous drugs, pilocarpine from **Pilocarpus** spp.) fruit (capsules of the Opium Poppy), seed (colchicine from the lily **Colchicum autumnale**), caffeine from coffee, cocoa, kola).

Alkaloids with a tendency to occur in taxonomic groups include:

Family **Apocynaceae**: reserpine from **Rauwolfia** and the Australian **Alstonia constricta**.

Family **Solanaceae**: atropine, hyoscyne, hyoscyamine from **Datura**, **Atropa**, **Hyoscyamus** and the corkwoods of Australia **Dubosia myoporoides** and **D. leichhardtii**, nicotine and nor-nicotine from **Nicotiana** and **Duboisia hopwoodii** (pituri).

Family **Papaveraceae**: protapine generally, morphine and codeine specifically from the Opium Poppy **Papaver somniferum**.

Alkaloids common to unrelated plants include caffeine and often, in addition, theobromine from **Theobroma cacao** (cocoa) and **Cola acuminata** (kola) both of **Sterculiaceae**, **Coffea** spp. (coffee with 2.5 percent caffeine) of **Rubiaceae**, **Camellia sinensis** (tea with 4 percent caffeine) of **Theaceae**, and **Ilex** spp. (mate) of **Aquifoliaceae**.

ALLELE: one of two or more genes of a heterozygous individual which occupy identical positions (loci) on homologous chromosomes and pair at meiosis, and are factors acting as alternative conditions to the same developmental process. Also allelomorph. Members of a series of more than two alleles are **multiple alleles**. **Allelic**, **allelomorphic**: relative to alleles.

allel(on) Gk.: as in **allele**, **allelopathic**, one another.

ALLELOPATHIC: growth-inhibiting as a consequence of the influence of one organism on another, e.g. the condition of 'soil sickness' when caused by the build up of toxic exudates from roots or fallen leaves.

ALLIACEOUS: resembling, or relative to **Allium** spp., e.g. the onion, garlic, leek, chives, shallot are alliaceous crops.

ALLIANCE: of ecology, a group of associations (q.v.) floristically related and of similar structure. In naming the alliance, consideration usually is given to the most characteristic dominant species of its component associations.

allo(s) Gk.: other; different time; not contemporary.cf. synchronous.

ALLOGAMOUS: cross-fertilizing; reproducing by cross-fertilization, cf. autogamous.

ALLOMETRIC: relative to a difference in a measure (e.g. a rate of growth) from a standard.

ALLOPATRIC: originating from, or occupying, different geographic regions. cf. sympatric.

ALLOPOLYPLOIDY: the multiplication of chromosomes through hybridisation by two different species, i.e. the addition of dissimilar sets of chromosomes, e.g. an **allotetraploid** is a polyploid derived by the doubling of chromosomes in the hybrid of two diploid species. See also autopolyploidy, aneuploidy.

ALLOTROPIC: occurring in different form with different properties under identical conditions.

ALLUVIAL: in general, brought by the movement of water. Of soils, relative to a profile (q.v.) developed from fine-textured material, **alluvium**, (e.g. silt, clay) transported by water.

ALPINE: of a community, relative to an environment where snow covers the ground continuously for six or more months of the year, i.e. above the tree-line. For the Australian Alps, above elevations of 5,500 or 6,500 feet, the tree-line marked by the Snow Gum **Eucalyptus niphophila**. See also alpine herbfield.

ALPINE HERBFIELD: a closed alpine community dominated by perennial herbs as, e.g. **Brachycome nivalis**, **Danthonia alpicola**, **Poa caespitosa**, **Celmisia longifolia**, etc.

als(os) Gk.: as in **alsophila**, a shaded place; copse; grove.

ALTERNATE: of parts adjacent but with other structures placed between, e.g. when stamens are interposed (or alternated) with petals on the rim of a receptacle. Of leaves when developed at different levels on opposite sides of the stem.

ALTERNATION OF GENERATIONS: the succession of the gamete-forming (haploid) and spore-bearing (diploid) phases of a life cycle, marked by a structural (not always) and genetic (always) difference between gametophyte and sporophyte, isomorphic when the generations are structurally alike, **heteromorphic** when unlike. Most ferns have two independent generations, the seed plants only one, the gametophyte (e.g. embryo sac and pollen tube of angiosperms) never is an independent or macroscopic structure. Almost without exception, the sporophyte of bryophytes never is completely independent of the gametophyte.

alt(us) L.: high. **altior**: the comparative degree.

ALVEOLA: (plural alveolae) in general, a small pit or depression. Also alveolus plural alveoli).

alysi(s) Gk.: as in **alysicarpus**, a chain.

amabile, amabilis L.: of pleasing appearance.

ambi(re) L.: as in **ambient**, **ambiens**, to go around or surround.

ambigu(us) L.: of uncertain origin or affinity.

ambly(s) Gk.: as in **amblygonous**, blunt (hence blunt-angled, obtusely-angled).

AMEIOSIS: the substitution of the double reduction division of normal meiosis with a single division so that the spore mother-cell is unreduced in number of chromosomes. Ameiotic: relative to ameiosis.

AMENSALISM: a relationship or interaction within a community antagonistic to some of its members, e.g. the production of antibiotics by fungi and bacteria, the exudation of organic substances by roots and fallen leaves which induce a 'soil-sickness'. cf. commensalism.

AMENTUM: see catkin. Amentaceous, amentiferous: bearing catkins.

AMIDO: of the group (-CO NH₂) which replaces the carboxyl (-CO OH) group of an organic acid to form an **amide**, as by a reaction with ammonia, e.g. of carbamide, or urea, CON₂H₄ derived from carbonic acid - HO CO OH → NH₂CO NH₂.

AMINO: of the group (-NH₂) which replaces one or more hydrogen atoms of a molecule of ammonia with an organic radical (R) to form an amine. e.g. NH₃ (ammonia) → RNH₂.

AMINO ACID: an organic acid possessing a basic amino group. When synthesised by plants, conforming generally to the formula R CH(NH₂) COOH where R is a variable group and the -NH₂ group is attached usually to the carbon atom closest to the COOH (the acidic carboxyl group): glycine, the simplest, is CH₂(NH₂)COOH, the R group here represented by a single hydrogen atom. Through enzymatic reactions under appropriate conditions may be converted to a higher or a lower amino acid. e.g. transaminated. One of over a hundred detected within plants either combined or in the free state, but when combined by linkage of its carboxyl and amino groups (the peptide bond) to form a protein, generally is one of twenty five occurring in definite proportion and number (usually in hundreds) to characterise the protein which may lack one or more of this twenty five.

A number of the protein-forming amino-acids are essential for animal nutrition: prominent are arginine, cystine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophane, valine. See also amphoteric, protein.

AMITOTIC: of nuclear division when in the nature of a simple splitting of the nuclear material into halves. Especially of procaryotes (e.g. bacteria and blue-green algae) where the nucleus of the eucaryote is paralleled by a DNA-containing region within the cytoplasm.

AMMONIFICATION: of soil, the break-down of organic nitrogenous compounds ultimately to ammonia through putrefaction of organisms and their wastes.

While ammonia (or the ammonium ion NH₄⁺) is an available form of nitrogen to plants, more usually it is absorbed as a nitrite through an immediate oxidation by nitrifying bacteria. Within a root, the nitrate is reduced indirectly to ammonia which rapidly is transformed to organic nitrogen, particularly as amino acid.

ammo(s) Gk.: as in **ammocharis**, sand.

AMOEBOID: with the nature, especially in movement, of the protozoan unicellular amoeba which moves in a creeping and flowing manner by extension of temporary pseudopodia.

amphi- (Gk.): as in **amphiphloic**, both, on both sides.

AMPHICARPIC: of a plant when bearing both aerial and subterranean fruits. Also amphicarpous.

AMPHICRIBAL: see under vascular system.

AMPHIMICTIC: of a plant when regularly reproducing by sexual mean.

AMPHIMIXIS: reproduction by sexual means.

AMPHIPHLOIC: of a stele with phloem on both sides of the xylem.

AMPHIPLOIDY: allopolyploidy (q.v.) in which the polyploid possesses the sum of the chromosome sets from each of its parent species. Also amphidiploidy.

AMPHITROPOUS: see under placentation.

AMPHIVASAL: see under vascular system.

AMPHOTERIC: of a substance (e.g. an amino acid) ionizing (as a zwitter-ion) either as an acid or as a base, dependent on the pH of the solution where dissociated.

amplex(us) L.: as in **amplexans**, **amplexicaul**; embracing.

AMPLEXICAUL: stem-embracing or -clasping, as the base of a lamina when almost surrounding the stem.

AMPLITUDE: of ecology, the gradient of tolerance shown by a species to a single factor or aggregation of factors, as, e.g. light, temperature, soil, water.

AMYLIFEROUS: bearing or producing a starch (L. *amylum*).

AMYLOID: starch-like.

an- Gk.: as in **ananthus**, **anacanthus**, **anhydrous**, without.

ana- Gk.: as in **anagyris**, backwards, or again; as in **anacardifolium** (ana . . . cardi . . .) like. Also against, throughout.

-ana: as in **montana**, **moluccana**, **muellana**, relative to; possessed by; in honour of, female gender.

ANABOLISM: the synthesis from simple to more complex substances by metabolically-active organisms. e.g. by photosynthesis. Also biosynthesis. cf. catabolism. Anabolic: relative to the processes of anabolism. i.e. to endogenic reactions.

ANABRANCH: a tributary of a river which either re-enters the river lower down or disappears in flat or sandy land.

ANADROMOUS: of venation when the first set of veins arises from the upper (i.e. adaxial to the main stem) side of the mid-rib.

ANAEROBIC: tolerating an absence of free oxygen or actively avoiding free oxygen.

ANAEROBIC RESPIRATION: the oxidation of organic substances for the release of energy with the oxidising agent (or hydrogen acceptor) being other than oxygen, a faculty of an anaerobe. See also fermentation.

ANALOGOUS: of organisms (with close or wide affinities) when bearing a resemblance in structural parts through a similarity in function. Of parts when similar in function and/or structure but originating from different sources. **Analogue**: the analogous organism or part.

ANALYTIC: relative to the breaking-down of a complex to its essential parts. cf. synthetic.

ANASTOMOSE: in general, forming a reticular or net-like pattern. Of venation, with the minor veins branching and intersecting.

ANATOMY: the science of the macroscopic and microscopic structure and structural relationships of organs and organisms. See also histology. **Anatomic**: relative to a feature of anatomy.

ANATROPOUS: see under placentation.

anceps L.: two-edged, two-sided.

andro-: as in **androecium**, **androphore**, **protandrous**, a male. From Gk. *aner*.

ANDROECIUM: the male part of a flower, consisting of stamens.

ANDROGYNODIOECIOUS: of a population or species with some members bisexual, some functionally female only, some functionally male only, and some neuter.

ANDROMONECIOUS: of a plant bearing inflorescences of mixed bisexual and staminate flowers.

ANDROPETALOUS: with petaloid stamens.

ANDROPHORE: of a flower, an elongated part of a receptacle which bears an androecium. Of a fungus, a hypha bearing an antheridium.

anemo(s) Gk.: as in **anemone**, atmospheric wind.

ANEMOCHOROUS: dispersing seed through the agency of wind. Also anemochoric.

ANEMOMETRIC: relative to the measured velocity or force of wind.

anemoni-: as in **anemonifolia**, of **Anemone**, a plant of windy places.

ANEMOPHILOUS: pollinating, or dispersing spores, through the agency of wind.

anethi-: as in **anethifolia**, of **Anethum (Umbelliferae)** from Gk. **ano** - upward, **theo** - to run hence quickly growing.

ANEUPLOIDY: of a genetic system, a loss or gain in a chromosome number basic (haploid) to a taxon, without simple numerical relationship, commonly attributable to an irregularity at meiosis, e.g. by unequal interchange, or by fragmentation, of chromosomes. **Aneuploid series**: of a taxon, a sequence of chromosome numbers not forming a progressive series from simple multiplications of the basic number but suggesting a progressive gain or loss by the polyploids (aneuploids) forming the group.

aneura: with inconspicuous venation. From Gk. **a**, without; **neuron**, nerve.

ang(eion) Gk.: as in **angiosperm**, **angophora**, **sporangium**, a vessel (hence an enclosed structure or cavity).

ANGIOSPERM: a seed-bearing vascular plant characterised by the development of a complex reproductive structure, the flower, within the carpel of which is borne the ovule wherein an embryo-sac (the female gametophyte) is developed, basically with eight nuclei, three of these fusing with two male nuclei at fertilization. See overleaf.

Dominant of most terrestrial floras, varies from a minute thalloid structure (e.g. the aquatic duckweed of **Lemnaceae**) to a forest giant with shaft-like trunk (e.g. of **Eucalyptus**), the number of species is in the order of about 300,000. A member of the class **Angiospermae** of some authors, or a division (**Anthophyta**) of others, its families often of great diversity. e.g. **Compositae** (range 25,000 to 30,000 species in at least 1,000 genera), **Orchidaceae** (range 15,000 to 20,000 in about 800 genera) and, in decreasing order but of some magnitude, **Papilionaceae**, **Rubiaceae**, **Gramineae**, **Euphorbiaceae**. The grass family, **Gramineae**, is the most widespread with the greatest number of individuals making up the species (in the order of 5,000 in about 500 genera). See also dicotyledon, monocotyledon, geological time, vessel, wood.

ANGSTROM UNIT: (abbreviated A) a unit of micro-length equivalent to a ten millionth part of a millimetre, i.e. 1×10^{-7} mm or 0.001 microns.

angust(us) L.: as in **angustifolia**, narrow.

angio(s) Gk.: as in **angiosanthos**, expanded (hence flowers borne along an expanded (spreading) axis).

ANION: the negatively-charged ion, attracted to the anode or positively-charged pole. Of concern to plant growth are hydroxyl (OH⁻), nitrate (NO₃⁻), nitrite (NO₂⁻), phosphate (PO₄⁻), sulphate (SO₄⁻), carbonate (CO₃⁻), chloride (Cl⁻) etc. See also ionization.

anis(s) Gk.: as in **anisotropic**, different from; unequal.

ANISOGAMIC: reproducing by the union of dissimilar gametes.

ANISOPHILLY: of a horizontal shoot, a difference between the upper and lower leaves, or between the upper and lower surfaces of such leaves, frequently as a result of external forces (e.g. available light, gravitational force, etc.).

ANISOTROPIC: with different structure along different axes.

ANNUAL: of habit, relative to a herb when completing its life cycle within a single vegetative period (which may vary in time from a few weeks to several months), thus escaping its unfavourable growth period (summer or winter) by reducing its whole growth-potential to its seed. Usually an adaptation to arid or desert conditions, or to disturbed (e.g. cultivated) land. Also used as the noun for such a herb. See also perennation.

ANNUAL RING: see Growth Ring.

ANNULAR: in the shape of a ring. Also annulate.

annulifer(us) L.: bearing a ring-like structure.

ANNULUS: in general, a ring-like structure. Of ferns, a group of cells on the wall of a sporangium concerned in the opening of the wall for the release of spores.

ano- Gk.: as in **anopterus**, upward (hence with an ascending wing).

anomal(os) Gk.: as in **anomalous**, singular; irregular.

ANOMALOUS: differing in certain detail from its allies, as of a species when departing in some respect from the general patterns given by other species of its genus.

anser L.: as in **anserinifolia**, a goose (hence with leaf-shape resembling a webbed foot).

ANTAGONIST: of pathology, an organism inhibiting growth of another from factors either physical (e.g. destruction of protective tissues, induction of a change in pH of the growth medium) or biotic (e.g. the production of an antibiotic).

ANTARCTIC ELEMENT: the element of a present-day flora which evidently originated from the postulatory ancient lands of the southern hemisphere (i.e. from the Antarcto-tertiary flora), indicated in part by a representation, at least at generic level, in two or more floras of temperate Australia, New Zealand, the Andean region of South America, and South Africa. e.g. **Nothofagus**, **Podocarpus**, **Dacrydium**.

ante L.: as in **antedate**, before.

antennifer(us) L.: bearing an antenna-like structure.

ANTERIOR: of the side facing away from the axis to which the part is related. e.g. the anterior surface of a petal is the outermost side. cf. posterior.

ANTHER: the pollen-producing part of a stamen, typically divided by a band of tissue (**connective**) to two lobes (**anther-lobes** or **sacs**) each dehiscent through a slit or pore-like opening. Within each lobe are the sporangia, usually two in number, within which are developed spore mother-cells which give rise to pollen-grain, and a uniseriate layer of cells, the **tapetum**, which serves as a nutritive tissue for the spore mother-cells. From Gk. **antheros**, flowering.

ANTHERIDIUM: the structure of plants other than conifers and angiosperms within which are produced male gametes.

ANTHEROZOID: a motile gamete, hence male.

ANTHESIS: the process of flowering, or the flowering period.

anth(os) Gk.: a flower, as in **anthophilous**: of insect-pollinated plants when producing abundant and conspicuous flowers; **Anthophyta**: a name proposed by Cronquist (1960) for the division of flowering plants; **chysantha**: yellow-flowered, **perianth**, the enveloping leaf-like whorls of a flower.

ANTHOCYANIN: a water-soluble pigment occurring in the cytoplasm or cell sap of pigmented flowering plants. Chemically a glycoside (q.v.) which may be hydrolysed by enzyme or acid to an aglycon, **anthocyanidin**. Anthocyanidins (of the group cyanidin, delphinidin, pelargonidin) change colour according to the pH of their dispersal media and largely (although often modified by pigments of plastids in other regions) determine the range of reds, blues and purples of flowers and some fruit and, with carotenoids, the changing hues of autumn leaves. In general, an anthocyanin is specific for a species, its nature influenced by both genetic and environmental factors.

anthra(x) Gk.: as in **anthracophilus**, charcoal; coal.

ANTHROPOGENIC: relative to the influence of man (Gk. **anthropos**) e.g. on vegetation when determined by his clearing or burning-off operations or methods of agriculture.

anti- Gk.: prefix, opposite to; against (before vowels and h, ant-).

ANTIBIOTIC: of an associations (antibiosis) among organisms antagonistic to some through toxic compounds produced by others. Also applied to a substance produced by an organism with a toxic effect of another especially in the pathologic sense where the substance is a chemotherapeutic agent, e.g. penicillin originally derived as a metabolite of the fungus **Penicillium notatum** and toxic to a wide range (broad spectrum) of pathogenic bacteria and fungi, streptomycin, aureomycin, terramycin, and several others from the bacteria of **Streptomyces**, bacitracin from **Bacillus licheniformis** etc.

ANTIBODY: a substance formed in the serum of an animal in response to the reception of a foreign substance, an **antigen** (e.g. a protein, viral or bacterial filtrate) and is reactive with that antigen, the activated serum being known as the antiserum or immune serum.

ANTICLINE: of geology, see under folding.

ANTICLINAL: perpendicular to a surface.

ANTIPODAL: relative to a region or location directly opposite to another.

ANTISEPTIC: inhibiting the growth of pathogens on living tissues, or (as the noun) the inhibiting agent.

ANTRORSE: directed upwardly.

-anum, -anus: suffices (neuter and male gender) close to; belonging to.

ap- L. (before p): as in appressed, towards or to.

APETALOUS: without a corolla.

aphan(os) Gk.: as in **aphananthe**, **aphanopetalum**, inconspicuous; obscure.

aphel(is) Gk.: as in **aphelia**, simple.

APICAL: relative to the apex or apice of a structure. From L. **apex**, the top.

APICAL DOMINANCE: of growth, the dominance of the terminal bud to lateral buds. Unless external factors are limiting, dominance is influenced by the concentration of auxin (q.v.) at the apex of the shoot. When dominance is strong, habit will tend to be **decurrent**, when weak, excurrent.

APICULATE: of an apex when terminating abruptly in a short, flexible tip.

APLANETIC: without motile spores.

apo- Gk.: prefix, away from; downwards.

APOCARPOUS: of a gynaecium with a single carpel or with carpels free from one another. cf. syncarpous.

apodo-: as in **apodophyllum**, without a supporting stalk. (from Gk. -a, -pous).

APOGAMOUS: in general, asexually reproductive. Of a fern when developing an embryo from a prothallus by a division of a cell other than the egg-cell. **Apogamy**: the condition.

APOGEOTROPIC: growing in a direction away from the earth's gravitational pull, as (e.g.) as ascending shoot. Negatively geotropic.

APOMICITIC: relative to apomixis.

APOMIXIS: reproduction which replaces or substitutes for sexual reproduction, the plant so formed being an **apomict**. Usually refers to the processes of **vegetative reproduction** and **agamospermy**. In the former, normally accessory structures (bulbs, bulblets, rhizomes, stolons, etc.) may produce apomicts, or fully-formed planets (propagules) may arise from meristem or, as in vivipary, from within sterile inflorescences to become detached from the parent (see also bulbil). **Agamospermy** involves the production of an embryo but without fertilization (see parthenogenesis, apogamous), meiosis does not occur, so that all progeny so derived have the same genetic constitution. See also clone. cf. amphimixis. From Gk. **apo**, **mixis**, a mixing.

APOSPOROUS: of a fern when developing a prothallus from a cell of a sporangium, or from the surface of a frond when no sporangium is formed, no spores being formed. Of a bryophyte when its sporophyte develops (e.g. by budding) a gametophyte, no spores being formed. **Apospory**: the condition.

appendiculat(us) L.: bearing an appendage.

APPLANATE: of a surface when flattened.

APPLE: of eucalypts, a descriptive name limited in use to the south-eastern mainland in reference to a few (viz. **Eucalyptus bridgesiana**, **E. goniocalyx**, **E. cinerea**) spreading-branched, densely-foliaged trees of moderate height (hence valuable for shade and shelter) with a rough-barked trunk shorter in length than the depth of the crown. The wider use of the term is for **Angophora** spp. and in a restricted sense to a few unrelated species as **Planchonella australe** (Black Apple), **Syzygium moorei** (Rose Apple), **Schizomeria ovata** (Crab Apple).

APPOSITION: of a cell wall, the additional of new layers to already existing layers. cf. intussusception. See also accretion.

APPRESSED: closely and flatly pressed against a surface, as a stem-appressed leaf.

AQUATIC: with water as the normal habitat; (as a noun) a hydrophyte.

aqua L.: water. **Aqueous**: of water. **Aquiderous**: water-carrying.

ARABLE: of land capable of being tilled for the production of crops.

ARACHNOID: cobweb-like, as from strand of long white hairs.

arbor L.: a tree. **Arborescent**: becoming tree-like in habit.

ARBORICULTURE: the cultivation of trees.

archae(os) Gk.: as in **archaeon**, ancient.

ARCHAEAN: relative to the ancient (earliest-formed) rocks of the Pre-Cambrian era (see Geological Time). Of the basement rock of the Australian continent marking up the Great Plateau of Archaean Shield which extends over the western half of the continent at elevations of 1,000 to 2,000 feet. While exposed over extensive area, much is now covered by consolidated sand-dunes.

arche Gk.: as in **archegonium**, **archesporium**, a beginning.

ARCHEGONIUM: the female gamete-producing structure of bryophytes and vascular plants other than angiosperms and two genera of gymnosperms. When mature, is composed typically of an enclosing **neck** projected above the gametophyte and an embedded part, **venter**, the lowermost contained cell of which is the egg. By breakdown of cells above the egg (when present), a canal is formed through which at fertilization, the male gamete passes to unite with the egg.

ARCHESPORIUM: a single cell, or group of cells, within a sporangium from which may be derived spore mother-cells.

archi Gk.: as in **architype**, first (hence the hypothetical original, or prototype, of a taxon).

arct(os) Gk.: as in **arctotis**, a bear (often in reference to its rough, shaggy hair).

ARCUATE: arched; curved.

arcu(a) L.: a casket.

aren(a) L.: as in **arenaceous**, **arenicolous**, sandy; a sandy place.

ARENACEOUS: relative to sand; with the appearance or texture of sand.

ARENICOLOUS: dwelling in sandy places.

AREOLATE: partitioned into small spaces or cavities, each an areole.

argente(us) L.: as in **argentea**, **argenitifolia**, silvern; with the colour of argentum.

argill(a) L.: as in **argillaceous**, **argillicolous**, a clay.

ARGILLACEOUS: relative to, or with the appearance or texture of clay.

arg(os) Gk.: as in **argophyllum**, white.

argut(os) Gk.: clear; bright.

argut(us) L.: sharp; piercing.

argyr(os) Gk.: as in **argyeia**, **argyrodendron**, silvern.

-aria L.: as in **bursaria**, **oraria**, **uticularia**, relative to, possessed by, female gender.

ARID ZONE: in general, the region of permanent desert. For Australian conditions, generally accepted as the region where, on average, the ratio of monthly rainfall (P) to the monthly evaporation (E) is greater than 0.4 for no month of the year. i.e. the P/E does not exceed 0.4, the ratio at which moisture of the soil is considered just sufficient for plant growth. See also desert, eremaen zone.

ARIL: in general, a fleshy outgrowth from the coat of a seed. In a restricted sense, an outgrowth from the base of the ovule which eventually covers the seed completely. cf. caruncle, strophiole. **Arillate**: possessing an aril.

-aris (usually after l or v) Gk.: as in **rivularis**, relative to.

arista L.: a bristle. **Aristate**: bearing a stiff bristle.

-arium, -arius L.: as in **canarium**, **arenarius**, connected with; possessed by, neuter and male genders respectively. As in **herbarium**, a place for.

ARMATE: armed with a defensive structure (L. **armature**) as a sharp point, stinging hair, prickle.

ARMILLATE: with a bracelet (L. **armilla**)-like fringe.

ARRECT: erect; directed upwardly.

ARTEFACT: an object shaped by human art of skill in contrast with one of similar design shaped by environmental conditions (e.g. of wind or water). The appearance within a structure or product of a feature brought about by the conditions of its investigation (**in vitro**) rather than as a normal event in its natural life or occurrence (**in vivo**). From L. **ars**, art; **factus**, made.

ARTESIAN: in general, relative to a deep bore from which water rises under pressure, e.g. the Great Artesian Basin of northern New South Wales, north-eastern South Australia, and western Queensland, which covers about 550,000 sq. miles: water from this source is often so high in mineral salt (sodium chloride and sodium bicarbonate particularly) that its value as continuous irrigation for crops is limited because of a destructive effect on soil structure.

arthr(os) Gk.: as in **arthropodium**, a joint.

ARTICULATE: of parts attached by joints to structures.

arv(um) L.: as in **arvensis**, a field (hence of cultivated fields). The diminutive is **arvilla**.

ASCENDING: directly upwardly, as a stem when gradually growing upwards.

ASCUS: (plural asci) the sac-like, spore-bearing structure of an ascomycete (see under fungus). From Gk. **askos**, a bag.

ASEPTATE: without cross-walls (septa), as the cells of many algal and fungal filaments.

ASEPTIC: free from pathogens.

ASH: of eucalypts a member of a botanic group, **Fraxinales**, or a stringybark (q.v.) when agreeing in habit and nature of wood (viz. Mountain Ash **Eucalyptus regnans** and Messmate Stringybark **E. obliqua**). The species occur mainly in wet sclerophyll forest of the highlands of the south-east of Australia and in Tasmania, and represent tall, shaft-like trees (e.g. Alpine Ash **E. delegatensis** reaching over 200 feet high, and **E. regnans**, world's tallest hardwood tree recorded at 350 feet). A few are of mallee form (e.g. Whipstick Ash **E. multicaulis**). Most are commercial timber sources, the wood being pale-coloured, very soft and light in weight for eucalypts and with durability to exposed conditions below average for the genus. The name is taken from the Ash of commerce (from the north temperate **Fraxinus**) because of a resemblance in the woods. Applied also to a few isolated species from unrelated genera, e.g. **Flindersia** and **Elaeocarpus**, and to **Achrotychia baueri** as Scrub Ash.

asiaticus: originating from Asia.

aspalathi-: as in **aspalathifolia**, of the legume **Aspalathus** of South Africa (probably from **a**, not; **spao**, to extract, in reference to the thorns).

ASPECT: of ecology, the direction to which a land slopes, e.g. a southerly aspect.

ASPERATE: with a covering of hairs rough to the touch. **Asperulate**: the diminutive condition. from L. **asper**, rough.

aspidi(on) Gk.: as in **aspidium**, a small shield.

aspleni-: as in **asplenifolia**, of the ferns of **Asplenium**, the name derived from Gk. **a**, without; **splen**, spleen to indicate a supposed cure for diseases of the spleen.

ASSIMILATION: the absorption or uptake of nutrient and its synthesis to more complex substances by the organism. Anabolism. **Assimilate**: a product of assimilation. **Assimilative**: of growth when purely vegetative. **Assimilatory**: functioning for assimilation.

ASSOCIATION: of ecology, a stable community with dominant members showing uniform floristic composition and spatial arrangement.

aster Gk.: a star, **asteriscos**, the diminutive.

atringens L.: tightening; contracting, astringent.

astr(on) Gk.: as in **astroloma**, **astrotricha**, a star.

astr(um) L.: a star.

ASYMMETRIC: irregular; not divisible into similar halves in any plant.

-ate L.: in **hastate**, **clavate**, like; in **septate**, **nucleate**, possessing.

ater L.: as in **aterosperma**, black; dark.

ather Gk.: as in **atherosperma**, an awn.

ATMOSPHERE: in general, a region of air, especially where there is accumulation and free interchange of gases. In particular, the gaseous envelope encircling the earth, maintaining a relative constant of gases and water vapour essential to the product of life and the source of rainfall, wind movement (from varying pressures) and electrical discharges. Through its water vapour, acts as an effective moderator of the temperatures to which land masses are exposed both from the sun during the day and the re-radiation of heat from land at night, thus preventing over-heating in daylight from infra-red radiation, and over-cooling at night. Its major component gases and their standard percentage proportions are nitrogen (78.09), oxygen (20.95), argon (0.93), carbon dioxide (0.03).

As a unit of pressure, the atmosphere is equivalent to slightly less than 15 lbs. per sq. inch and represents the pressure exerted by the atmosphere on the earth's surface. See also dew point, frost, light.

ATOMIC: relative to an atom, a unit of a chemical element electrically in balance (neutral) by an equal distribution of electron and proton particles, the number of which is specific for the element, e.g. an atomic structure with one proton and one electron (of equal and opposite charge) refers to the chemical element hydrogen, one with six protons and six electrons to carbon etc. See also electron, energy, isotope.

In a chemical reaction, atoms of the same or different elements are conceived as combining or 'bonding' chiefly through a transference of electrons (forming an electrovalent or polar bond) or a sharing of electrons (forming a co-valent or non-polar bond), or a combination of both (semi-polar bondage). When the bond is polar, there is a consequent loss of electrical neutrality, the atoms then being ions (q.v.), the number of electrons 'accepted' being the valency of the element. When the bond is non-polar, there is no ionization.

Atomic weight: of an element, the ratio of its weight relative to an isotope of carbon set at 12. When expressed in grams, gram atomic weight. From Gk. **a**, without; **tome**, division.

ATP: adenosine triphosphate. See under phosphorylation.

atr(um) L.: clothed in black.

atriplici-: as in **atriplicifolia**, of **Atriplex (Chenopodiaceae)**. From L. **ater**, black; **plexus**, woven.

atro-: as in **atropurpurea**, dark; of black (hence dark purple).

ATTENUATE: narrowed.

aulaco-: as in **aulacocarpa**, furrowed. From Gk. **aulos**, a tube.

AULOPHYTIC: living non-parasitically in the hollow of another plant.

auranti(us) L.: as in **auranthifolia**, **aurantia**, of the orange **Citrus aurantium (Rutaceae)**, or with the colour or orange.

aure(us) L.: as in **aurea**, **auricomum**, golden.

AURICLE: a lobe, especially when at the base of a lamina.

auricul(a) L.: diminutive of **auris**, an ear. (hence a lobe).

AURICULATE: bearing a lobe or auricle.

australe, australis L.: southern; austral.

AUSTRALIAN ELEMENT: of phytogeography, that part of the Australian flora which evidently has had its origin within the mainland or Tasmania. also the **autochthonian** element.

AUTHOR CITATION: in plant nomenclature, the accepted practice, for purposes of accuracy, completeness, and ease of verification, of attaching in abbreviated form the name of the author who first validly published the name of the taxon. i.e. the practice of identifying a taxon with its author when first mentioned in literature intended as a scientific contribution.

When a name has been proposed but not validly published by an author and is subsequently published and ascribed to him by another author, insertion of an 'ex' is made between the former author's name and the publishing author's name. thus, A. Cunn ex Benth. indicates that Bentham validly published a name originally proposed by Cunningham but not published by him. When a name has a horticultural origin, **Hort.** (from hortulanarium) is used before the 'ex'. When a species or lower rank is transferred to another taxon, with or without change of status, its name is retained (unless such name is in use, preoccupied, within the new taxon) and is followed by the author's name in parenthesis, followed by the name of the effecting author. e.g. **Grevillea buxifolia** (Sm.) R.Br. indicates that for the plant now known by the combination given by Robert Brown, James Smith had published earlier with his diagnosis the name **Embothrium buxifolium**. When a name with a description, or reference to a description, supplied by one author is published in the work of another author, the word 'in' is used to connect the two. e.g. **Eucalyptus alpina** Lindl. in Mitch.

When desirable to abbreviate the citation, the name of the author supplying the description or effecting a transfer should be retained. e.g. **Eucalyptus alpina** Lindl., **Phyllota phyllicoides** Benth. (from **P. phyllicoides** (Sieb. ex D.C.) Benth).

auto(s) Gk.: as in **autogamous**, **automictic**, self (hence self-fertilizing).

AUTOCHTHONOUS: of organisms indigenous to a specific region, the indigenous known as the **autochthon**. From Gk. **autos**; **chthon**, ground.

AUTOECIOUS: of a parasite when able to complete its whole life-cycle within the one host, e.g. certain fungal rusts. Of a liverwort (see Bryophyte) when archeogonia and antheridia occur on separate branches of the thallus.

AUTOGENIC: self-causing.

AUTOLYSIS: the self-destruction of cells and tissues by the reactions of their enzymes.

AUTOPARASITIC: living parasitically upon another parasite, as mistletoe parasitic on mistletoe.

AUTOPHYTIC: see autotrophic.

AUTOPLOIDY: of a genetic system, the progressive duplication of a chromosome set from the one true-breeding parent.

AUTORADIOGRAPHIC: relative to the 'self-tracking' of a 'labelled' substance. i.e. the plotting on a photosensitive plate or film exposed under appropriate conditions to an organism or tissue within which a substance made radioactive (see isotope) has been introduced, the object being to demonstrate the region where the 'labelled' substances is dispersed.

AUTOPOLYPLOIDY: the replication of chromosomes by a pure-breeding line to a number a simple multiple of that basic to the species, e.g. an autotetraploid may be derived from a diploid parent by treatment with the alkaloid colchicine which has the effect of preventing the formation at mitosis of two nuclei, thus leaving in one nucleus the two double sets of chromosomes. cf. allopolyploidy, aneuploidy.

AUTOTROPHIC: biosynthesising from inorganic substances, not dependent for growth on an external supply of organic substances - a quality of an autotrophe. See also chemoautotrophic, photoautotrophic. cf. heterotrophic.

AUTOTROPIC: 'self-adjusting', i.e. resuming the normal polarity of growth on removal of a factor changing the normal polarity.

aux(ein) Gk.: as in **auxetic**, to increase (hence of a factor when promoting growth).

AUXIN: see under phytohormone.

AUXOTROPHIC: of a mutant (e.g. within a bacterial or fungal culture) when requiring a nutrient additional to the needs of the parent strain.

AWN: a bristle-like structure, as of the floral bracts of many grasses.

AXENIC: of a culture (microbial or tissue) when derived purely from a single organism or its part.

AXIAL: relative to the long or vertical axis of a structure, or to the line of normal polarity, e.g. an axial cell system has the cells disposed with their long axes parallel to the direction of the shoot.

AXIL: the angle formed by a part in relation to its parent structure, e.g. as that formed by a leaf in relation to the stem.

AXILE: as in axile placentation (q.v.) relative to an axis.

AXILLARY: within an axil, e.g. axillary buds are developed within leaf-axils.

AXIS: the main stem or central line of development of an organ or organism

azolla: from Gk. **azo**, to dry; **allo**, to kill, hence killed by dryness.

AZONAL: of soil when without definite horizons (q.v.).

BACCATE: of a fruit when of a fleshy or pulpy (succulent) texture; berry-like. See berry, drupe, hesperidium, pepo.

BACCIFEROUS: producing or bearing berry or berry-like fruits (L. **bacca**).

BACILLAR: rod-like. **Bacillus:** a rod-like bacterium.

BACKCROSS: the cross-fertilization of a hybrid with one of its parents, the resultant progeny known as the backcross generation.

BACTERICIDAL: of an agent when actively killing bacteria, e.g. chloramphenicol, an antibiotic derived from the bacterium **Streptomyces venezuelae**, active against the agent of typhoid, **Salmonella typhi**.

bacterion Gk.: a small rod.

BACTERIUM: (plural bacteria) a micro-organism which, although of definite cellular organisation, has the essential parts of its protoplast undifferentiated (diffuse), not (as in plants of higher levels) limited by complex membranes to organelles. While usually **heterotrophic** (hence parasitic or saprophytic) from an absence of chlorophyll or other light-fixing pigment, may also be **chemoautotrophic** by the ability to extract carbon from carbon dioxide through energy derived by the oxidation of inorganic compounds (e.g. of nitrogen, sulphur, iron), or **photosynthetic** by possession of a type of chlorophyll or other pigment but then strictly anaerobic. Possesses the nucleic acid DNA concentrated in a more or less definite nucleus (or **nuclear apparatus**) and, although asexually reproducing, transference of genetic material (simple chromosomes capable of mutating) is possible through a type of conjugation, usually only part of the DNA being transferred on a donor-recipient basis.

The habitat of the bacterium may be soil, water, air, or host. It may be thermophilic and tolerate (or require) temperatures up to 50° or more (e.g. **Thermomonospora**, **Thermoactinomyces**) or barophilic and withstand pressures up to 600 atmospheres. It may be bioluminescent or diffuse to its medium fluorescent pigments. In some cases, e.g. **Clostridium** a survival feature is the intracellular development of highly-resistant resting-bodies (**endospores**) which are released on dissolution of the parent cell and may remain viable for many years.

The organism may remain unicellular or be divided by septa to become multi-cellular and form a **trichome**. It may be motile by a flagellum or flagella (of a single fibril), by a gliding movement on a solid surface or by a spiralling movement. When unicellular, is typically of the spherical (coccoid), rod-shaped (bacillar), helical or spiral (spirillum) or filamentous form, and may unite with others to form a chain, e.g. **Streptococcus** with some species forming chain up to 150 microns long, or form clusters, or in a few, a firm-textured gelatinous matrix (**zoogloea**). The protoplast is limited by a membrane probably of lipoprotein nature, externally lined by a thin, usually rigid, cell-wall probably of cellulose or hemicellulose and possibly with chitin. The cell-wall is enclosed by a slime-layer or a polysaccharide (e.g. galactan) which, when conspicuously developed and in close contact with the cell, forms a **capsule**. In trichomes, the capsule is replaced by a **sheath** from which a stalk-like attachment (**holdfast**) to the surface frequently is developed.

The nature of the cell-wall provides the basis for the well-known but little understood **Gram-reaction** (first developed by the Danish physician Christian Gram in 1884), the differential staining of the cell by crystal violet (or methyl violet) for a definite period followed by an iodine solution, a decolourising by alcohol and counter-staining by safranin when a resultant blue stain indicates a positive (gram-positive) reaction, and red a gram-negative reaction. The decolourising agent appears prevented entry by a barrier of high lipid content of the Gram-positive wall.

A member of the most primitive group of organisms with an unknown, doubtfully monophyletic origin. Certain bacteria show affinity with the blue-green algae (**Cyanophyceae** or **Schizophyceae**) and current classifications place the bacteria as class **Schizomycetes** with the class **Schizophyceae** under a common division **Schizophyta** or **Protohyta**, the latter division adding the viruses as class **Microtobiotes**. In consideration of the vast field of bacteriology, the following superficial sketch is given to illustrate the diverse nature of this ubiquitous group of organisms.

A. unicellular, rigid-walled, coccoid, bacillar, or spiral, usually less than 2 microns wide, sometimes in chains, clusters or in zoogloal masses, usually motile by terminal (polar) flagella, gram-negative. Reproduction by simple transverse fission. - order **Pseudomonadales**.

Included is a sub-order (**Rhodobacterlinae**) of photo-synthetic anaerobes which oxidise compounds either of sulphur or carbon. When sulphur, carotenoids may mask a chlorophyll to

give red and purple colours. The chlorophyll, bacterio-chlorophyll, absorbs from the visible and infra-red spectrum of light. **Red and purple sulphur bacteria** are strictly anaerobic at least when exposed to light and usually are associated with hydrogen sulphide - containing waters, the sulphide being oxidised to sulphur which is stored within the cell. Forms include the unicellular, motile, encapsuled type (e.g. **Chromatium**), sometimes colonial, usually about or less than 2 microns wide although the spirally-twisted **Thiospirillum** may be up to 4 microns or more wide and over 40 microns in length.

When carotenoids are not prominent, a type of chlorophyll absorbing from the infra-red region gives a green colour, or an unidentified photosynthetic pigment may give a yellowish-green colour. The **green sulphur bacteria** (e.g. **Chlorobium**) are unicellular non-motile organisms of marine and fresh water muds, **Chlorobium** (less than 2 microns wide) oxidising hydrogen sulphide to sulphur which, deposited outside the cell, may be further oxidised to a sulphate by an external outflow of enzymes.

When carbon compounds (e.g. alcohols, acetates, lactates) are the hydrogen donors (hydrogen sulphide not being oxidised), colours may be red, purple, or brown, both bacteriochlorophyll and carotenoids being present. Because of a need for organic sources, such coloured bacteria are not strictly autotrophic. **The red and purple non-sulphur bacteria** (e.g. **Rhodopseudomonas**) typically are unicellular, less than 2 microns wide, motile and colonial.

Within the second sub-order (**Pseudomonadineae**) are the **chemoautotrophic bacteria** which are colourless, mostly aerobic and using carbon dioxide as the sole source of carbon, usually of soil or water, e.g. the nitrifying bacteria **Nitrosomonas** and **Nitrococcus** which oxidise ammonia to nitrate, and **Nitrobacter** and **Nitrocystis** which oxidise nitrite to nitrate. In addition, other inorganic compounds are oxidised, e.g. hydrogen to water by **Hydrogenomonas**, methane by **Methanomonas**, hydrogen sulphide or a thiosulphate by **Thiobacillus** (sulphur usually deposited within the cell, ammonia often being used, **T. denitrificans** in the process reducing nitrate to nitrite), carbon monoxide, etc.

The remainder of the sub-order are heterotrophic and mostly aerobic. Representatives are:

- the pathogens of plants **Pseudomonas** (e.g. wilt of potatoes, gummosis of cherry) and **Xanthomonas** (e.g. leaf scald of sugar cane, leaf spot of cotton), a species of **Pseudomonas** diffusing a fluorescent pigment used as an indicator dye of **pyocyanin**.

- acetic acid bacilli (e.g. the aerobic **Acetobacter** and **Acetomonas**) which oxidise various organic compounds to organic acids, alcohol to acetic acid, glucose to gluconic or keto-glutonic acid - these are agents of industrial fermentation.

- the marine or fresh-water bioluminescent **Photobacterium**, sometimes fluorescent **Alginomonas**, curved bacilli of **Gallionella** which are attached to a surface by a ribbon-like stalk composed of, or with deposits of iron oxide, **Spirillum** of stagnant or organically-rich water, with a spiral axis.

- sewage purifying bacilli, primary colonisers of the percolating filter (bacterial bed) of sewage disposal as the first stage of its purification, and the alternative system of activated sludge. **Zoogloea** which gives the name to the colonial form of certain other bacteria.

- the pathogenic members of **Vibrio**, curved bacilli, e.g. the agent of Asiatic cholera **V. comma**.

- B. unicellular or multicellular bacilli, heterotrophic, 2 microns or less wide occurring in chains (trichomes) often ensheathed, the sheath usually impregnated with iron or manganese oxides, freeing cells which are either motile or non-motile, gram negative, of fresh water or marine. **Chlamydo bacteriales**. (e.g. **Sphaerotilus**, **Leptothrix**).
- C. Cells in dense groups with radiating filaments from the end of which may be formed (budded) a daughter cell (**Hyphomicrobium**, **Rhodomicrobium**) or unicellular, ovoid, spherical or pyriform attached at the end of a stalk from a holdfast, budding occurring at the free end of the cell (e.g. **Pasteuria**), of soil or mud of fresh water. **Rhodomicrobium** is photosynthetic. **Hyphomicrobiales**.
- D. unicellular, rigid-walled, coccoid or bacillar, sometimes pleiomorphic, heterotrophic, usually less than 2 microns wide, motile or non-motile, the flagella when present not polar (i.e. are normally

peritrichous). Reproduction by transverse fission. Saprophytic, parasitic, often pathogenic, of fresh and salt water, air, soil, animal and plant hosts. Sometimes occurring in chains but not as trichomes. **Eubacteriales**.

In this, the major group of bacteria, the following are illustrative.

- (i) gram-negative motile, aerobic bacilli or cocci, free-living in soil, fixing atmospheric nitrogen - **Azotobacter** (e.g. **A. chroococcum**).
- (ii) gram-negative, motile or non-motile, aerobic bacilli associated with the roots of plants either as symbionts (**Rhizobium** spp. in the nodules of leguminous plants where nitrogen-fixing) or as pathogens causing malformations (e.g. **Agrobacterium tumefaciens** causing crown-gall).
- (iii) gram-negative bacilli, carbohydrate-fermenting, occurring in alimentary canals either normally commensal (e.g. **Escherichia coli**, **Proteus vulgaris**) or pathogenic (causing, e.g. gastroenteritis by species of **Salmonella**, typhoid fever by **S. typhi**, dysentery by **Shigella** spp.), or parasitic on plants causing soft rots (e.g. several species of **Erwinia**). The entero-bacteria.
- (iv) gram-negative aerobic bacilli pathogenic on mammals, e.g. **Brucella** (brucellosis, undulant fever in man, contagious abortion of cattle), **Haemophilus** (e.g. purulent meningitis, infections of the respiratory tract, conjunctivitis), **Pasteurella** (various septicemias, bubonic and pneumonic plagues by **P. pestis**).
- (v) gram-positive, aerobic cocci.
 - (a) the lactic acid cocci, homofermenters of carbohydrates to lactic acid, e.g. the chain-forming **Streptococcus**, some species commonly found in dairy products, sometimes causing the souring of milk, one **S. cremoris** used in butter and cheese making, others common commensals of the respiratory tract and alimentary canal (a few anaerobic) or pathogenic **S. pyogenes** producing the toxins associated with scarlet fever and various septicemias.
 - (b) the cluster-forming micrococci common on, or in, skin and mucous membranes, e.g. **Staphylococcus aureus** ('golden staph') highly resistant to the normal antibiotics, causative of some bronchopneumonias, food-poisoning (gastro-enteritis), various skin infections.
- (vi) gram-negative cocci, kidney-shaped or hemispherical occurring in pairs, non-motile, aerobic, pathogens, e.g. **Neisseria gonorrhoeae** (gonococcus, causative of gonorrhoea and other venereal diseases). **N. meningitidis** (meningococcus, an invader of the nasopharynx spreading to the central nervous system to cause a meningitis).
- (vii) gram-positive, aerobic, non-sporing bacilli.
 - (a) lactic acid bacilli. Fermenters of carbohydrates to lactic acid either almost completely (homofermentative) or with the production of additional compounds as carbon dioxide, ethanol, acetic acid (heterofermentative) **Lactovacillus delbrueckii** of industrial fermentation, a homofermentative agent converting maltose and dextrose to lactic acid. Commonly occur in fermenting plant (e.g. vegetable and grain mashes, fruit juices) and animal products (e.g. cheese, milk) in association with the yeasts.
 - (b) the several members of **Corynebacterium** pathogenic on plants and animals, e.g. **C. diphtheriae** of diphtheria.
- (viii) gram-positive, non-motile, non-sporing anaerobic bacilli normally found in alimentary canals fermenting carbohydrates with the production of carbon dioxide and acetic acid, additionally propionic acid (**Propionibacterium**) or butyric acid (**Butyribacterium**).
- (ix) endospore-producing bacilli, the endospore often wider than the producing cell which is swollen as a result. Mostly saprophytes of soil, e.g. the aerobic **Bacillus** (**B. subtilis** of industrial fermentation producing glycerol, ethanol, lactic acid, and amylolytic, pectolytic and proteolytic enzymes. **B. anthracis** causative of anthrax, a disease leading to haemorrhagic septicemia), the anaerobic **Clostridium**, several (e.g. **C. butyricum**) nitrogen-fixing but many pathogenic. **C. tetani** and **C. botulinum** produce a toxin (endotoxin) causing diseases of the nervous system when diffused into the animal body. Unlike **C. tetani** (tetanus), **C. botulinum** (botulism) need have no direct contact with the host of its toxin. Butanol, ethanol, acetone and riboflavin are derivatives from **C. acetobutylicum** of industrial fermentation.

E. a definite mycelium developed in young stages (the hyphae more or less a micron diameter) which may break up into segments, sometimes branched (**Nocardia**, **Actinomyces**), or remain

intact and (e.g. **Streptomyces**) produce spores (conidia) at the ends of aerial hyphae (conidiophores) or other spores (sporangiospores) formed by fragmentation or segmentation of hyphae (sporangia). In **Mycobacterium**, a mycelium is either poorly or not developed, no spores are formed but a multicellular nature is suspected. Gram-positive, mostly soil, heterotrophic. **Actinomycetales**.

Some pathogens of animals and plants (e.g. the aerobes of **Nocardia** and anaerobes of **Streptomyces**), several streptomyces sources of antibiotics, e.g. streptomycin used in treatment of tuberculosis from **S. griseus**, aureomycin from **S. aureofaciens**, chloramphenicol from **S. venezuela**, etc. **S. scabies** causative of Common Scab of potatoes.

The gram-stain resistant tubercle bacilli of **Mycobacterium** include **M. tuberculosis**, and the agent of leprosy **M. leprae**.

Thermoactinomyces includes thermophilic (e.g. an optimum 60°) agents of humus-formation.

- F. multicellular filaments (trichomes) sometimes up to 2,000 microns, not enclosed in a sheath, frequently motile, often forming endospores, with a Feulgen reactive (i.e. DNA positive) disc-shaped central nuclear apparatus, heterotrophic, of decomposing organic matter, water, intestines. **Caryophanales (Carophanon, Simonsiella, etc.)**.
- G. occurring in trichomes, sometimes unicellular, motile not by flagella but by a gliding or rolling motion when in contact with a solid substrate hence with a flexible wall, cell width up to 70 microns. Marine, fresh water, soil, or decomposing organic matter, heterotrophic. **Beggiatoales (e.g. Beggiatoa, Thiobrix)**.
- H. vegetative cells bacillar or fusiform, gram-negative, flexible, not flagellate but motile by a slow gliding movement. Colonial in a thin flat **plasmidium** from the margins of which single cells or groups of cells migrate, usually leaving a trail of slime. Resting cells (sometimes absent) formed singly from a cell which, together with others, are localised in a usually brightly-coloured fruiting-body. Occur in rotting vegetable matter or decaying wood, soil, water both fresh and salt. When marine chitin and agar may be digested; when terrestrial cellulose may be broken down. Slime bacteria (e.g. **Cytophaga, Myxococcus, Chondrococcus, etc.**). **Myxobacterales**.
- I. flexible, spirally-wound, actively motile but not flagellate, up to 30 microns or more in length, some (e.g. **Spirochaetes**) with a group of fibrils wound round the main axis and appearing as a single axial filament. Occur as free-living saprophytes of stagnant fresh or salt water, some pathogenic, e.g. the strictly parasitic **Treponema pallidum** causing syphilis, **T. pertenue** the tropical disease yaws; **Leptospira** species causing a jaundice and meningitis bovine leptospirosis affecting cattle and man, **Borrelia** species relapsing fever. Spirochaetes. **Spirochaetales**.
- J. cocci extremely small (up to 300 millimicrons) producing branching filaments up to 50 microns long which later become chains of spherical bodies released, by fragmentation, as highly resistant cocci, non-motile, gram-negative. Saprophytic, parasitic or pathogenic. A single genus **Mycoplasma** causing pleuropneumonias, e.g. **M. mycoides** contagious pleuropneumonia in cattle. **Mycoplasmatales**.
- K. Cocci of bacilli (but often pleiomorphic), gram-negative, intermediate in size to the bacteria and the filterable viruses, obligate parasites occurring usually within the cells of vertebrate host or an invertebrate host (e.g. louse, tick) which may be a vector. Classified as an order in association with the **Virales** (viruses) forming a class **Microtobiotes**, the two groups having in common an incapacity for reproduction outside a living cell, but the viruses are far less susceptible to the normal antibiotics. **Rickettsiales**. e.g. **Rickettsia, R. prowazeki** the louse-borne agent of scrub typhus. others, e.g. **Anaplasma**, are parasites of red blood cells. **Miyagawanella** spp. certain types of viral pneumonia and the diseases transmissible from birds to man, psittacosis from **M. psittaci** with hosts psittacine birds, e.g. parrots and ornithosis from **M. ornithosis** with hosts usually other than psittacine types but causative of similar disease.

BACTERIOPHAGE: (phage) a virus dependent on a bacterium for its reproduction. A DNA-containing, protein-coated form spherical in shape when simple but when complex tadpole-like with definite

head and tail and up to 200 millimicrons long. While the protein coat is retained on the surface of the bacterial host, the DNA is injected within to take over direction of metabolic processes. This direction may lead to the formation of a number of new phages which are released for infection of other bacterial cells when rupturing (lysis) of the host cell occurs. In other cases, a form of commensalism is known to occur when the phage remains (as a prophage) to cause certain metabolic changes which may lead to an increased degree of resistancy or toxicity of the bacterial host.

BACTERIOSTATIC: of an antibody of chemotherapeutic agent (e.g. penicillin, streptomycin) preventing the reproduction (multiplication) of bacteria.

barbat(us) L.: bearded; with a fringe or tuft of hair.

BARBELLATE: barbate, but with the hairs bristle-like and hooked.

BARK: the tissues, collectively, outermost to the cambium of a woody plant. The superficial layers which are readily stripped from a trunk or large branch represent alternate layers of **periderm** (q.v.) and non-living **phloem**, together marking up a **rhytidome**. The rhytidome provides an insulating barrier to atmospheric water and gas exchange. The inner bark of periderm and phloem are actively functioning, the periderm forming a protective sheath for the phloem and functioning sometimes for storage. From Danish **bark**.

bar(os) Gk.: as in **barophilous**, pressure; weight (hence adapted to high degrees of atmospheric or hydrostatic pressure, as certain marine bacteria which flourish at pressures of 600 atmospheres).

BASALTIC: of soils when originating from basalt, an igneous rock of fine texture and dark colour which, when forced as molten magma through volcanic vents or fissures, may form sheets of lava covering large areas. See also **krasnozem**.

bas(i)s Gk.: as in **basicephala**, **basifixed**, basal; of the base.

BASIC: of a chemical substance when reactant with hydrogen ions of dissociating to hydroxyl ions. Of soils when alkaline in reaction.

BASIDIUM: the typically clavate structure of a basidiomycete (see under Fungus) within which occur karyogamy and spore-production.

BASIFIXED: of an anther when its connective is a direct continuation of the filament.

BASIFUGAL: developing away from the base. Centrifugal. cf. **basipetal**.

BASIFUGIC: intolerant of basic soils.

BASIN: of land, an area over which drains a river or river-system, e.g. the Lake Eyre Basin, an extensive internal drainage system for rivers flowing westwardly from the coastal highlands of Queensland; the Hunter River Basin of the eastern coast which discharges to the sea waters from eastwardly-flowing rivers.

BASIPETAL: developing downwardly from the apex, as an inflorescence when from the tip of the shoot a flower is formed, to be followed at successive lower levels by other flowers. Also **centripetal**. cf. **acropetal**.

BASOPHILOUS: adapted to, tolerant of, or with an affinity for, alkaline or basic conditions. cf. **acidophilous**.

bathy(s) Gk.: as in **bathymetric**, depth (hence relative to the vertical levels of space considered in terms of, e.g. the distribution of organisms).

BATHYPELAGIC: of the depths of the ocean (from Gk. **bathys**, and **pelagos**, sea).

BEDROCK: the solid rock of the earth's crust, sometimes exposed but usually below the fragmented mantle-rock of which soil is a superficial part.

bellid(us): of the daisy **Bellis (Compositae)**.

BENTHIC: of the lake or ocean floor, the **benthos** (Gk., the depths of the sea).

BENTHOS: applied also to the flora and fauna at or near the lake or ocean floor.

BERRY: a pulpy or fleshy (succulent) indehiscent, one or more-seeded fruit formed of one or more carpels, with the inner layer of its pericarp never hard, as is the case with the drupe (q.v.). See also hesperidium, pepo.

bi(s) L.: as in **bicarpellate, bicostate, bifid**, twice.

BIENNIAL: of a herb (or a herb) when developing leaves (in a rosette) during the first vegetative season which usually survive the winter period and, in the following season, the flowering (usually leafy) shoot, the plant dying after seeding. Usually a plant originating from cold-temperature regions, of open or cultivated soils, often (as with the root-crops carrots, swedes, turnips, etc.) storing reserve food.

BIFID: forked; divided to two lobes or segments.

BIFURCATE: of branching when forming a fork by the equal or near equal growth of parent and lateral shoot.

BILATERALLY SYMMETRICAL: of structure when divisible into two equal parts in one plane only.

BILLABONG: a water-hole originating from a non-permanent watercourse.

BINARY: of two units or components.

BINARY FISSION: in general, the splitting into two parts. Of bacteria and unicellular algae and fungi, asexual reproduction by division of the cell to two functionally (usually) independent parts.

bin(i) L.: as in **binary, binate**, in twos.

BINOMIAL SYSTEM: see under Nomenclature.

bio(s) Gk.: as in **biochemistry, biology** life (hence the chemistry of, and the general science of, living organisms).

BIOCATALYST: an agent (viz. an inorganic ion, an enzyme, a growth substance, a vitamin) essential in the control or direction of a metabolic process.

BIOCLIMATIC: relative to the influence of climate on life.

BIOCOENOSE: a community of a particular habitat.

BIOENERGETICS: the science of energy exchanges and transformation in biological processes.

BIOGENESIS: the descent from, or production from, previously-existing organisms.

BIOLUMINESCENCE: the emission of light from a metabolic process, e.g. by certain bacteria and fungi.

BIOMETRIC: relative to the application of mathematical techniques in the interpretation of biological observation, e.g. techniques of statistical analysis.

BIONOMIC: relative to the interaction of the organism with its environment.

BIOSPHERE: the life-supporting region and its inhabitants of the planet Earth.

BIOSYNTHESIS: the building-up of complex molecules from simpler ones by an actively-functioning organism. Biosynthate: a product derived from biosynthesis.

BIOSYSTEMATIC: an approach to objective consideration of classification and relationships among taxa through the study of living populations under both natural and artificial environment conditions, from the aspect of form, function, growth and development.

BIOTA: the flora and fauna of a region.

BIOTIC: relative to living processes.

BIOTYPE: the individuals, collectively, of the one genotype, as the assemblage of members of a pure-line. See also clone.

BIPAROUS: see dichotomous.

BIPINNATE: see under pinnate.

BISEXUAL: of a reproductive structure when both male and female parts are present and functional. Hermaphrodite.

BITERNATE: divided again to three segments.

BIVALENT: of homologous chromosomes when paired (conjugated) at meiosis.

BLACK EARTH: a soil group formed from volcanic or calcareous parent materials, possessing a neutral to alkaline reaction, a black to dark-grey colour in the A horizon, and a good granular structure with a self-mulching surface. A fertile soil although with content of organic matter normally below 5 percent. Soils of the Wimmera and Darling Downs districts are of this nature.

blaeri-: as in **blaeriaefolia**, of the African **Blaeria** (**Ericaceae**) - derived from a personal name (P. Blair).

blast(os) Gk.: as in **blastogenic**, bud (hence reproducing by the development of buds).

blephar(is) Gk.: as in **blepharocarya**, an eyelash (hence fruit bearing capillary hairs, or cilia).

BLIGHT: of a plant, a pathologic condition causing sudden and extreme withering.

BLOODWOOD: a member of a group of eucalypts characterised by terminal branched-corymbose inflorescences, relatively large ovoid or globular fruits bearing broad winged seeds, and leaves with straight and closely-set parallel venation, the undersurface paler. The name is taken from the brown or red wood deeply stained by an exudation of a gum-like kino (q.v.) from lesions in the bark.

Most members are of the tropical north but Marri **Eucalyptus calophylla** and Red Flowering Gum **E. ficifolia** (both well-known for their floral wealth) are from the south-west of Western Australia, Lemon-scented Gum **E. citridora** and Spotted Gum **E. maculata** are timber trees of the eastern coast (although adaptable to much drier conditions), and **E. terminalis** is widespread throughout the inland and interior of the continent. The most southern range is that of Red Bloodwood **E. gummifera** which traverses the tropical to temperate eastern coast.

BLUEBUSH: of a community dominated by the halophilous and xenomorphic members of **Kochia** with long-established recognition as drought resistant fodder plants in the arid interior or inland of the continent. Also (as the noun) applied to such a plant. The name is taken from the bluish hue given in the field by the greyish-white foliage of the most widespread **K. sedifolia**. This species is adapted to soils with limestone close to the surface: other bluebush are found on sandy flats or near watercourses, sometimes in association with salt bush (q.v.).

BLUE GUM: a name applied to a few eucalypts with bark smooth and of a bluish-grey colour, in particular to those of the south-east and east of the mainland and Tasmania whose typical habitat is the wet sclerophyll forest. The Southern Blue Gums **Eucalyptus globulus**, **bicostata**, and **maidenii** are noted for their dark-green adult leaves lanceolate and long (sometimes longer than 12 inches) and broad juveniles leaves frequently very glaucous and borne on quadrangular stems. The Eastern Blue Gums, e.g. the giant timber trees of **E. grandis**, **saligna**, **deanei**, have adult leaves with some resemblance to the bloodwoods (q.v.) in that the upper surface is darker and the venation straight and parallel. In South Australia, blue gum refers to the ironbark **E. leucoxylon** which is smooth-barked on the upper trunk and mottled white and blue.

BOG: of a community, or a community, when adapted to moist or very moist conditions and composed usually of hummock-forming mosses, acidophilous shrubs or hydrophytes and helophytes. When developed on a slightly raised or convex surface of land, a **Raised Bog**; when developed on a flat or slightly concave surface of land, a **Valley Bog**.

BOLE: of a tree, the trunk up to the first main branches.

BOREAL: relative to the north, especially (in the phytogeographic sense) to the coniferous forests of the northern hemisphere.

BOSTRYX: see under cyme.

botane Gk.: as in **botanical**, **botany**, pasture (hence relative to, and the science of, plant biology).

botry(s) Gk.: as in **botrycephala**, a cluster or bunch.

BOX: of eucalypts, a member of a botanic group (**Buxales**) whose components range in form from trees 100 feet or more high (e.g. **Eucalyptus bosistoana**) to mallees, and have bark rough and sub-fibrous, persistent (or only on the lower trunk of the Grey Boxes **E. bosistoana**, **moluccana**, **microtheca**). Essentially a tree of woodlands of dry areas with hot summers, mostly of the eastern temperate and sub-tropical regions of the continent. Typical of the group are the paniculate inflorescences, the small fruit with valves exsert only in Coolabah **E. microtheca**, the very strong, hard and durable wood resembling the European Box of commerce (from **Buxus sempervirens**), and the value as timber and honey sources. A close ally is the Yellow Box **E. mellidora**, a foremost as a honey source. Of some prominence also as dominants of woodland are Fuzzy Box **E. conica** and White Box **E. albens**.

The valuable timber tree of eastern brush, frequently planted as a street and avenue tree, **Tristania conferta**, is known as Brush Box.

brachi(on) Gk., brachi(um) L.: as in **brachiate**, an arm (hence branched).

brachy(s) Gk.: as in **brachycome**, short.

BRACT: of angiosperms, a leaf, usually modified in shape and size, at the base of a peduncle.
Bracteate: with a bract or with bracts.

BRACTEOLE: an accessory bract, e.g. of a pedicel. **Bracteolate:** with a bracteole or with bracteoles.

BRACTEOSE: with, or composed of, bracts.

brady(s) Gk.: as in **bradygenic**, slow (hence retarded in development).

brevi(s) L.: as in **brevifolia**, short.

BRIGALOW SCRUB: a community in which the freely root-suckering Brigalow **Acacia harpophylla** is dominant. Of widespread extent throughout the western slopes of the eastern highlands of queensland (e.g. the Darling Downs and Fitzroy River Basin) and to a lesser extent the north-western plains of New South Wales, occurs principally on clay or clay-loams of the 20 to 30 inch rainfall belt.

brunne(us) L.: brown.

BRUSH: a forest community of high rainfall regions (mainly summer-autumn), frequently on rich soils, floristically of great diversity, several species being present but none with particular dominance. Also Rain Forest.

bryo Gk.: as in **bryophyllum**, to sprout (hence sprouting from the leaf).

bryon Gk.: a moss, hence **bryology**, the science of the mosses and their allies.

BRYOPHYTE: a multicellular, photosynthetic, non-vascular or partially vascular plant, mostly terrestrial, with habit prostrate and thalloid or erect and composed of stem and leaves, attached to a substratum by absorptive capillary-like rhizoids, usually inconspicuous except when in mass. An embryophyte with regular heteromorphic alternation of generations, the diploid (sporophytic) generation never completely independent from the haploid (gametophytic) generation, the sex organs multicellular with the reproductive cells ensheathed by a wall of sterile cells, the female reproductive cell solitary in its archegonium.

A plant generally believed to represent a terrestrial line to dominance of the gametophyte from an ancestor derived from the green algae, the other line represented by the vascular plant with the sporophyte the dominant phase. Its classifications embraces three classes, hornworts (**Anthocerotae**), liverworts (**Hepaticae**) and mosses (Musci).

The macroscopic plant, the gametophyte, normally developed from a spore, bears multicellular antheridia (producing flagellate male gametes) and archegonia (producing within each an egg-cell). Fertilization requires moist conditions, the fusion of the motile gamete with the egg-cell leads to the development of an embryo from which arises the sporophyte (a **sporogonium**) usually enveloped by a **sheath** or **calyptra** formed by enlargement of the venter of the archegonium. The mature sporogonium is composed of a spore-bearing structure (**capsule**) and a basal absorbing part, a **foot**. Meiotic division of spore mother-cells forms the tetrads of spores which are released on rupture of the capsule, dispersed by wind or water, and develop under moist conditions to new gametophytes. In many liverworts and hornworts, elongated sterile cells, **elaters**, formed within the capsule concurrently with spores, aid in dispersal through a hygroscopic sensitivity. Gametophytes may be developed also from separated parts or from bud-like **gemmae**.

Hornworts

In this group, a simple thallus develops dorsiventrally and has within each cell a large chloroplast, part of which is a region of protein (a **pyrenoid**) associated with the formation of starch. Rhizoids are unicellular. the origin of sex organs is from internal cells of the dorsal surface of the thallus, the archegonia almost completely embedded. Growth from the archegonial region forms a sheath through which pushes the apex of the capsule. The sporogonium is complex and elongates to an indefinite length from active division of a meristematic region between foot and capsule. It has a central axis (**columella**) of sterile cells encircled by the spore-bearing tissue, chloroplasts and often stomata. Two genera of note are the widespread **Anthoceros** with thallus lobed or crisped on the margin bearing on its ventral surface mucilage cavities containing colonies of the blue-green alga **Nostoc**, and the tropical epiphytic **Dendroceros** with thallus a single cell in thickness but with a large thick mid-rib projecting below.

The much larger groups of liverworts and mosses differ from the hornworts by the greater number of chloroplasts (without pyrenoids) within each cell, the origin of the sex organs from superficial cells, and the absence of a meristematic region at the foot of the capsule. Rhizoids of liverworts are unicellular (hence comparable to root-hairs of vascular plants) but in mosses are chains of single cells. Archegonia of mosses and some leafy liverworts are formed at the tip of the stem or its branches, thus arresting further growth from these points (the **acrogynous** condition), or in other leafy liverworts (of the **anacrogynous** condition) from other than an apical cells and without arrest of growth. Both archegonia and antheridia may occur on the same plant (the plant then **homothallic**) or on different plants (then **heterothallic** or dioecious). When homothallic, the plant is **paroecious** when both organs occur on the same branch but are segregated, **autoecious** when occurring on different branches, and **synoecious** when intermixed on the same branch. Leaves (when present)

subtending these organs often are different in shape and size from other leaves and are referred to as **perichaetal** when distinguishing them from foliage leaves. Of the sporogonium, a connective **seta** of capsule and foot is usual which, by elongation, pushes the capsule through the calyptra on maturation of the spores (liverworts) or at an early stage in the development of the embryo (mosses).

Liverworts.

Development of the liverwort from a spore is dorsiventral, leading to a usually dichotomously branched thallus or (a majority) a branched foliose stem. Sex organs develop from single initial cells on the dorsal or anterior surface. The capsule is without a columella but usually develops elaters. While a few liverworts are aquatic (e.g. **Riccia fluitans**) and a few others can withstand periodic desiccation, the common habitat is a shaded moist site. Some are epiphytes, others epiphylls. Greatest representation of the several orders is from the tropical northern hemisphere but the orders **Marchantiales** (e.g. **Marchantia**, **Riccia**) and **Jungermanniales** are well represented in Australia. Sex organs of **Marchantia** are borne on stalked, 'umbrella-like' branches (archegoniophores and antheridiophores) but in **Riccia** these organs occur directly on the dorsal surface of the thallus. for the **Jungermanniales**, the origin of archegonia may be either anacrogynous (e.g. **Riccardia**, **Pallavicinia**) or acrogynous (e.g. **Porella**, **Plagochila**). Growth from the gametophytic tissue close to the archegonium produces a tissue, an **involute**, which ensheaths the calyptra of the young sporophyte. When anacrogynous, the plant usually is undifferentiated to stem and leaves, the sexual organs borne laterally and on the dorsal surface of short lateral branches of the thallus. When acrogynous, the plant is foliose, usually with three rows of leaves along a stem, the antheridia globular, borne on long stalks and axillary to the leaves. Leaves subtending organs are termed bracts, those below archegonia **perichaetal bracts** and those below antheridia **perigonial bracts**. A few of the uppermost perichaetal bracts are fused to form a **perianth** which encloses the capsule.

The Mosses.

Greatest specialisation and diversity are shown by this major group. Distribution is wide with some favour for the colder regions of the world. Germination of a spore leads to a filamentous or thalloid (**Sphagnum**) **protonema** which usually dies after formation of an erect branch, a **gametophore**, bearing the sex organs. The gametophore arises from the protonema as a lateral bud which develops a pyramidal apical cell, division at each face of the cell (**cutting face**) forming a leaf so that, in most, a branch with three vertical rows of leaves is built. On these leafy branches are borne the sex organs. Rhizoids of both protonema and gametophore are multicellular. The leaves are spirally and symmetrically arranged on a stem composed of a central cylinder, cortex and epidermis. Development of archegonia is acrogynous. The capsule is without elaters but usually with a columella, and (except in **Andraea**) an apical cap, an **operculum**.

Three groups make up the mosses - bog (or peat) mosses (sub-class **Sphagnobrya**), granite mosses (sub-class **Andreaobrya**) and true mosses (sub-class **Eubrya**).

The bog mosses (**Sphagnum**) frequently cover large tracts of swampy lands. There is an abundance of water-absorbing large hyaline cells in contrast with relatively few chlorophyll-bearing cells. A single gametophore is produced from the thallus, archegonia in a terminal cluster, the antheridia axillary to the leaves. The sporogonium is composed of a large globular capsule with a neck-like connective at its base representing a seta, and a bulbous foot. The function of the seta is taken over by an elongation (a **pseudopodium**) formed from the axis of the branch.

Granite mosses (**Andraea**, **Neurocladia**) usually occur on siliceous rocks of arctic or alpine regions. The gametophores usually bear the sex organs in terminal groups on separate branches. The sporogonium is similar to that of **Sphagnum** except that the capsule is enclosed by a calyptra and dehiscence through four valves.

True mosses (e.g. **Dawsonia**, **Funaria**, **Polytrichum**) represent the peak of the bryophyte's evolutionary development. They have universal occurrence in habitats ranging from rock faces to ponds to tree trunks. In addition to the filamentous protonema, constant features include a sporogonium with an elongated seta, a capsule photosynthetic and often with stomata internally differentiated to several tissues and opening by an operculum which overlies a hygroscopically sensitive tissue, a **peristome**, of aid in the control of spore-dispersal.

The role of the moss and other bryophytes as early colonisers of barren sites and the power to bind soil against erosion are of recognised economic importance. Sphagnum among other mosses contributes to formation of peat, this compressed and carbonised residue has yielded materials and products ranging over fuel, ethyl alcohol, nitrogen source, paper and insulating material, a moisture-retentive medium for plant propagation (additional to Sphagnum from an actively-growing source), and the root-penetrable seedling container commonly known as the 'jiffy-pot'.

bucculent(us) L.: in the nature of full-blown cheeks (**buccae**), hence inflated.

BUD: a group of cells (or a single cell) with a potential for active division for the initiation of vegetative or reproductive growth. In relation to its parent structure, may be of terminal (apical), axillary, or adventitious origin; may be normally active, or be passive (dormant) until removal of the inhibiting factor. Of seed-bearing plants may include within its structure a protective enclosure of modified leaves (scales) often hardened and resinous, or the leaves may be relatively unmodified (the bud then naked).

BUDDING: of propagation, a method of inducing a graft with a bud (or part of a shoot with a bud) as the scion. In a general sense, developing from a bud or producing buds. Of a fungus (e.g. a yeast), a method of asexual reproduction.

BUD SPORT: a part (e.g. leaf, flower, fruit) arising from a mutated bud and with an appearance and genetic system different to the normal structure.

BUFFER: a substance, e.g. a salt of a weak acid (as sodium phosphate) or an amphoretic compound (as an amino acid), capable of controlling or resisting changes in the pH of a solution by the release of ions of opposite charge to those tending to increase the acidity or alkalinity of the solution. Colloids, and to a lesser degree, substances within a root have the property of buffering the pH of a soil.

BULB: a bud, usually subterranean, enclosed by modified leaves or fleshy scales, from which may arise a root and shoot system. Within the axils of the scales, other bulbs (cloves) may develop which have potential for independent growth. A feature of the **Liliaceae**, e.g. the onions and garlic of **Allium**.

BULBIL: a small bulb arising adventitiously from a leaf-axil, inflorescence, or other origin. **Bulbifery**: the apomictic condition of bulbil production. See under apomixis.

BULLATE: of a surface when wrinkled or with numerous minute blister-like swellings. From L. **bulla**, a bubble.

bursa L., Gk.: as in **bursa-pastoris**, a sac or pouch-like structure.

BUTTRESS ROOT: a flattened, plank-like expansion formed from root and trunk of certain often shallow-rooted trees especially of the rainforest (e.g. from **Ficus**, **Tarrietia**, **Sloanea** spp.), apparently acting as an anchorage when developed, with others, around the trunk base, often to heights of six or more feet.

buxi-: as in **buxifolia**, of **Buxus**, the European Box.

BYSSOID: thread-like; forming a mass of fine threads.

c, C: see calorie. °C: see centigrade.

c, ca: **circa**, approximate, in the region of. cf.: compare with.

CADUCOUS: falling of withering away very soon after development.

caeno-: see caino-.

caerule(us) L.: dark blue; sky blue.

caesi(us) L.: bluish-grey.

CAEPITOSE: matted or tufted, as grasses when forming mounds.

caino(s) Gk.: as in **cainozoic**, recent (hence of the geologic era when ancestors of present-day animals (especially mammals) were well represented).

calam(us) L.: as in **calamifolia**, **calamus**, a reed.

calcar L.: as in **calcarate**, a spur.

CALCAREOUS: in general, with the colour or texture of chalk. Of soils, relative to a high content of free calcium (and often magnesium) carbonate to a degree that the reaction is decidedly alkaline.

calcari(us) L.: growing from calcareous soils.

calce(us) L.: as in **calceiform**, a shoe.

calceol(us) L.: as in **calceolate**, a small shoe.

cali(s) L.: as in **calcicole**, **calcicolous**, of limestone, chalk or calcium and its compounds (hence a plant of, and inhabiting calcareous soils). **Calcifuge**, **calciphobe**: a plant intolerant of calcareous soils.

caliginos(us) L.: dark, misty.

callisto(s) Gk.: as in **callistemon**, beautiful (hence **calli(sto)**, **stemon**, beautiful stamens).

CALLOSE: of tissue when forming a callus.

CALLOSE: as a substance, a polysaccharide (reducible to glucose units on hydrolysis) lining certain cell walls (e.g. sieve tube members, pollen-grains before maturity) where its function is conceived as a barrier to the diffusion of small moleculod solutes. Found also in tissue as a wound response, and as a component of the cell wall of many fungi.

CALLUS: in general, a hardened and thickened region. Of a wounded tissue, a mass of cells developed as a protective covering, capable, under suitable conditions, of active division to form new structures. See also graft, wound hormone.

cal(os) Gk.: as in **caladenia**, **calotis**, **calophylla**, beautiful.

calor L.: as in **caloritolerans**, heat (hence heat-tolerating).

CALORIE: of heat or energy exchange, a unit expressing the amount of energy (as heat) required to raise the temperature of a substance under specified conditions, one calorie (gram calorie, c) being equivalent to the amount of energy required to raise the temperature of 1 gram of water 1 centigrade degree, specifically from 14.5° to 15.5°. For biologic systems, the practical unit is the kilocalorie (kilogram calorie, C or K cal.) indicating the amount of energy required to raise the temperature of 1,000 grams of water 1 centigrade degree.

CALORIFIC: relative to heat exchange. **Calorific value**: of a fuel, the amount of energy available from its conversion expressed in values (c or C), indicating that such energy when converted to heat would raise the temperature of water (of mass in grams or kilograms) 1 centigrade degree. From L. **calor**, heat.

caly(x) L.: as in **calytrix**, a calyx (hence calyx with bristle, **thrix**).

CALYCIFORM: in the shape of a cup or calyx.

CALYCINE: of a calyx.

CALYPTRA: a hood or lid-like structure of certain buds and fruits, or (of bryophytes) sporangia. Also operculum. **Calyptrate**: bearing a calyptra.

calymma Gk.: as in **hypocalymma**, a covering, sheath, or veil.

CALYX: (plural calyces) of a flower, the primary sterile appendage of a floral receptacle made up of sepals.

CALYX TUBE: a tube formed from the bases of sepals (sometimes misapplied to the floral receptacle when tube-like).

camaldul(i) L.: as in **camaldulensis**, the name of an Italian monastic order (the epithet given by Dehnhardy for the River Red Gum refers to the origin of the plant on which he based his diagnosis, i.e. the monastery gardens of the order near Naples).

CAMBIAL: relative to a cambium.

CAMBIUM: a continuous sheath-like layer of meristem (q.v.) formed as a residual from active division of meristem at the stem apex. When of secondary growth (as a **vascular cambium**) indicates cells which reproduce either for the vertical system of tissues (the initiating cells termed **fusiform initials**) or for the transverse or ray system (the cells then **ray initials**). The epidermis of primary growth may be replaced by a **periderm** formed from a **cork cambium** or **phellogen**.

campan(a) L.: as in **campanulate**, a bell (hence rounded at the base and gradually enlarged upwardly to the top to resemble the shape of a bell).

campaspe, campestre, campestris L.: on plains or level terrain.

campto(s) Gk.: as in **camptotricha**, flexible.

campylo(s) Gk.: as in **campylotropous**, curved (see under placentation).

CANALICULATE: with a longitudinal groove.

CANCELLOUS: reticulate or lattice work-like. From L. **cancelli**, a lattice or grating.

candicans L.: becoming glistening-white.

candid(us) L.: glistening with white.

CANESCENT: of a surface when with very short hair which gives a whitish hue. From L. **canesco**, to become white.

CANKER: a pathologic condition when evidenced by localised dead (necrotic) tissues of a stem.

CANOPY: of a community or layer of a community, the collective continuous or discontinuous cover provided by a foliage.

canthar(is) L.: as in **cantharophilous**, a beetle (hence pollinated by beetles).

capill(i) L.: as in **capillaris**, hair (hence fine and hair-like or capillary) or with very fine hair.

CAPILLARITY: of a liquid, its action when introduced to a capillary tube in which air is free to pass. Liquids with the ability to wet the wall of the capillary will continue to rise to a height inversely proportional to the diameter of the bore, hence the finer the bore, the greater the height attained. The action is dependent on the relevant surface tensions of the capillary wall/air and capillary wall/liquid system and is positive as long as the former surface tension is greater, and the attraction of the molecules of the liquid to the wall (adhesion) and to each other (cohesion) continues. See also surface tension, wetting agent.

CAPILLARY: as a noun, a tube, pore or passage with very small internal cross-section (fine bore). As an adjective, of a filament or hair when very fine or slender, or (as in capillary force) relative to a capillary.

CAPILLARY WATER: of soil, moisture held by soil particles as a film on their individual surfaces and in pores formed by their aggregation.

capillos(us) L.: very hairy.

CAPITATE: in general, forming a rounded head; of a compound stigma when the united stigmas form a head-like mass terminal on the style.

capitat-us etc., **capitellat-us**, etc.: epithets, usually in reference to flowers appearing simply capitate or like a capitulum.

CAPITULUM: a racemose inflorescence with sessile flowers (florets) compacted on a flattened and expanded, or rounded apex of a peduncle (disc or receptacle), often surrounded by an involucre of bracts. **Capitulate:** forming a capitulum, as the florets of a majority of the **Compositae**.

caprae L.: she-goats (singular **capra**).

CAPREOLATE: with, or formed like, tendrils. From L. **capreoli**, supports.

CAPSULE: in general, an enclosing membrane. A fruit when dry, dehiscent, and two or more locular in a limited sense but see also pod and pyxis. Capsular: relative to, or with the nature of, a capsule.

CARBOHYDRATE: one of a group of chemically related (polyhydroxy) compounds basically of carbon, hydrogen and oxygen, conforming generally to an empiric formula $C_x(H_2O)_y$. . . e.g. **glyceraldehyde** $CH_2OH.CHOH.CO$ or $C_3(H_2O)_3$. When of this nature are the monosaccharides or sugars. Other carbohydrates are derived by consideration of two or more sugars, some with other elements added.

Monosaccharides may be classed by the number of carbon atoms present in the molecule, **glyceraldehyde** thus is a **triose** sugar. The **pentose** (5-carbon) sugars ribose and deoxyribose are constituents of nucleic acids. The **hexose** (6-carbon) sugars glucose and fructose are synthesised by green plants from carbon dioxide and water and are both the starting materials for more complex substances and the source of energy derived by respiration.

In general, linkage of two or more monosaccharides with loss of water (i.e. condensation) form **oligosaccharides**, e.g. through biocatalytic reactions glucose and fructose may form the disaccharide sucrose, and when a large number of monosaccharides are concerned in condensation, **polysaccharides** are the products, e.g. starch and cellulose the nature of the component sugars (i.e. in solubility, crystalinity and sweetness in taste) being greatly modified. Both oligosaccharides and polysaccharides may be converted through biocataylsis back to their original sugars, e.g. starch, cellulose, callose back to glucose. See also callose, cellulose, chitin, glycoside, nucleic acid, phosphorylation, photosynthesis, respiration ,starch, sugar.

CARBONACEOUS: resembling or relative to, a form of carbon (e.g. charcoal, coal, graphite) or its compounds (e.g. carbon dioxide). From L. **carbo**, coal, charcoal.

CARBON CYCLE: the recycling of carbon from its utilization as carbon dioxide from the atmosphere or water (see photosynthesis) and its return chiefly through the respiration and decay of plants and animals, the combustion of fuels, and the weathering of rock.

CARCERULUS: a schizocarpic fruit (q.v.) when its several mericarps are derived from a superior ovary.

CARDINAL: of points or properties, fundamental or essential.

cardi(a) Gk.: as in **cardiophylla**, a heart (hence leaves shaped like the heart of playing cards).

CARNITE: bearing a keel or ridge-like structure. From L. **carina**, a keel.

carlinoides: epithet, resembling the thistles of **Carlina (Compositae)**.

CARNEOUS, CARNOSE: of a fleshy texture. From L. **carnis**, flesh.

CARNIVOROUS: of a plant when utilizing animal tissue as an accessory nutrient through the action of proteolytic enzymes with the ability to reduce proteins to amino acids. In a limited sense, insectivorous. Usually the plant is an inconspicuous herb of a bog community with special structures for capturing and holding minute animals (e.g. insects) e.g. the Pitcher Plant **Cephalotus follicularis** develops from its petioles pitcher-like sacs which store a liquid; the sundews of **Drosera** and the Rainbow Plant **Byblis gigantea** develop brightly coloured hairs which secrete a viscid substance.

CAROTENOID: a water-insoluble pigment either associated with chlorophyll in chloroplasts mainly as a carotene (C₄₀H₅₀, a precursor of Vitamin A), or in other plastids or chromatophores, giving yellow, orange or red colours, e.g. the red of some fruits, the yellow of some flowers changing colours of 'autumn leaves' when due to the unmasking of a yellow carotenoid by the dispersal of chlorophyll and the breakdown of this pigment with an accompaniment of colours of certain anthocyanins. In photosynthesis, a primary or secondary absorber from wavelengths of light different to that absorbed by chlorophyll, the latter absorbing mainly in the red and blue part of the spectrum, the carotenoid in the green. Energy so derived probably is transferred to chlorophyll when occurring in the same plastid but the carotenoid itself does not appear to act directly in photochemical reactions. See also xanthophyll.

CARPEL: the ovule-bearing unit of a gynaecium, composed typically of an ovary, a sterile style, and a pollen-receptive stigma.

CARPELLATE: of, or bearing a carpel or carpels, e.g. a multi-carpellate fruit is one formed from a gynaecium of several united carpels.

carpo(s) Gk.: as in **carpophagous**, fruit (hence fruit-eating).

CAROPHORE: of a flower, a projection through carpels, formed as a prolongation of the receptacle, the carpels at first adhering to it but separating at maturity - a feature of the **Geraniaceae** (e.g. **Geranium**) and **Umbelliferae** (e.g. **Platysace**). Of a fungus, the stem of a sporocarp (fruiting body).

-carpus, -carpa, -carpum: as in **stenocarpus**, **megacarpa**, **microcarpum**, fruited.

CARTILAGINOUS: with the texture of cartilage, i.e. gristle-like smooth, firm and elastic).

CARUNCLE: of a seed, a small fleshy outgrowth from the coat (testa) when confined to the base or apex.
Carunculate: bearing a caruncle.

cary(on) Gk.: as in **eucaryotic**, nucleus (hence with a true nucleus). In other compounded words, e.g. **hedycarya**, a fruit especially when a nut or nut-like.

CARYOPSIS: an achene (q.v.) with the pericarp fused with the seed - the fruit typical of grasses, e.g. the 'grain' of cereals.

case(us) L.: as in **caseolyticus**, cheese (hence cheese-destroying).

CASPARIAN STRIP: a lignified or suberised band forming part of the primary wall of certain cells, especially those of an endodermis of a root where its function is one of water-regulation by acting as a barrier to water movement.

cassia: generic name of ancient origin and unknown meaning, perhaps referring to Mount Cassia in northern Syria.

CASTANEOUS: reddish-brown; chestnut-coloured.

casuarina: generic name, probably meaning Cassowary-like in allusion to a likeness of this bird's feathers to the branches.

cata- Gk.: prefix, down, out, below.

CATABOLISM: the breaking-down of complex molecules to simpler ones for the release (re-utilization) of energy, e.g. by respiration. Catabolic: relative to the processes of catabolism, i.e. to exergonic reactions.

CATADROMOUS: of venation when the first set of veins arises from the lower side of the mid-rib.

CATALYSIS: the acceleration or retardation of a chemical reaction by a substance, the **catalyst**, which itself remains relatively unchanged during the reaction. Catalysts of living processes (biocatalysts) are enzymes (in addition to growth substances and certain inorganic ions) which, in general, are specific for one type of reaction, operate at a specific temperature and pH range, and are required in very small amounts to produce relatively large changes in the reactants (the substrate). They appear to function by at first chemically combining with the substrate to form a labile complex, the products of the reactions and the unchanged enzyme then being released. In other cases of catalysis, chemical combination may not occur, the catalyst appearing to act as an adsorbing surface for one or more of the reactants.

CATAPHYLL: a rudimentary leaf concerned with storage and/or protection, e.g. a cotyledon, scale-leaf, bud-scale.

CATCH CROP: a crop designed to restore organic matter to the soil. cf. cover crop.

CATCHMENT: of land, and area of drainage. See also basin.

CATEGORY: of classification, a level to which a taxonomic group (taxon) may be assigned. In contemporary plant classification, these levels in descending order are: Division, Class, Order, Family, Tribe, Genus, Section, Series, Species, Variety, Form and their respective sub-units where applicable.

catena L.: a chain.

cathar(os) Gk.: as in **catharanthus**, pure.

CATION: the positively-charged ion attracted to the cathode or negatively-charged pole, e.g. the ions of cation exchange including hydrogen (H⁺), potassium (K⁺), ammonium (NH₄⁺), calcium (Ca⁺⁺), sodium (Na⁺), etc., when soil colloids acts as the cathode.

CATION EXCHANGE: the displacement of cations by other cations, e.g. cations of mineral elements adsorbed by colloids of clay or humus displace (or exchanged) by hydrogen ions under conditions of extreme moisture, the displaced cations being brought (leached) to levels below their availability to roots. See also acid soil.

CATKIN: a spike- or raceme-like, sometimes pendulous, inflorescence of unisexual flowers, usually (at least the male) shed as a unit on completion of development, the flowers often subtended by scaly bracts and pollinated by wind (anemophilous). Featured in the families **Salicaceae (Salix, Populus)**, **Betulaceae (Betula)**, **Juglandaceae (Juglans)**, **Fagaceae (Quercus, Castanea)**, **Casuarinaceae (Casuarina, Gymnostoma)**, inter alia, the apparent simplicity of the amentiferous condition suggested primitiveness but anatomical studies have shown the catkin to be a complex inflorescence derived by reduction from inflorescences of families not necessarily with close affinity.

CAUDATE: bearing a tail-like appendage. From L. **cauda**, a tail.

CAUDEX: in general, the persistent stem of an herbaceous perennial (sometimes partly underground) but applied also to a trunk when of long duration and slow increment, e.g. of some palms, cycads, tree-ferns, and xanthorrhoeas (as **Kingia australis** with an estimated annual increment of 3 mm).

CAULESCENT: developing a stem.

CAULICOLOUS: living on herbaceous stems, as certain fungi.

CAULIFLOUS: developing flowers directly from a stem.

CAULIFLORY: the production of flowers on leafless woody stems or main trunks, the flowers developing from buds which are either replaced from year to year, or are dormant until the shoot has reached a considerable diameter. Black Bean **Castanospermum australe** develops flowers from leafless older branches, while other trees of Australian rainforest (e.g. **Ficus**, **Syzygium**) may flower directly from the trunk or main branches.

CAULINE: borne on a stem. From L. **caulis**, a stem or stalk.

CELL: the self-regulating, self-reproducing structural unit of organisms with a function determined by its position in space and time, in most plants differentiated by an external wall to a **protoplast** with a system of **organelles** functioning interdependently. The protoplast is enclosed from the wall by a double-layered membrane (**plasma membrane**) selectively permeable to solutes diffused through pores or pits of the wall. In general, an enclosed space or cavity. From L. **cella**, a room. See also cytoplasm, tonoplast, nucleus, mitosis, meiosis, cytokinesis, vacuole, endoplasmic reticulum, mitochondrion, ribosome, plasmodesmata, tissue.

CELL DIVISION: the division of a mother-cell to two daughter-cells by the division of its nucleus (karyokinesis) and cytoplasm (cytokinesis), and the development of a cell-plate (formed from the mitotic apparatus) to two layers within which is a middle lamella, each layer becoming the plasma membrane and the primary cell wall of each daughter-cell. See also mitosis, meiosis.

CELL SAP: see under vacuole.

CELLULAR: relative to a cell or system of cells.

CULLULAS: an enzyme or group of enzymes, with cellulose the substrate, synthesised by certain fungi and bacteria, and by certain unicellular animals (protozoans) e.g. within the digestive tract of termites.

CELLULOSE: a polysaccharide $(C_6H_{10}O_5)_x$ composed essentially of long (i.e. over 3,500 units to each chain) straight chains of an isomeric form of glucose the which cellulose may be hydrolysed (e.g. by strong acid). The major component of the cell walls of at least the higher plants providing high tensile strength, elasticity and plasticity.

The properties of cellulose are of high value to the textile industry, e.g. cotton (about 90 percent cellulose) and other commercial fibres. Cellulose from various woods and the 'linters' of cotton is the raw material for the rayons - **viscose** (or regenerated cellulose) from which cellophane and methylcellulose are derived, and **acetate** rayon (or cellulose acetate) which also is converted to a sheeting comparable to cellophane. The processing of various woods and other cellulosic sources (as the textile 'rags') yields the pulp for paper-making; the chips of wood waste and the fibre (bagasse) of sugar-cane after extraction of sugar are converted to various building and insulating boards. See also fibre.

CELL WALL: the inert secretory product of a protoplast forming the limiting layer of a plant cell and serving, either through the turgidity of the contained protoplast or the thickening of the wall, for mechanical support.

When of cellulose, the **primary** (first formed) **wall** is composed of a series of interwoven and interconnected strands (microfibrils) broken at intervals by spaces where non-cellulosic material may be deposited. When cells form tissues, the primary wall fuses initially with an adjacent primary wall, cemented by an intercellular pectic substance (calcium or magnesium pectate), the fused walls known as the **middle lamella**. Secondary development of the middle lamella is intracellular, mainly cellulose at first being added but with small regions (pits) left unthickened. Later, according to the

function of the tissue, the wall may undergo the processes of lignification, suberization, or cutinization or such inorganic substances as silica and calcium carbonate may be added. Adjacent cells are in direct cytoplasmic connection by plasmodesmata (q.v.).

cel(us) L.: high; lofty, celsissim(us) the comparative degree.

CENSER MECHANISM: of fruit, a method of dispersing seed through a shaking action, e.g. of a capsule when the shaking effect of wind or other agent causes a dispersal of seed.

centenari(us), centum, centi(ens) L.: a hundred.

centesim(us) L.: the hundredth.

CENTIGRADE: (°C) the standard unit of temperature in the metric system where, from the scale of Celsius, the melting point of pure ice and the boiling point of pure water are at 0° and 100° respectively.

For conversion to the Fahrenheit scale (32° to 212°), the formula

$$\frac{C = 5(xF^{\circ} - 32^{\circ})}{9} \quad \text{may be applied.}$$

Alternatively, °C may be multiplied by 9/5 and 32 added to give °F.

CENTIMETRE: (cm) the standard unit of length in the metric system equivalent to 0.3937 inches (in.), 10 millimetres (mm), or the one-hundredth part of a metre (m). For a rough conversion, 2.5 cm is almost equal to 1 in.

Cubic centimetre (cc or ccm) a metric unit of volume of 1 gram of water at 4°C = 1 cc) equivalent to millilitre (ml), the one-thousandth part of a litre or 0.061 cubic inches.

centr(um) L.: the centre.

CENTRIFUGAL: developed or developing outwardly from the centre. cf. centripetal.

CENTRIFUGATION: of a solute or dispersed substance, its precipitation or sedimentation from the dispersal medium through means of a centrifugal force (producing movement away from the axis of rotation) created by a machine a **centrifuge**. Proteins and certain organelles may be separated selectively from their containing cells by means of an ultracentrifuge, i.e. a machine capable of rotation at or up to 50,000 revolutions per minute.

CENTRIPETAL: developed or developing inwardly or towards the centre.

cent(on) Gk.: as in **centrathus**, **centrolepis**, a spur or sharp point.

CENTROMERE: see under chromosome.

cepaci(us) L.: as in **cepacious**, onion-like.

cephal(e) Gk.: as in **cephalotus**, **brachycephala**, a head.

cera L.: as in **ceraceous**, **cereous**, a wax (hence waxy, wax-like, wax-coloured).

cer(as) Gk.: as in **aegicerras**, **cerastium**, a horn.

cerat(ion) Gk.: as in **ceratopetalum**, a little horn.

CERATOID: horn-like, horny.

cero(ei)s Gk.: as in **anthoceros**, a horn.

CEREAL: a grass yielding grain of as food for stock or man. Commonly cultivated and the chief parents of the domesticated strains are barley (**Hordeum vulgare**), maize (**Zea mais**), millet - white (**Panicum milaceum**). Hungarian (**Setaria italica**), Japanese (**Echinochloa frumentacea**), oats (**Avena byzantina**, **A. sativa**), rice (**Oryza sativa**), rye (**Secale cereale**), sorghum (**Sorghum** spp.), wheat (**Triticum aestivum**, **T. durum**).

Grain refers to the fruit (a caryopsis) sometimes (barley, oats, rice) including the persistent '**hull**' or '**husk**' formed by the fused bracts (lemma and palea) of the floret. 'Kernel' also refers to the fruit (the 'groat' of oats) considered of two parts, **bran** (which includes the pericarp, testa and endosperm) and the **germ** (the embryo which generally forms a small basal swelling).

Wheat, barley and rice have been a staple source of food for a period predating history. At present, about two billion people are almost completely dependent on grain crops for subsistence, the food (while proving adequate calorific value) lacks certain amino acids (e.g. lysine) vital to an optimum diet for humans. Grain yields both carbohydrate and protein (rice, while yielding on a unit acreage basis the highest of cereals in calorific value, has the least protein), the carbohydrate making up about 80 percent of the grain has a particular concentration (chiefly as starch) in the endosperm, the protein is particularly abundant in the germ. Present also in the grain are fatty derivatives (e.g. phospholipids and fixed oils), vitamins of the B complex (e.g. thiamine, nicotinic acid, riboflavin), minerals (chiefly as phosphates and sulphates of potassium, magnesium and calcium).

Processing of the grain for consumption involves essentially the conversion of the starch to a digestible form as, e.g. the pre-cooked breakfast cereals and cereal stock feeds, porridge from oatmeal, boiled rice. Other processes may involve the removal of husk by abrasion and polishing, e.g. pearly barley, polished rice from 'paddy' or raw rice. The controlled, gradual grinding and sieving to a specified fineness of the separated endosperm (i.e. the milling of grain from wheat, rye, maize, barley) produces a white flour or meal. Certain flours and meals (viz. wheat and rye) possess two proteins, **prolamin** and **glutenin**, which form with water a **gluten** with elastic and flow properties and an ability to ferment (activation by yeast) necessary for bread-making. By far wheat is the major source of grain for bread and other baked products, its selection of strain determined by its milling and baking qualities in addition to its response, as a crop, to local geographic conditions. Strains of wheat are termed 'hard' when their milled endosperm yields a coarse and gritty, free-flowing flour mostly of entire cells, soft when the milled product is very much finer with a tendency of the fragmented cells and free starch to combine. On the baking quality (or strength), a 'strong' wheat denotes a suitability for bread-making with a high protein content, 'weak' when more suitable for biscuit and cake-making, or self-raising flour, when a coarse open crumb structure and relatively low protein content render it unsuitable for bread. Coarse particles from the milling are used (as a **semolina**) in the processing of macaroni, spaghetti, and vermicelli.

Barley grain provides a meal used as stock feed but is of particular importance in the fermentation and distilling industries - the production from the grain mash (which may include also grain of maize and rye except in beer and stout making) of alcohol through the processes of **malting** (involving germination of the grain to a malt for the activation by enzymes of starch) and brewing (the fermentation of the malt, or wort in beer-making by yeast through sugar to alcohol) and distillation of the fermented product to pure alcohol, or by various treatments (e.g. the addition of hops from **Humulus lupulus** to the mash in beer-making) to beer, stout, whiskey. Other products include furfural (used in various industrial processes, e.g. as a solvent), acetone, butanol, and riboflavin.

The cereal crop may be for grazing (rye, maize, sorghum, millet) for hay (oats, rye, maize, millet, sorghum) or silage. The millets provide grain as a human food in certain of the developing countries and birdseed to the much better endowed; broom millet supplies the fibre for the well-known millet brooms.

cerebr(um) L.: as in **cerebrose**, a brain (hence convoluted).

cerevisi(a) L.: beer.

cerin(us) L.: wax-coloured.

cernu(us) L.: drooping; nodding, cernuous.

cervin(us) L.: fawn-coloured.

chaet(e): as in **chaetiferous**, **brachychaete**, a bristle. From Gk. **chaite**, hair.

CHAIN REACTION: a process ensuing from a sequence of reactions, each reaction dependent on the products of the reaction preceding it.

CHALAZA: of an ovule, the basal part marking the attachment of a funicle.

chalc(eus): as in **chalcophyte**, copper (hence a plant favouring soils rich in this mineral).

chamae-: as in **chamaelaucium**, dwarf or prostrate (hence 'dwarf poplar'). From **chamai** Gk.

CHANNEL COUNTRY: of the continent, a vast area of south-western Queensland including about eight million acres of flood-plains irrigated naturally by periodic waters of the intricate river-systems which have their origin in the eastern highlands and flow over a thousand miles to the arid interior before ultimate discharge to the Lake Eyre Basin.

CHARTACEOUS: of parchment or paper-like texture, usually devoid of green.

CHASMOPHYTE: a plant rooted in, or growing on, the detritus of a rock crevice. cf. lithophyte. From Gk. **chasma**, an opening.

cheil(os) Gk.: as in **cheilanthos**, a lip.

CHELATE: of plant nutrition, a substance which (as a solute) regulates or prevents the precipitation from solution of metallic salts through an ability to adsorb their cations. e.g. ethylene diamine tetra-acetic acid (EDTA) and hydroxythylethylene diamine tri-acetic acid (HEEDTA) are chelates (or sequestering agents) of the mineral iron and, as such, may be used as a foliar spray for the correction of a chlorosis caused by a deficiency of the soluble salt of this element.

chel(e) Gk.: as in **cheliform**, a claw.

chem(eia) Gk.: as in **biochemistry**, transmutation.

CHEMILUMINESCENCE: the emission of light as a result of a chemical reaction, e.g. the oxidation of yellow phosphorus. See also bioluminescence.

CHEMOAUTOTROPHIC: obtaining the energy required for biosynthesis from the oxidation of inorganic substances, e.g. of bacteria when oxidising sulphur, hydrogen, sulphide, iron, inorganic nitrogenous compounds for their metabolic needs. Also chemosynthetic.

CHEMOTROPIC: of movement when induced by a chemical stimulus.

chen Gk.: as in **chenopodium**, a goose (hence 'web-footed', in allusion to the shape of the leaves).

CHENOPODIACEOUS: relative to members of the family **Chenopodiaceae** especially to their communities when the salt bushes (e.g. **Atriplex**) and blue bushes (**Kochia**) are the dominants.

chersa Gk.: waste places, hence **chersophyte**, a plant favouring wasteland for its development.

CHIASMA: (plural chiasmata) of chromosomes, the observable point of exchange of segments between the paired halves at meiosis. The consequence of crossing-over (q.v.).

ch(e)il(os) Gk.: as in **chiloglottis**, **calochilus**, a lip.

CHIMAERA: a tissue-complex (e.g. as shown by a variegation or a modification in an organ) of genetically distinct cells, the resultant of a mutation within certain cells of a meristem or (as in a graft-hybrid) an association of meristems.

ch(e)imon Gk.: as in **chimonophyte**, winter.

chion(os) Gk.: snow.

CHITIN: a polysaccharide making up the bulk of most fungal, and some algal cell walls in addition to the cuticle of insects and other invertebrates.

chiton Gk.: as in **brachychiton**, a vest; an undercovering.

clamyd(is) Gk.: as in **achlamydeous**, a cloak; an outer covering (hence of a flower when without a perianth).

CHLAMYDOSPORE: an asexual spore of a fungus formed by the thickening of the wall and eventual separation of a cell from its parent hypha.

chloa Gk.: as in **chloanthos**, **echinochloa**, **eriochloa**, grass.

CHLORANTHY: a pathologic condition in which floral parts (e.g. petals) are changed to vegetative leaves.

chlor(os) Gk.: as in **chloris**, grass green.

CHLORENCYMA: chlorophyll-bearing tissue.

CHLOROPHYLL: the principal light-absorbing pigment of plants, appearing green from its major reflection of this band of the spectrum. Of several chemical variants, predominant are **a** ($C_{55}H_{72}O_5N_4Mg$) and **b** (with a methyl group of a substituted by an aldehyde group) which absorb to greatest degree from the blue and red bands. Only **a** shows at photosynthesis the fluorescence normally involved in the process and indicating dissipated ('unused') energy, hence **a** is recognised as the sole carrier during photosynthetic reactions of energy absorbed by itself directly and from other photoactive pigments present.

The molecule of chlorophyll is composed of a complex cyclic structure (four pyrrole rings) within which is a single atom of magnesium, and a long straight chain (a terpenic alcohol, phytol). The phytol, and the magnesium atom (replaced in haem by iron), distinguish it from the colouring matter of vertebrate blood which forms, with the protein globin, haemoglobin. Both chlorophyll and haem are typed as metallic compounds of porphyrin groups. When extracted by a fat-solvent (e.g. alcohol), chlorophyll **a** appears blue-green incident light with a red fluorescence, is optically active (laevorotatory) but loses much of its photochemical activity. See also light, photosynthesis, alga, bacterium, protochlorophyll.

CHLOROPLAST: the chlorophyll-containing plastid, when regular in form (very irregular in such green algae as **Spirogyra**) ellipsoid or discoid but changeable in shape and orientation according to its exposure to light. In addition to chlorophyll and the associated xanthophylls and carotenes included in the lipid fraction (up to 40 percent), up to 70 percent of total content may be protein, while various enzymes, photosynthates, nucleic acids and inorganic substances have been detected. Its self-replication at cell-division through precursor **proplastids** has been shown.

Ultrastructure: within a containing system of membranes (**peristromium**) a layered series of plate-like **lamellae** are concentrated ('stacked') at regular intervals, the stacked lamellae forming **grana**, the unit of each stack, a disc-like **granum**, connected to an adjacent granum by an **intergranum lamella**. Each lamella carries adjoining layers of chlorophyll and lipid on one side, and a protein later in the reverse side. The region where the lamellae are few or none, the **stroma**, functions for the storage of other biosynthates (especially enzymes), commonly starch grains being present.

CHLOROSIS: a pathologic condition of green plants, resultant of a severe reduction in chlorophyll, evidenced by a yellowing or loss of colour in photosynthetic tissue. Included among the causal agents are adverse nature and intensity of light, deficiency of nutrient (viz. iron, magnesium, potassium, manganese), desiccation. **Chlorotic:** relative to the condition.

CHONDROID: firm, tough but flexible, grist-like or cartilaginous.

chondro(s) Gk.: as in **chondroid**, **chondromyces**, cartilage; gristle.

chor(e) Gk.: as in **choronomic**, a region (hence relative to the influence of a geographic region).

chor(ein) Gk.: as in **anemochoric**, **anemochorous**, to spread.

chori(s) Gk.: as in **choripetalous**, separate; not united.

chor(a), chrom(a), chromati(um) Gk.: as in **chroococcum**, **herichora**, **chromosome**, **chromatic**, **chromatophore**, colour.

CHROMATIN: that part of a nucleus reactant to a stain selective for DNA (the Feulgen reaction) to give a deep red colour.

CHROMATOGRAPHIC: relative to an analysis of a substance based on the separation and detection of its components when passed (as a solution or vapour) through an absorbent paper (as in paper chromatography) or column of a solid absorbent carrier (as in gas or vapour phase chromatography).

CHROMATOPHORE: a pigmented plastid other than a chloroplast.

CHROMONEMA: (plural chromonemata) the element or individual fibril of a chromosome when thread-like, i.e. forming a chromatid.

CHROMOSOME: a unit of a nucleus, chemically a series of polypeptide chains to which are attached nucleic acids, resolving to a coiled (helical), thread-like structure at the beginning of a nuclear division. At this phase it is split along its length into **chromatids** except at a particular point, the **centromere**, of vital concern as an organiser and orientator in subsequent movements. The protein chains are divisible to groups, **genes**, each gene attributed either singly or as one of a group with specific control or influence of a character manifested by the products of the division. For a species, the number of chromosomes with a nucleus remains constant for all replicated cells under normal conditions. From Gk. **chroma**, colour; **soma**, a body. See also meiosis, mitosis, karyotype, nucleic acid, nucleus, gene, polyploidy.

chrono(s) Gk.: as in **chronotropic**, time (hence of movement when influenced by the factor of time).

chryso(s) Gk.: as in **chrysophaea**, gold (hence of golden colour, chrysophanic).

chthn(os) Gk.: as in **chthnocephalus**, earth; ground.

chylo(s) Gk.: as in **chylocaulous**, **chylophyllous**, succulent.

CICATRICE: a scar left by the abscission of a part.

-cidal: as in **bactericidal**, **fungicidal**, lethal to, inactivating.

CILIATE: fringed with fine soft hairs, as the margins of some leaves.

CILIUM: (plural cilia) of plants, a hair-like structure, usually one of a marginal series forming a fringe. See also **flagellum** for which it is sometimes equated.

CINCINNUS: see under cyme.

cinct(us) L.: an encircling structure, a girdle.

cinere(us) L.: ashen; ash-grey (cinereous).

cinerascens: becoming ash-grey.

cinnabar(i) Gk.: as in **cinnabareus**, **cinnabarinus**, cinnabar (hence scarlet or vermilion-coloured).

CINNAMON FLORA: a fossil-flora from the early Tertiary period of Australia having affinities with fossil-flora of comparable age from other parts of the southern hemisphere, viz. the Andean Region of South America. The fossil-flora represents both a mesic broad-leaved element (with modern representatives found in **Cinnamomum**, **Laurus**, **Daphnandra**, **Nothofagus**, **Ficus**, **Pittosporum**) and a sclerophyllous element (modern representatives found in **Eucalyptus**, **Casuarina**, **Banksia**, **Persoonia**, **Hakea**, etc.).

CIRCINATE: rolled from the top downwardly to form a coil, as the developing fronds of ferns.

circis Gk.: a ray.

circulans L.: circling, becoming round.

circulat(us) L.: curled.

circum L.: around.

CIRCUMNUTATION: of a geotropism (q.v.) in a negative direction, the response being a spiralling movement of a shoot or tendril around a support.

CIRCUMSCISSILE: opening by a transverse circular line, the valve usually coming away as a flap or lid. See also dehiscence, capsule.

cirrh(os) Gk.: as in **cirrhosus**, dull yellowish brown, tawny.

cirr(us) L.: as in **cirrosee**, a curl (hence producing a spiralling tendril). Also cirrhose, cirrhous, hence **cirrhosus** may also be in this sense.

citre(us) L.: lemon-yellow; citrine.

citri- L.: as in **citrifolia**, of **Citrus** (probably derived from the ancient town Citron, of Judea).

citriodor(us): yielding a lemon-scented principle.

clad(os) Gk.: as in **cladium**, **phylloclade**, **cladode**, a sprout; a branch or twig, a stem.

CLADODE: a flattened, lamina-like stem functioning as a leaf and arising from the axil of a much reduced true leaf. Also cladophyll, phylloclade. e.g. of the Prickly Pears **Opuntia** spp. and other cacti.

CLASS: as a category (q.v.) a level above an order and below a division. As a taxonomic group, one uniting orders believed of a common line of development within the structure of their division.

In naming the class, although no fixed rules apply, the recommendation of the International Code is that the ending **-phyceae** for algae, **-mycetees** for fungi, and **-opsida** for other plants are attached. When sub-classes are named, the recommended suffices are -phycidae, -mycetidae, and -idae. For angiosperms, **-ae** (class) and **-idae** (sub-class) usually are retained. e.g. **Dicotyledonae**. For grammatic use, see under -a.

CLASSIFICATION: of systematic botany, the arrangement of groups (basically species) in a system designed to express both the inter-relationships and the identities of these groups, and to indicate their evolutionary development.

The form of most systematic classifications is an ascending series of levels (an hierarchy of categories, the magnitude of each greater than that below it), each level indicating a union of groups believed of common origin.

CLATHRATE: of a surface when marked by a series of fine lines to resemble a grate- or lattice-work.
From Gk. **klethra**, a lattice.

clava L.: a club, hence **clavate**, of a structure when gradually enlarging or dilating from base to apex to appear like a club.

CLAVIFEROUS, CLAVIGEROUS: bearing a clavate structure.

CLAE: a flattened petiole-like part as formed, e.g. by the base of certain petals or, as in staminal claw by a connation of filaments.

CLAY: a sedimentary rock of very fine grain, recognised in mass as a plastic and sticky substance when moist but hard and cohesive when dry, derived initially from the weathering of igneous rocks (e.g. feldspars) exposed at the earth's surface. Usually derived as a hydrated silicate (e.g. kaolin, quartz, silica) or hydrated oxide of aluminium and iron.

As a fraction of soil, that part where the particle size is less than 0.002 mm, i.e. the finest texture where the largest surface area per mass is available, hence with high colloid-forming property.

CLAYPAN: an underlying soil horizon of high density and resistance to percolation by water, formed partly by the accumulation of leached clay.

cle(i)o Gk.: as in **cleome**, to close.

cleisto(s) Gk.: as in **cleistogamous**, closed.

CLEISTOGAMY: of angiosperms, the partial suppression of cross-pollination by a closure of flowers, normally in the sense that other flowers of the same plant (or at least the same species) are normally open for cross-pollination.

clem(a) Gk.: as in **clematis**, a branch of a vine (hence vine-like).

cl(e)il(os) Gk.: as in **clianthus**, glory.

CLIMAX: of a community when in stable equilibrium with its environment.

CLINE: the gradation of differences in form within a species over a geographic area (topocline) or ecological range (ecocline), the variant within the species being the **clinal form**.

cliv(us) L.: as in **clivorous**, a slope, (hence growing on slopes). The Greek equivalent is **klitos**.

clon, cloni(s) Gk.: as in **clone**, a cutting or twig.

CLONE: a group of individuals, each a **ramet**, produced asexually from a single parent hence normally of uniform genetic identity.

CLOSED: of a community when forming a continuous ground cover unbroken by wide areas of bare soil.

clost(e)r Gk.: as in **clostridium**, a spindle.

CLOUD: see under dew point.

cneori-: as in **cneorifolia**, of the shrubs of **Cneorum (Cneoraceae)**.

cnid(on) Gk.: as in **dendrocnide**, a nettle (hence 'tree-nettle' or 'stinging tree').

co- (from L. cum): as in **co-axil**, with; together (hence with a common axis).

COACERVATE: clustered.

COAGULATE: changed in physical state (e.g. by clotting or curdling) from a liquid to a solid or semi-solid. Also the product so derived.

COAL: a solid, black or brownish black, combustible mineral complex formed by partial decomposition of vegetation dating from the Carboniferous period of the late Palaeozoic under anaerobic moist conditions. Often there is an associated increase in pressure and temperature when natural gas (with methane the main constituent) may be formed. On the basis of percent content of fixed carbon, includes peat (below 55), lignite and brown coal (30-60), bituminous or soft coal (48-83), anthracite (over 93).

COALESCENT: coming together to join.

coarctat(us) L.: pressed together.

coccine(us) L.: scarlet in colour.

COCCUS: (plural cocci) of fruit, see mericarp (originally used for the unit of a schizocarp formed from more than two carpels, mericarp reserved for a bicarpellate schizocarp). Of a bacterium, one spherical (coccoid) in shape.

cochleari(us) L.: spoon-like.

COCHLEATE: resembling the helix-like shell of a snail or other mantled mollusc. From Gk. **kochilos**, a snail.

cochlo Gk.: as in **cochlospermum**, to twist.

codon Gk.: as in **codoncarpa**, a bell.

ceolo-: as in **ceolocarpus**, hollow. From Gk. **koilos**.

coeno(s) Gk.: as in **coenobial**, in common.

COENOBIUM: (plural coenobia) a group of unicellular organisms normally held together (e.g. by a gelatinous envelope) to form a closely integrated colony acting somewhat as an individual organism, e.g. the colonial green algae of **Volvox**, **Pandorina**, **Pleodorina**. **Coenobial**: relative to a coenobium.

COENOCYTE: an organism undifferentiated to cellular units but possessing a number of free nuclei. Especially of algae and fungi, where division of nuclei without division of cells occurs.

COENOCYTIC: of a cell of a multicellular organism, or a unicellular organism, with possessing a number of free nuclei.

COENOSPECIES: of genetics, a group of ecospecies (q.v.) which, although to a certain extent inter-fertile, either do not cross with other coenospecies or, if crossing, produce completely sterile hybrids. Approximates the taxonomic species or genus.

CO-ENZYM: the component of a complete enzyme (holoenzyme) other than the protein part (apoenzyme) which by itself is inactive. Sometimes used interchangeably with **prosthetic group** (simply the non-protein part of a complete enzyme).

Co-enzyme I, NAD nicotinamide adenine dinucleotide (syn.: DPN diphosphopyridine nucleotide) and Co-enzyme II, NADP nicotinamide adenine dinucleotide phosphate (syn.: TPN triphosphopyridine nucleotide) are the hydrogen (or electron) acceptors of photosynthesis and respiration.

cognat(us) L.: related; cognate.

COHERENT: attached to, but not fused with, another part of the same kind. cf. adherent.

COHESION: of parts, union without fusion when of the same kind. Of particles or their molecules, the attraction to one another, measurable as a force.

-cola: as in **monticola**, inhabiting. Feminine gender, from **L. colens**.

COLD TREATMENT: of seed, see stratification, vernalization.

cole(os) Gk.: as in **coleus**, **coleogyne**, a sheath.

COLEOPTILE: of the embryo of many monocots, a cap protective to the plumule and formed by part of the cotyledon.

COLEORHIZA: of the embryo of some cycads and monocots, a sheath of tissue surrounding the base of the radicle.

COLLATERAL: of structures when occurring side by side at the same level and in the same direction.

COLLENCHYMA: a temporary, non-rigid, supporting tissue formed by elongate actively-functioning cells with walls unevenly thickened but with highly plasticity in the outer layers of stems before secondary thickening, and secondary supporting structure as petioles, also in the outer layers of walls of certain flesh fruits.

collin(us) L.: located on a hill.

COLLOID: a substance which disperses in a medium (solid, gas, liquid) as an aggregation of particles held in permanent suspension, thus forming a two-phased colloidal system, the colloid forming the dispersal phase, the medium the continuous phase. Since the size of the colloidal particles is in the region of 2 to 200 millimicrons, a very large total surface area is available for the adsorption and exchange of ions and molecules, the particles carrying an electric charge (usually negative). Certain colloidal systems (e.g. of proteins) may exist both in liquid (**sol**) and semi-solid (**gel**) states according to physical conditions, a continuous sol-ing and gelling being a feature of protoplasmic systems. From Gk. **Kolla**, glue.

COLLUVIAL: brought by the action of gravitational force, e.g. the accumulation of rock debris (talus) brought by gravity from upper slopes.

colo L.: as in **monticola**, **cavernicolous**, to inhabit.

COLONY: a group of individuals (usually of the one species) living in close community. **Colonial**: of organisms when forming colonies. Of a fungus, a colony is a globular mass of hyphae developed by the one hypha. See also coenobium.

color L.: colour, tint.

colorans: epithet, of varying or variegated colour.

COLORIMETRIC: relative to a quantitative determination based on a colour change, e.g. by the use of 'indicator' dyes which change colour within a definite pH range, the colour change usually recorded by a colorimeter composed essentially of a photoelectric cell through which a beam of light is directed and a galvanometer for recording the change in electric current when the beam of light is directed to the photocell through the test solution.

-colous: as in **algocolour**, living on, inhabiting.

COLPATE: of a pollen-grain when having a longitudinal groove or opening (**colpa**) in the outer wall (exine). Usually prefixed to indicate the number of calpae as in mono- (most gymnosperms, the

monocots, and a few dicots especially of the woody **Ranales**), tri- (most dicots), pan- (with many furrows), a- (without colpae).

colus L.: a whorl.

comat(us) L.: with tufts of hair.

come Gk., coma L.: as in **brachycome**, **comesperma**, a tuft of hairs.

COMMENSALISM: the relationship or interaction among species (the commensals, usually of different species) sharing the same external environment but neither nutritionally dependent on, nor antagonistic to, one another. See also amensalism, symbiosis.

COMMISSURE: in general, a line or seam marking the union of parts.

communi(o) L.: as in **commune**, **communis**, a communion (this sense is often intended rather than from **communis**, common, i.e. gregarious in a community but not necessarily common).

COMMUNITY: a dynamic system of plants with their dependent fauna considered in relationship to each other and to the resources of their environment. See also ecosystem, population, structure, phytosociology, physiognomy.

comos(us) L.: hairy (often in reference to hairs but also in relation to a tufted habit).

COMPANION CELL: of a sieve-tube element, a cell derived singly or in a series from the same mother-cell, actively functioning and in intimate contact with the sieve-tube conceivably controlling the passage of solutes from sieve tubes to other tissues.

COMPENSATION POINT: see under photosynthesis.

COMPETITION: the struggle among individuals for utilization of the resources of the habitat available to them.

COMPLANATE: of a structure when flattened or compressed.

COMPLICATE: of parts when folded. Conduplicate.

COMPOST: a product of organic matter, especially plant litter, vegetable waste and manure, derived from the fermentative processes of a succession of micro-organisms, and serving as a fertilizer for soils in addition to providing a humus.

COMPOUND LEAF: a leaf when divided to entire units, leaflets, or of a single leaflet when unifoliate (q.v.). The leaflets may spread fan-wise from a common origin (see digitate, palmate, pedate, ternate) or from both sides of a rachis (see pinnate). See also foliolate, jugate.

COMPOSITE: compounded. e.g. of a group or structure when made up of two or more components superficially appearing to form a unit. Applied also to a member of the family **Compositae**.

COMPRESSION WOOD: the wood (reaction wood) of conifers when modified by a physical state of growth, e.g. by the lateral position of a branch when the wood on the lower side becomes highly lignified apparently in response to the compressional force.

CONCENTRATION: of a solution, the mass of volume of the solute present, e.g. a 10% solution of a solid or liquid indicates that for every 100 gms or 100 mls of the solution, 10 gms or 10 mls of the solute are present. See also molal, molar, normal solution.

CONCHOID: resembling in shape the shell of a mollusc. From L. **concha**, a shell.

concinn(us) L.: of graceful or elegant appearance.

CONCOLOROUS: of the same colour, as a leaf when both surfaces are green in equal intensity.

concret(us) L.: compacted to a mass (concrete).

CONDENSATION: in general, a union or massing together, e.g. of molecules of a gas or vapour to a liquid or solid state by the removal of heat or increase in pressure. In a chemical reaction, the combination of atoms (e.g. of hydrogen and oxygen) and freeing (e.g. as water) to give other chemically combined products.

condit(us) L.: storing or preserving, especially of a savoury principle.

CONDUCTANCE: of heat or other form of energy, its transfer through a solid (the conductor) from particle to particle, its degree of conductance (i.e. conductivity) the reciprocal of its resistance.

CONDUCTING TISSUE: tissue functioning for the transport and distribution of solutes throughout the plant. Of higher plants, the vascular elements of xylem and phloem.

CONDUPLICATE: folded together lengthwise.

CONE: a general term, without reference to nature or homology, for the reproductive structure of conifers, cycads, lycopods, lepidodendrids, and sphenopsids. Also strobilus.

confert(us) L.: closely packed, e.g. of flowers or fruit.

CONFERVOID: made up of thread-like structures.

CONFLUENT: blending together. The epithet **confluens**, blending or combining with other species.

CONGENERIC: of the same genus.

conglobat(us) L. collected in a globular mass (conglobate).

CONGLOMERATE: crowded together.

CONGRUENT: corresponding with.

CONIDIOPHORE: of a fungus, a hypha producing asexual spores (conidia). See also under bacterium for conidia. From Gk. condition, the diminutive of **conis**, dust.

CONIFER: a seed-bearing, usually monoecious vascular plant, in habit a tree often, tall, excurrent or fastigate, or a shrub sometimes (e.g. **Microcachrys**) weakly-branched and straggling, with leaves evergreen, spirally-arranged, whorled or clustered, scale-like, needle-like, or narrow in form. Its male reproductive structure is cone-like, usually much smaller than the female, composed of an axis bearing spirally-arranged sporophylls, each sporophyll with two or more pollen-sacs (sporangia) within which is developed pollen-grain, usually the pollen produced in profusion and carried to the female by wind currents. the **female** or **ovule structure** is composed essentially of a scale (ovuliferous scale) frequently occurring in a spirally-arranged or whorled series to form ultimately a woody cone. On the surface of the scale are borne one or more ovules, unenclosed except by a single integument.

Classification: a member of the class **Conopsida** of some authors or class **Coniferae** of others, with orders **Cordaitales**, **Ginkgoales**, **Taxales**, and **Coniferales**.

The **Cordaitales** are known only from the fossil-record and conceivable are the ancestral line to conifers. **Ginkgoales**, based on the maidenhair tree **Ginkgo biloba** of China, possibly the oldest surviving seed-bearing plant, virtually extinct in the wild but frequently cultivated, have in common multi-veined broad and flat leaves and motile (male) gametes. These features are absent in the **Taxales**, an order unique in that no cone is evident either from fossil ancestors or present-day members (the taxads, included the yews of **Taxus** and **Torreya**, e.g. California nutmeg **Torreya californica**). The male structure is a whorled series of radically-symmetrical sporophylls (each with

4-6 pollen-sacs) and sterile scales, the female is solitary in the axils of foliage leaves or leaf-scales and composed of an axis from which arises a cup-like aril enclosing a single erect ovule. Not always is the female structure a cone in the major order, **Coniferales**, but here, from anatomic comparative studies of fossils and extant members, morphological reduction is implied.

Podocarpaceae, Cephalotaxaceae: of the two exceptional families of **Coniferales**, the ovule (and seed) either is subtended by a scale-like bract sometimes fleshy, or bears an aril often coloured and enclosing it, solitary in **Podocarpaceae**, paired in **Cephalotaxaceae** (the plum-yews of eastern Asia). The **Podocarpaceae**, have a particular distribution in the southern hemisphere and are represented in Australia by 7 of the 100 species or so species of the monoecious **Podocarpus** mainly in rainforest, e.g. Brown Plum **P. elatus**, Black Pine **P. amarus**, 1 of the 16 species of **Dacrydium**, the timber and essential oil yielding **D. franklinii** confined to Tasmania and now occurring in stands to inaccessible for present exploitation, two monotypic genera also confined to Tasmania, the shrubby **Microcachrys tetragona** and the timber tree Celery Top Pine **Phyllocladus asplenifolius**, finally two isolated species of **Microstrobos**, one (**M. niphophilus**) in Tasmania, one (**M. fitzgeraldii**) in New South Wales, both very local and at high altitudes. The New Zealand **Dacrydium cupressinum** provides the timber Rimu.

Cupressaceae: in other families of **Coniferales** there is rarer modification in the female cone. This is chiefly in the **Cupressaceae** where the fruit is fleshy and berry-like in the junipers, and small, rounded and with whorled scales in the cypresses (the fruit of both known sometimes as a gallbulus). For this family both cone-scales and leaves are in whorls of two or more, the leaves frequently stem-appressed and scale-like. **Callitris** of 16 species has 14 endemic to Australia ranging from coast to inland, providing the cypress pine of the timber industry (viz from **C. hugelii**) and the resin sandarac from the bark of **C. verrucosa**. **Actinostrobus** of two shrubby species is endemic to south-western Australia and the monotypic **Diselma** (**D. archeri**, a shrub) endemic to Tasmania. Widely cultivated throughout the continent and originating from the northern hemisphere are the cypresses (**Cupressus**), False Cypress (**Chamaecyparis**), thujas or Arbour Vitaes (**Thuja**) and the junipers, **Juniperus communis** of Europe provides fruit ('juniper berries') used, e.g. in gin-making and for extraction of an essential oil 'oil of juniper'. **Tetraclinia articulata** of north and north-west Africa, and Spain, yields the resin sandarac from its bark. **Thuja plicata** of North America provides the timber Western Red Cedar.

Araucariaceae: the spiral arrangement of cone-scales and leaves is the rule in the remaining families of **Coniferales**. The seed may be solitary on the cone-scale and often embedded, the scale fused with the subtending bract, as the **Araucariaceae** where the leaves predominantly are broad and flat (viz. **Agathis**) or awl-shaped and angled (some **Araucaria**). The Karri Pines of **Agathis** are dispersed throughout the lands of the south Pacific, 3 of the 15 species being endemic to eastern Queensland. **Araucaria** of 10 species has 2 endemic to the tropical and sub-tropical eastern coast, Bunya Pine **A. bidwillii** and the more extensive Hoop Pine **A. cunninghamii** which reaches as far south as the Hastings River of New South Wales. Much cultivated along the eastern seaboard is Norfolk Island Pine **A. excelsa**, **A. klinkii** of New Guinea (Klinki Pine) and **A. angustifolia** of South America (Parana Pine) are sources of well-known timbers.

Pinaceae: the seed may be two per cone-scale (**Pinaceae**) of several (**Taxodiaceae**), the two families of the northern hemisphere with no natural representation in Australia. The value of the pines as timber trees has created their large-scale establishment in plantations (e.g. **Pinus radiata**, **P. pinaster**) to augment the depleted and naturally limited softwood timber sources. Overseas, several pines contribute the oleoresin turpentine from which colophony or resin, oil of turpentine, and terebene are derived, and Stockholm or Pine Tar. Typical of the pines are the dimorphic leaves and shoots. Normal long shoots bear achlorophyllous scale-leaves, supplementary short shoots axillary to the scale leaves bear 2, 3 or 5 green, needle-like leaves ensheathed at their base by scale-leaves, the short shoot deciduous as a unit and eventually replaced by male cones. In addition to the pines, the cedars (**Cedrus**), larches (**Larix**), spruces (**Picea**), tsugas (**Tsuga**), firs (**Abies**), have become parkland and hedgerow trees ubiquitous to the Australian landscape. **Abies balsamea**, the balsam fir of eastern Canada, yields the oleoresin Canada Balsam. Timbers familiar to Australian commerce include the North American Douglas Fir or Oregon (**Pseudotsuga menziesii**), Hemlock (**Tsuga heterophylla**) and the pines Monterey or Radiata (**Pinus radiata**), Loblolly (**P. taeda**), Ponderosa (**P. ponderosa**), Sugar (**P. lambertiana**), and the Sitka Spruce (**Picea sitchensis**), the European White Baltic Pine (**Picea abies**) and Red Baltic (**Pinus sylvestris**).

Taxodiaceae: features here include the absence of distinct bracts to the cone-scales, the latter flat or shield-like and bearing 2 to 9 ovules, and the frequent dimorphic, narrow or scale-like leaves persistent on branches ultimately deciduous but not, as in **Pinus** shed as a short shoot of a single leaf-cluster. World-famous are the Californian redwoods, e.g. **Sequoia semperivirens** and **Sequoia giganteum** where heights up to 360 feet are recorded. In common with the famed **Metasequoia glyptostroboides**, the 'living fossil' of China (and of the same family), and the bristle cone pines **Pinus aristata** of North America where stands believed 4,000 or more years old still exist, the redwoods are of great age and reflect their nature as relics from a greater, more extensive, distribution through the northern hemisphere during the early Tertiary of the Cainozoic era some 60 million years ago. The only Australian members of the **Taxodiaceae** are three species of **Athrotaxis** endemic to Tasmania, two King Billy Pine **A. selaginoides** and Pencil Pine **A. cupressoides** are valuable through depleted timber trees. Well-known from their frequent cultivation are the cryptomerias (**cryptomeria**) and taxodiums (**Taxodium**).

CONIFEROUS: in general, cone-bearing. Used especially in reference to conifers as in 'the coniferous forest of the northern hemisphere'.

CONJUGATE: joined in pairs.

CONJUGATION: as a type of sexual reproduction, the fusing together of the protoplasts of two morphologically similar cells to form a zygote, each protoplast acting as a gamete, e.g. by the **Conjugales** of green algae including **Zygnema** and **Spirogyra**. See also Bacterium.

CONNATION: the union of like parts, as the margins of petals when forming a sympetalous corolla, or the union of the bases of leaf-blades when sessile and opposite to form connate leaves.

CONNIVENT: of parts, usually when alike, meeting and adhering slightly but not fusing.

cono(s) Gk.: as in **conothamnus**, a cone (hence a shrub bearing cone-like fruit-clusters).

CONSERVATION: of natural resources, the provision for future need by the improvement and restoration to an economic balance during the present availability.

CONTIGUOUS: of parts, similar or not, touching but not fusing.

CONTAMINATION: in general, the unwanted inclusion of a substance or organism (the contaminant) foreign to the medium, especially in the sense that it is additional to an otherwise pure substance or culture.

CONTINENTAL DRIFT: the lateral movement, or displacement, of the surfaces of continents relative to one another, usually in the sense that the movement is of considerable magnitude and the time span of high order.

CONTINENTAL SHELF: the gently sloping margin of a continent extending from the shore to where, at about 100 fathoms below sea-level, the slope descends abruptly to the ocean (or abyssal) floor.

continu(us) L.: making continuous, i.e. uniting with other species.

CONTORTED: twisted.

CONTOUR: of land survey, a line connecting co-ordinates of equal elevation from a base-line.

CONTRACTILE: of a substance or material capable of shrinkage or contraction without permanent distortion.

CONVECTION: of heat, a transfer through movement or flow (by convection currents) in the conduction gas or liquid due to the change in density resultant of its heating. cf. conduction.

CONVERGENCE: of taxa, the acquisition of similar morphological features by dissimilar members through a similar response to identical environmental conditions.

CONVOLUTE: rolled around, as a leaf in bud when rolled up from one margin to leave the other margin external to the roll, or as sepals and petals in bud when one margin is directed outwardly and overlaps, while the other margin is directed inwardly and so is overlapped by, the respective margins of adjacent parts, the bud being contorted as a result. See also circinate, involute, revolute.

convolv(o) L.: as in **convolvulus**, to roll around; to cover.

COPPICE SHOOT: a shoot developing from a dormant bud of a trunk, especially when the trunk is reduced to a stump. cf. sucker.

COPPICE WOODLAND: a woodland (q.v.) subjected to periodic coppicing, i.e. the cutting of trees almost to ground level to stimulate further growth by coppice shoots.

copro(s) Gk.: as in **coprophilous**, dung (hence living on such excreta, as certain fungi).

COPSE: a small woodland.

corallin(us) L.: coral-like, e.g. in colour. Coralline.

CORALLOID: resembling coral.

CORDATE: in the shape of the heart of playing cards, as given, e.g. by the broad lobing at the base of some laminas. For epithets, **cordatus**, **cordifolia** etc. From L. **cor**, the heart.

cordyl(e) Gk.: as in **cordyline**, a swelling.

CORIACEOUS: of texture when tough and pliable, as a majority of eucalypt leaves.

CORK: see periderm. Cork of commerce is chiefly from the cork oak **Quercus suber** cultivated for this purpose in Portugal, Spain, and the Mediterranean countries in general.

CORM: a bulb-like structure, formed by enlargement of an underground stem-base, storing food reserved. Within the axils of protective dry scale-leaves, small corms (cormels or offsets) may form. A feature of the **Iridaceae**. **Cormous**: producing corms.

corne(us) L.: horny, horn-like; corneous. corneol(us) the diminutive.

CORNICULATE: bearing a small horn-like structure.

cornut(us) L.: horned; bearing a more pronounced horn-like structure; cornute. In epithets, **bicornatis**, **tereticornis**, etc. from L. **cornu**, a horn.

COROLLA: the second whorl of sterile appendages of a complete flower, made up of petals. When the margins of the petals are free from one another, the corolla is **polypetalous** or **choripetalous**; when connate, **sympetalous** (synpetalous) or **gametopetalous**. The united part of a sympetalous corolla is the **tube**, the free parts **lobes** or teeth which, when expanding radially form a **limb**. The opening of the tube is the **throat**.

coron(a) L.: as in **coroniformis**, a crown.

CORONA: of a corolla, an inner ring of hair-like or filamentous appendages (e.g. as of the Passionflower **Passiflora**) or scales, sometimes the scales very conspicuous and seemingly forming an 'inner corolla' (e.g. **Hippeastrum**, **Narcissus**).

coronat(us) L.: crowned.

CORPUS: of the apical meristem of a stem, the tissue underlying the **tunica** (q.v.) the cells reproducing for both the vertical and transverse tissue systems.

CORRASION: of rock its erosion through the abrasive action of fine-texture material carried by wind, water, or moving rock.

CORRELATION: mutual relationship.

CORREGULATE: wrinkled; folded; furrowed.

cort(ex) L.: as in **cortical**, **corticolous**, bark.

CORTEX: a continuous sheath of primary tissue (parenchyma) of a root-shoot system, primarily protective, limited on its inner periphery by the vascular system and on the outer by the epidermis.

cortina L.: a veil.

CORYMB: a racemose inflorescence with flowers brought more or less to a common level by a shortening or lengthening of pedicels, the lowermost and earliest-formed being outermost and opening first. From Gk.: **korymbos**, a flower-cluster.

CORYMBOSE: resembling a corymb but not necessarily derived in the same manner.

coryn(e) Gk.: as in **corynocapus**, **tricoryne**, a club (hence in the sense of being swollen to appear club-like).

cory(s) Gk.: as in **microcorys**, a helmet; a cap.

cosme(o) Gk.: as in **cosmelia**, to adorn.

cosmo(s) Gk.: as in **cosmophylla**, of beauty.

COSMOPOLITAN: of wide distribution in at least two continents.

COSTA: (plural costae) a rib of prominent ridge of a structure.

COSTATE: ribbed longitudinally.

COTERMINIOUS: of distribution when the outlying geographic ranges (for two or more taxa) are similar or adjoining.

cotul(e) Gk.: as in **cotula**, a small cup (In **Cotula** referring to the bases of the leaf-blades).

cotyl(e) Gk.: as in **cotyloid**, a cavity (especially when cup-like).

COTYLEDON: the lateral storage and absorbing, leaf-like organ of a mature embryo which, at germination, may become fully photosynthetic and closely resemble or function as a normal leaf, or remain as an organ primarily for storage. Of simple structure in most dicotyledons and many monocotyledons, may (e.g. the grasses) become highly specialised, a part (**scutellum**) functioning for the absorption of stored nutrient, another part (**coleoptile**) serving for protection of the plumule.

In number, the single cotyledon of monocots, the paired cotyledons of dicots, and the several (up to 16 or more) of conifers, are general but the addition or loss of one or more is not unusual, e.g. from 3 to 8 for some embryos of **Persoonia** spp. See also epicotyl, epigeal, hypogeal.

COTYLEDONARY: relative to a cotyledon.

COVER CROP: a crop designed to form a cover for a soil as a protection against, erosion, leaching, and excessive temperature fluctuations.

CRAB HOLE: a land surface marked by a series of pits or troughs, each from two to three feet deep. See also gilgai.

crasped(on) Gk.: as in **craspedate**, **craspedia**, a fringe.

crass(us) L.: as in **crassifolia**, **crassipes**, thick.

crassul(us) L.: as in **crassula**, moderately thick.

crater Gk.: as in **crateriform**, a cup-shaped hollow.

craty(s) Gk.: as in **cratystilis**, robust.

creber, crebra, crebrum L.: crowded; several together.

CREMOCARP: a schizocarpic (q.v.) fruit when its two mericarps remain attached at first to a carpophore (q.v.).

cremoris L.: of cream.

CRENATE: of a margin when indented at regular intervals to appear like the cutting-edge of a saw, but with the teeth rounded.

crenat(is) L.: notched.

CRENULATE: crenate but with very small indentations.

crepis Gk.: a shoe. **Crepidote**: shoe-like.

cressa Gk.: a native of Crete.

CRETACEOUS: of, or with the texture of, chalk.

crinit(us) L.: with long hair (L. **crinis**).

crinon Gk.: the Greek name for the lily (hence **crinoides**: lily-like).

crispat(us) L.: as in **crispate**, curled; crisped.

CRISPATE: of a margin when very irregular, twisted and curled.

cristat(us) L.: as in **cristate**, crested.

CRISTATE: bearing a ridge or crest, or in the form of a crest or tuft.

crithmi-: as in **crithmifolia**, of the herb **Crithmum (Umbelliferae)**.

croceus L.: saffron-coloured.

CROSS: of genetics, the fusion of gametes contributed by different parents. cross-fertilization.

CROSSING-OVER: of chromosomes, an exchange (through breakage and reunion) of corresponding segments (or chromatin) after pairing (as chromatids) at meiosis, the effect being the forming of new linkages of genes.

crotal(on) Gk.: as in **crotalaria**, a castanet (in reference to the seed rattling in the pods).

croton Gk.: a tick (in the genus, referring to a likeness of the seed to this arachnid).

CROWN: of a tree, the part above the first branches.

cruci(s) L.: as in **crucifera**, **cruciform**, a cross.

cruent (us) L.: blood-red.

CRUSTACEOUS, CRUSTOSE: forming a hard and brittle covering of crust, as a lichen when embedded within or attached to its substratum of rock. From L. **crusta**, a shell.

cryo(s) Gk.: as in **cryophilous**, cold; frost (hence adapted to conditions of snow, ice, or frost).

CRYOTURBATION: the weathering of soil under conditions of extreme cold.

cryph(e) Gk.: as in **cryphia**, a covering.

crypto(s) Gk.: as in **cryptandra**, **cryptocarya**, hidden.

CRYPTOGAMIC: relative to those plants (algae, fungi, bacteria, bryophytes, pteridophytes) with reproductive structures not as apparent as those of seed-bearing plants ('phanerogams').

CRYPTOZOIC: of geological time, relative to the era (the Pre-Cambrian) in which evidence of life is hidden because of an absence of means of ascertaining such existence.

CRYSTALLOID: a substance which disperses in a medium to form a true solution, i.e. a single-phased system, able to pass through an osmotic membrane. cf. colloid.

cte(is) Gk.: as in **paractaenum**, **ctenoid**, **ctenose**, a comb.

CUCULATE: hood-like; bearing a hood-like structure.

CULM: the stem of a grass, solid only at the nodes, or the solid (usually 3-angled) stem of a sedge.

CULTIGEN: a plant or group of plants known only in cultivation, apparently originating under domestication.

CULTIVAR: a variety or race (strain) produced in cultivation, not necessarily referable to a taxonomic unit.

CULTRATE: in the shape of a knife-blade.

cultir L.: as in **cultriformis**, a knife.

CUNEATE: resembling an isosceles triangle, inverted so that the apex is at the point of attachment, the angles rounded, i.e. flat, broad at the apex and tapered to the base.

cuph(os) Gk.: as in **cuphea**, curved.

cu(o) Gk.: as in **cupressus**, to produce (hence producing equal **parisos** branches).

cupre(us) L.: like, or with the colour of, copper.

CUPULE: a cup-like structure, e.g. when formed from enlarged and hardened floral bracts at the base of certain fruits, as the nut of oak (**Quercus**) where cupule and nut form the acorn.

curculi(o) L.: as in **curculigo**, a weevil (hence with a structure resembling the snout of a weevil).

curt(us) L.: abruptly shortened as though broken off.

curv(us) L.: curved, arched, bent, crooked.

CUSEC: of water flow, cubic feet per second, one cusec covering two acres to a depth of one foot in twenty four hours.

CUSHION PLANT: a plant adapted to harsh conditions (e.g. extremely strong winds) by development of short, closely-clustered shoots which arise a few inches above ground-level, the plant in time often spreading several square feet. In addition to alpine or polar communities, the habit may be adaptive in desert or scrub, the benefit being limitation of excessive transpiration and evaporation of water available to its roots (i.e. limitation of excessive evapotranspiration).

CUSPIDATE: ending in a sharp, rigid point (a cusp).

CUTICLE: see cutin.

CUTIN: the fatty and fat-derived substances including waxes (q.v.) occurring as a covering or **cuticle** to an epidermis and as a component of cell walls, serving as a barrier to water and gas exchange but permeable to the diffusion of aqueous solutions through cracks and ridges to a limited degree.

Cuticularisation: development of a cuticle. **Cutinisation:** addition of cutin to a cell wall as a cuticular layer.

cyano(s) Gk.: as in **cyaneous**, **cyanophyte**, blue; dark blue.

CYANOGENETIC: of a glycoside (q.v.) when hydrocyanic acid is the aglycon. Of a plant when secreting this type of glycoside.

cyath(os) Gk.: as in **cyathodes**, a cup.

CYATHIUM: the inflorescence of certain **Euphorbiaceae** (e.g. **Euphorbia**) seemingly a single flower but a very much reduced cyme of unisexual flowers without perianths, borne within a cup-like involucre of petaloid bracts, the staminate (of 1 stamen) grouped around a central, solitary, pistillate flower with a stalked ovary).

cybe Gk.: as in **microcybe**, a head.

CYBERNETIC: of living systems, relative to the principles concerned in their operation as self-controlling, self-adjusting mechanisms.

CYCAD: a dioecious cone-bearing seed plant which, from its erect usually unbranched trunk (from subterranean to several feet high), often armoured by the persistent bases of petioles, bearing a dense crown of frond-like, pinnately compound leaves, has an appearance intermediate to that of a fern and a palm. In some, the appearance is closer to the ancient seed-ferns (pteridosperms) with which evidence suggests a far greater affinity than with the conifers formerly believed the closest relatives.

The cycad trunk shows little or no secondary growth. The reproductive structure is a cone (not homologous with that of the conifer) either male or female, often very large ('pineapple-like') made up of a number of spirally-arranged cone-scales (sporophylls) except the fames in families not Australian. The male cone-scale bears numerous pollen-sacs, the female bears a single marginal pair of ovules when spirally-arranged in a cone (or, when not forming a cone, the ovules marginal and several). The spores are dimorphic, the male (pollen-grain) dispersed by wind but prior to fertilization develop the multi-flagellate sperm of macroscopic size, the largest spermatozoid of the plant kingdom. The macrospores develop to multi-cellular gametophytes within which, after pollination, ovules (or very much reduced archegonia) are formed, each ovule producing an egg-cell. Ultimate fertilization leads to the formation of a seed of large size, with endosperm, a three-layered coat, and an embryo with two hypogeal cotyledons.

Classification of the cycad is unsettled. Some authors treat it at divisional level (as **Cycadophyta**), others as class (**Cycadopsida** or **Cycadae**) with a single order **Cycadales**. Two monogeneric families **Cycadeceae** (**Cycas**) and **Stangeriaceae** (**Stangeria**) and a family **Zamiaceae** of several genera are established. The Australian representation is from 3 of the 8 genera of **Zamiaceae**, i.e. **Lepidosamia**, **Macrozamia** (including the well-known burrawang **M. communis**), and **Bowenia** (of tropical Queensland).

Stems and seed of cycads provide sources for starch, the sago of commerce while largely from the sago palms of **Metroxylon** is also derived from certain cycads, both palms and cycads chiefly of Indonesia and the Philippines. Seed of **Macrozamia** stores a toxin, macrozamin, which may be rendered innocuous by roasting and soaking treatments, a procedure adopted by the aborigines in their preparation of the seed as food. Extraction of starch and a jelly-like gum from **Macrozamia** was a small industry in pre-war New South Wales.

cycl(os) Gk.: as in **cyclops**, a circle or coil (hence **cyclos**, **ops**, eye).

CYCLIC: of a perianth when its parts are in whorls. Of an organic compound when the structure of its molecule is in the form of a closed chain or ring (e.g. the benzene ring), **homocyclic** when the ring is of carbon atoms only, **heterocyclic** when the atoms of the ring are of more than one kind (e.g. the structure of alkaloids). cf. aliphatic.

CYCLOSIS: the movement or streaming of cytoplasm within a cell.

cycn(us) L.: as in **cycnocephala**, a swan (hence with heads borne in the manner of a swan's head).

cymb(a) L., cymbi(on) Gk.: as in **cymbidium**, **cymbopogon**, **cymbiform**, a boat (hence a reference to a hollow or shallow recess).

cyma L.: a sprout of cabbage.

CYME: a cymose inflorescence including the monochasium and dichasium and their derivatives, and the pleichasium when there are more than two lateral branches).

The **monochasium**, with a single lateral branch, occurs usually when the leaf arrangement of the stem is alternate. Its derivatives are the **helicoid cyme** (or **bostryx**) when the unilateral branch order is repeated from the single lateral branch, and **scorpioid cyme** (or **cincinnus**) when branching for the lateral is an alternating series. Modifications based on the occurrence of flowers in a single plane are the **rhpidium** of the bostryx as shown by members of **Iridaceae**, and the **drepanium** of the cincinnus as shown by members of **Junaceae**. Derivatives of the monochasium tend to resemble to monopodium of racemose inflorescences (q.v.) but here branches are always axillary to the leaf (or bract) of the main axis, the pseudo-branches of the cyme being opposite to the leaf or bract when present.

When both axillary shoots below the terminal flower of the cyme develop, the inflorescence is a **dichasium** which, by further branching from the lateral branches, becomes a compound dichasium. Various modifications occur, e.g. a false dichotomous cyme may arise by suppression or loss of the terminal flower, a helicoid or scorpioid cyme may arise by suppression or loss of buds on one side. When internodes of a helicoid cyme (both monochasial and dichasial) are so reduced that the flowers appear to arise from a common point, a monochasial or dichasial umbel may result, the latter being the case with a majority of eucalypts.

CYMOSE: of a floral shoot when determinate in direction by development of flower at its apex, further growth being lateral. The sequence of flower-production is basipetal, the branching of the inflorescence sympodial.

CYMULE: a few-flowered unit of a compound cymose inflorescence.

cyn(os) Gk.: as in **cynodon**, a dog (hence 'dog's tooth').

cyphella Gk.: the hollow of the ear.

cyph(os) Gk.: as in **cyphia**, curved or bent.

CYPSELA: an achene (q.v.) formed from an inferior ovary and with a usually thin, leathery pericarp. Chiefly of the **Compositae**, often (as in the thistles) provided with a parachute-like pappus of aid in wind-dispersal. From Gk. **kypsele**, a hollow vessel. Plural: cypselae.

cyrt(os) Gk.: as in **cyrtanthus**, **cyrostylis**, curved, hollow, convex.

cyst(is) Gk.: as in **cysticarpus**, **cystocarp**, a sac or bladder (cyst).

CYSTOLITH: a concretion of calcium carbonate with other substances (e.g. cellulose) formed on certain cell walls (e.g. of the epidermis of **Ficus elastica**).

cyt(os) Gk.: a hollow, a cell.

CYTOCHROME: a system of enzymes (a, b, c located in mitochondria b, f, in plastids) with coloured active groups including di- and tri-valent iron, acting (through the interaction of cytochrome c with an oxidase to create an electron transfer in the valency change of iron) as a hydrogen carrier in the final stage (formation of water, release of energy) of aerobic respiration and, in photosynthesis, a carrier of energy adsorbed from light by chlorophyll.

CYTOGENETIC: relative to the correlation of cytological and genetic investigations concerned with the causes of organic variation.

CYTOKINESIS: of cell division, the division of cytoplasm after division of the nucleus into two parts, each part containing one of the daughter nuclei and becoming a daughter cell by formation of a wall.

CYTOLOGY: the science of the structural and functional organization of a protoplasmic system (normally a cell) and the implications of this organization protoplasmic system (normally a cell) and the implications of this organization to the function, differentiation, heredity and phylogeny of the organism.

CYTOPLASM: the protoplasmic content (or protoplast) of a cell other than its nuclear content from which it is limited by a **nuclear membrane** extended to a pervading **endoplasmic reticulum** (q.v.) and from the cell wall by a plasma membrane or **plasmalemma**. Occurs as a translucent, colourless viscous, ground substance of varying viscosity and about 80 percent water. Often (in plants) exceeded in volume by the sap-storing **vacuolar system** from which it is limited by vacuolar membrane/s, sometimes reduced to a lining of the cell wall. Forms a complex system of diffusion barriers controlling the movement and function of the organelles and solutes (e.g. enzymes) dispersed within.

CYTOPLASMIC INHERITANCE: a concept recognising that, in co-ordination with the nucleus, cytoplasm is actively concerned and is influential in some types of inheritance, e.g. of the self-replicating chloroplasts and mitochondria, of certain types of sterility (as male sterility) in hybrids. the genetic factor conceived is the **plasmagene** its nature largely determined by the type of cytoplasm contributed by the gamete of the female parent.

CYTOTAXONOMY: classification based on comparative karyology, i.e. the study of the number, size and shape of chromosomes and their behaviour at meiosis. See also karyotype.

CYTOTYPE: a plant or group of plants variant from its species in some cytological feature. Also **cytodeme**.

dacry(on) Gk.: as in **dacryoid**, a tear (hence with the shape of a tear-drop).

dactyl(os) Gk.: as in **dactyloid**, a finger.

DAMPING-OFF: a disease causing abrupt death of seedlings after (post-emergent) or before (pre-emergent) growth above soil-level, induced by such soil-dwelling fungi of **Phytophthora** and **Pythium** (**Peronosporales**) and form-genera **Rhizoctonia** and **Fusarium** (**Deuteromycetes**) virulent to plant-growth under conditions of high humidity and temperature.

daphno-: as in **daphnoides**, of Daphne (**Thymelaeaceae**).

dasy(s) Gk.: as in **dasyphyllum**, hairy.

DAUGHTER CELL: of reproduction, either of the two cells resultant from the division of a mother cell.

DAY LENGTH, DAY NEUTRAL: see under photoperiodism.

DELBATE: with a white powdery covering.

debile, debilis L.: slender and weak.

deca Gk., decem L.: as in **decandrous**, **decamerous**, ten; ten-fold.

DECAY: the reduction of organic matter other than nitrogenous compounds, by fungi and bacteria. See also putrefaction.

DECIDUOUS: shedding at the end of its growth-period, as foliage when unreplenished during a dormant season (cf. evergreen) or bark when periodically shed (cf. persistent).

decipiens L.: deceiving.

DECLINATE: curving downwardly, or turning outwardly.

DECOMPOUND: more than once, or compoundly, divided.

DECORTICATION: the shedding of bark. The epithet **decorticans**, decorticating.

decor(us) L.: graceful in appearance.

DECUMBENT: of a shoot when prostrate for most of its length but with the tip ascending or erect.

DECURRENT: continuing in line with another structure, as a leaf-blade when its attachment runs in line with the stem to give a ribbed or angled appearance.

DECUSSATE: arranged in pairs of opposite members (e.g. leaves), each pair turned at right-angles to the succeeding pair.

DEFINITE: of parts when occurring in a fixed or constant number, usually less than twenty. Of an inflorescence when cymose.

DEFLEXED: turned or bent downwardly.

DEFOLIATION: the shedding of leaves, either as a seasonal normality or as a consequence of a disease (e.g. by insect attack or physiological disturbance).

DEHISCENCE: of a mature organ, the method of rupturing or opening for the release of contents, e.g. spores or seed.

Of a fruit, dehiscence may be simply through pores or slits of the pericarp (**poricidal dehiscence**), or the pericarp may separate along a definite line (suture) to a varying degree (as in most follicles) or along two sutures (as in legumes or pods), the segment separated being a **valve**, thus the follicle is one-valved (or univalvular), the legume two-valved (or bivalvular). Since both fruits are monocarpellate, the number of valves is equal to, or double, the number of compartments (**locules**) opened. When the fruit is a multi-carpellate capsule, the number of valves is equal to the number of locules and dehiscence is **septicidal** when division occurs along lines concurrent with the septa formed by the carpel walls, and **locullicidal** when along lines bisecting the angles formed by septa (the valves being formed by the united halves of adjacent carpels). Dehiscence of a uni- or multi-carpellate capsular fruit may also occur by a transverse circular line so that a lid-like upper portion separates, dehiscence then being circumscissile (e.g. a **pyxis**). Of anthers, see extrorse, introrse, latrorse.

DEHISCENT: splitting open when mature.

DEHYDRATION: as a chemical process, the loss of water from a compound resulting in a change of molecular structure, e.g. the dehydration of ethyl alcohol yields ethylene. See also condensation.

delicat(us) L.: of dainty appearance.

DELIQUESCENT: of habitat when the leading position of a main stem is terminated by repeated branching above it, cf. excurrent. Of a salt (e.g. calcium or magnesium chloride) becoming dissolved in water absorbed from the atmosphere (as moisture) when the vapour pressure of water over the salt is less than that of the surrounding atmosphere.

DELTOID: resembling a triangle with equal sides.

DEME: of ecology, a unit of classification for a population of a specified taxon. Usually used as a suffix as, e.g. **topodeme**: a deme of a defined geographic area; **ecodeme**: a deme of a defined habitat.

DEMERSED: submerged, at least partially.

DENATANT: migrating with the current, as a current-drifted plankton.

dendro(n) Gk.: as in **dendroid**, **dendrology**, a tree. **dendrobium**: **dendro(n)**, **bi(os)-um** (hence epiphytic on trees).

DENDROCHRONOLOGY: the study of age determination in relation to trees and timber through comparative methods based on growth rings.

DENDROGRAM: a presentation of relationship in graphic form, e.g. in the form of a branched tree.

dens L.: as in **bidens**, a tooth.

DENITRIFYING: a bacteria when reducing nitrates. See nitrification.

DENSITY: of a substance, its mass per unit volume. when compared with a mass of water of equal volume at the same temperature (density of 1 ml. close enough to unity at room temperature), **relative density** or **specific gravity**. Of a gas, density is the mass of 1 cc. expressed in grams.

DENSITY: of ecology, the average number of individuals of a particular species present in the sampling of a defined area.

DENTATE: of a margin when deeply indented at regular intervals to appear like the cutting-edge of a saw, the teeth acute. cf. crenate.

DENTICULATE: the diminutive degree of dentate, u.e. with the indentations not deep.

DEPAUPERATE: reduced in form or function.

DEPLANATE: brought to a common level.

DERMAL: relative to the protective tissue-layers of a shoot, as the epidermis and periderm.

DERMATOGEN: of the apical meristem of a root, the outermost layer.

DERMATOPHYTE: a plant (usually a fungus or bacterium) parasitic on the epidermis or skin, hair, or nails of an animals, the disease created (e.g. ring-worm) known as a dermatomycosis.

DESERT: a region of more or less permanent climatic conditions (e.g. excessive evaporation to precipitation, extreme cold or heat) hostile to the support of major organic life except that which has developed special means for survival. Applied also to a community characterised by a sparse coverage of annual herbs, low succulent shrubs, larger xerophytic shrubs, and hummock-forming grasses.

DESICCATE: without moisture; dried up.

desm(os) Gk.: as in **desmodium**, **trichodesma**, **eudesmia**, a union or bond.

DESOLATE: isolated; alone.

despict(us) L.: lowly; of mean form.

DETERGENT: a substance, usually a fatty acid or derivative (e.g. a soap) with a molecular structure of two parts, one (a lipophilic group) with a strong affinity for hydrocarbons (as oil or grease), the other (a hydrophilic group) with a strong affinity for hydroxy compounds (e.g. water), each strongly repellent to its alternative. When grease or oil is at equilibrium in water to form a surface layer, the action of a detergent when added is that its lipophilic dispersed to form an emulsion through the affinity of the hydrophilic group for water. See also surfactant.

DETERMINANT: a factor controlling or determining the development of a process or condition.

DETERMINATE: of definite or terminal duration.

deust(us) L.: scorched; seared.

deuter(os) Gk.: as in **deuteromycetes**, second; alternative (hence an alternative class (form-class) to the taxonomic classes of fungi known by their sexual stages.

DEVELOPMENT: of an organ or organism, the progressive change in nature, from conception to maturity. Growth normally is a necessary complement.

devex(us) L.: hanging down; dependent.

DEW POINT: the point of temperature at which, by a further lowering in temperature, water-vapour at full saturation in the atmosphere will be deposited (condensed) as fog, mist, cloud, rain, snow, frost, or dew dependent on pressure, humidity, and the region of condensation.

dextra L.: the right side.

DEXTRO ROTATORY: of an optically-active substance when rotating the plane of polarised light to the right. Indicated by the letter d or the symbol + (plus).

DEXTORSE: spiralling from left to right (clockwise). cf. sinistrorse. From L. **dextrorsum**, on the right hand.

di(s) Gk.: as in **diadelphous**, twice (hence of stamens when grouped in two bundles).

dia- Gk.: as in **diachronous**, apart (hence dating from different periods of time) or, as in **diageotropic**, across, through.

DIAGEOTROPIC: of growth when at right-angles to the earth's gravitational pull, e.g. the horizontal growth of an underground tuber.

DIAGNOSIS: of a taxon, the short critical description enumerating the detail which differentiated the taxon from its closest allies.

dialy-: as in **dialysepalous**, separated (from Gk. di-, apart; lyein, loose).

DIALYSIS: the separation of crystalloids (the dialysate) and colloids by the passage of their mixed solution through an osmotic membrane.

DIASPORE: see dissemination.

DIASTROPHIC: of the sudden or gradual movement of the earth's crust.

DIATROPIC: of orientation when at right-angles to the direction of the stimulus.

DICHASium: a usually three-flowered inflorescence in which the main axis (peduncle) is terminated by a flower and subtends two lateral branches also flower-terminated. By further branching from the lateral branches, a compound dichasium may be formed. **Dichasial**: relative to a dichasium. See also cyme.

DICHLAMYDEOUS: of a flower when possessing both calyx and corolla.

dicho(s) Gk.: as in **dichopogon**, double, in two.

DICHOGAMY: of a bisexual flower, the maturing of the stigma and anthers at different times, the effect being the avoidance of self-pollination. See protandry, protogyny.

DICHOTOMOUS: of branching when developing in a forked manner, the two branches either equal (bifurcate or true dichotomy) or not equal by the more vigorous growth of one (sympodial dichotomy).

DICLINOUS: of a species, dioecious; of an individual, either unisexual or monoecious.

DICLINY: dioecium, or monoecism.

DICOTYLEDON: (abbreviated in this work to dicot.) an angiosperm for which the following are characteristic but not exclusive to it; floral parts pentamerous (in 5's) and divisible to calyx and corolla, embryo with two epigeal cotyledons, cambium forming a continuous cylinder, vascular system forming a single cylinder sometimes (when herbaceous) reduced and dissected, leaves pinnately or palmately, sometimes reticulately veined, root system a branched primary root. While none of these features applies to all dicots, there is also no clear separation from the monocotyledon which evidence favours as a derivation from an early dicot stock. Overall similarities and differences support their maintenance as separate classes.

Treated by most authors as a class **Dicotyledonae** or other authors as sub-class **Dicotyledonidae**, the tendency has been to establish finer limits for orders and families as relationships become better known. Hutchinson (1959) provides 80 orders linking about 340 families, some families with one or few members, others with thousands.

dicra-: as in **dicrastylis**, forked. From Gk. **di**, **crat(os)**, power.

dictyo(n) Gk.: as in **dictyodromous**, a net (hence net-veined, anastomose).

DICTYSOME: see Golgi.

DICTYOSTELE: a stele (q.v.) in which the vascular cylinder is dissected into a network of overlapping leaf-gaps. A particular feature of ferns.

dicuph(us) Gk.: double curved.

DIDYMOUS: occurring in pairs. From Gk. **didymos**, double.

DIDYNAMOUS: of stamens when occurring in two pairs of unequal length, i.e. when the flower has four stamens only, two of which are longer.

DIFFERENTIATION: in one sense, the elaboration of structure for specialisation of function through the co-ordination of cells and tissues during development.

difformis L.: of odd or irregular form or appearance.

DIFFRACTION: of light, the deviation or bending of its rays when encountering some obstacle to its passage in a straight line, e.g. from its passage over a sharp edge or through a narrow slit as in a grafting.

DIFFUSE: of habit when open and loosely spreading.

DIFFUSE POROUS: of hardwoods (q.v.) when vessels (pores) arranged in groups or rows, scattered more or less evenly throughout the xylem. Characteristic of eucalypt woods.

DIFFUSION: the kinetic molecular movement of particles (gas, liquid, solute, and to a much more limited degree solid) uniformly throughout the space (or medium) available from regions of high to regions of low concentration or pressure, at a rate independent of other substances which may be present. See osmosis, permeability.

DIFFUSION PRESSURE DEFICIT: (DPD) of an osmotic system, the deficit between osmotic pressure and turgor pressure (q.v.). For a plant cell, when DPD is zero, the tendency of water to diffuse without or from the cell also is at zero.

DIGITATE: in general, arising from an axis like fingers of a hand. See also palmate.

DILATED: expanding as a flattened surface.

DIMEROUS: of two parts.

DIMORPHIC: of two forms similar in kind but dissimilar in shape or structure. **Dimorphism:** the production of dimorphic forms.

d(e)ino(s) Gk.: as in **dinoflagellata**, formidable; stimulating wonder.

DIOECIOUS: of a species with some members bearing male reproductive parts only, others bearing female parts only, hence requiring for its perpetuation the proximity of two plants of different sex.

dios Gk.: as in **diospyros**, divine.

DIPLOBIONTIC: of an individual when its life-history is passed in two distinctly different morphological forms, i.e. the sexual and asexual stages are morphologically different.

DIPLOID: with two complete sets of chromosomes, each set contributed by each of the two gametes (of the haploid condition) essential normally in the formation of the zygote and the organism arising from it. Expressed symbolically as $2n$. See also meiosis, mitosis, alternation of generations.

DIPLOID GAMETOPHYTE: a phase of apomixis (q.v.) in which mitotic division within an ovule (see apospory, diplospory) forms directly a gametophyte with unreduced chromosome number.

diplo(s) Gk.: as in **diploid**, **diplopeltis**, double, twofold.

DIPLOSPORY: the formation of the diploid gametophyte from a sporogenous cell of an ovule with meiotic division either omitted or modified so that pairing and reduction of chromosomes do not occur.

DIPLOSTEMONOUS: of an androecium when its stamens are double the number of petals or sepals.

di(s) Gk.: as in **dipterous**, two (hence two-winged).

dis- L.: as in **dissect**, **dissociation**, apart, asunder.

disciss(um) L.: spit apart.

DISC FLORET: of certain **Compositae**, e.g. **Brachycome**, **Calotis**, **Olearia**, one of the group of inner florets of the head, usually tubular and distinct from the outer (peripheral) ray florets.

DISCOLOUROUS: of varying or different colour.

disc(os) Gk.: as in **discoid**, a disc (hence flat and round).

DISEASE: a condition adversely affecting the normal functioning of an organism.

DISINFECTANT: a substance lethal to pathogens.

DISJUNCT: discontinuous, e.g. of a species with a natural distribution broken by regional gaps (usually wide) hence of geographically isolated occurrences.

dispar L.: as in **disparate**, unlike.

DISSEMINATION: dispersal of reproductive structures, disseminules or diaspores (e.g. spores, seed, fruit, vegetative parts) chiefly through the agencies of gravity, wind, water, animal).

DISSEPIMENT: a partition or cross-wall (septum). Of an ovary, a septum formed by an infolding of adjacent carpel walls; of a fruit, a septum formed by an ingrowth of a suture.

DISSIMILATION; the oxidation of compounds synthesised by assimilation (or anabolism) through respiration and fermentation (i.e. catabolism).

dissit(us): as in **dissitiflora**, to scatter (hence flowers not in compact inflorescences).

DISSOCIATION: of electrolytes, their conversion to ions. See ionisation.

DISTAL: farthest away from the point of reference.

DISTICHOUS: arranged in two ranks, as leaves on opposite sides of a stem and in the same vertical plant.

DISTILLATION: of a liquid, the conversion of its physical state to a vapour and its reconversion (as a distillate) by condensation. See also sublimate.

DISTINCT: of similar parts not joined to one another.

DISTYLY: heterostyly (q.v.) when flowers of a species are of two forms, long and short styled. See Pin and Thrum.

diuris: (from **dis-**, separating, and **-oura**, a tail) hence referring to the tail-like lobes of the labellum.

DIURNAL: relative to the alternation of daylight and darkness. Of flowers when opening only during the daylight.

DIVARICATE: forked, widely divergent.

DIVERGENT: spreading apart.

divers(us) L.: as in **diversifolia**, variable, more than one kind.

dives L.: in plentiful number.

DIVISION: as a category, the highest level of the plant kingdom. As a taxonomic group, one uniting classes. In nomenclature, no fixed rule apply to the division although the International Code recommends that the name be compounded from characters indicating its pattern, preferably styled from the Greek language, and that the suffix **-phyta** be attached to all groups except the fungi where **-mycota** is preferred. For sub-divisions, the suffices recommended are **-phytina** and (for fungi) **-mycotina**.

In earlier classifications divisional groups were thallophytes, bryophytes, gymnosperms, and angiosperms but these have lost some significance in the light of better-known relationships. Representative of current concepts is the classification of A. Cronquist (Bot. Rev. 26: 4, 1960). Here, two sub-kingdoms are proposed. **Thallophyta** and **Embryophyta**. Division of **Thallophyta** are **Schizophyta** (see bacterium), **Rhodophyta**, **Chlorophyta**, **Euglenophyta**, **Pyrrophyta**, **Chrysophyta**, **Phaeophyta** (see alga), and Fungi. The common ancestor of the thallophytes is believed the bacterium. For the **Embryophyta**, divisions are **Bryophyta** (see Bryophyte), **Psilophyta** (see psilopsid), **Lepidophyta** (see lycopsid), **Calamophyta** (see sphenopsid), **Filicophyta** (see fern), **Coniferophyta** (see gymnosperm), **Cycadophyta** (see cycad), **Anthophyta** (see angiosperm). This major group is believed ultimately derived from the thallophytes through the green algae. The psilophytes are considered ancestral or close to the ancestral line of vascular plants.

DNA: the nucleic acid (q.v.) deoxyribose.

DOLABRATE: axe of hatchet-shaped. From L. **dolabra**.

dilochos Gk.: long.

DOLIOFORM: barrel-shaped. From L. **dolium**.

DOMINANCE: of inheritance, the condition when a hybrid shows, for some character, a greater resemblance to one parent. The gene for this character occurs as an allelic pair, a **dominant** contributed by the parent resembled, a **recessive** contributed by the other parent.

DOMINANCE: of ecology, the condition when a component (the **dominant**) exerts a leading influence in a particular community or stratum by its frequency and life-form.

dorato(s) Gk.: as in **doratoxylon**, a spear.

DORMANCY: temporary suppression of growth which may be of advantage in surviving ultimately unfavourable conditions. May be of seasonal nature, as the dormant period of buds, or due to the presence or absence of a growth factor, as of seed when influenced by a need for light or darkness, specific temperature, or after-ripening or by possession of a coat impermeable to water. Suppression may be of positional nature, as buds when lateral or adventitious and inhibited by active growth of a terminal or leading bud.

doron Gk.: as in **melliodora**, a gift (hence a gift of honey).

dors(um) L.: as in **dorsal**, **dorsiventral**, the back.

DORSAL: of a surface remote from its axis, as the undersurface of a leaf. cf. ventral.

DORSIFIXED: of an anther when its filament is attached on the dorsal surface.

DORSIVENTRAL: with dorsal and central sides structurally different.

dory(s) Gk.: as in **dorysanthes**, a spear.

draco(n) Gk.: as in **dracocephalus**, a dragon, dracain(a), as in **dracaena**, a female dragon.

DREPANIUM: see under cyme.

drepan(os) Gk.: as in **drepanophylla**, sickle-shaped, falcate, drepanoid.

drimy(s) Gk.: as in **drimys**, acrid, pungent.

dromo(s) Gk.: as in **acrodromous**, **catadromous**, a course.

dros(os) Gk.: as in **drosanthemum**, **drosera**, dew.

DRUPE: a succulent fruit composed of an outer fleshy layer and an inner stony or hard layer of pericarp, enclosing (usually) a single seed. See also tryma, stone fruit.

DRY FARMING: the techniques of agriculture applied to conditions of limited water availability, i.e. limited rainfall and no irrigation. Such techniques are designed to conserve for the growing season moisture which has been brought to the ground by rainfall.

DRY FRUIT: see achenial fruit, capsule, schizocarp.

drym(ys) Gk.: as in **drymaria**, a forest.

DRY ROT: the decay of dry timber by the fungus **Merulius lacrymans** (a basidiomycete), moisture necessary for its growth being brought from a ground-source through water-conducting hyphae, in addition to that produced by its respiration.

DRY WEIGHT: of plant material, the weight after treatment designed to remove the content of moisture, e.g. by drying at a specific temperature for a specific period of time.

dubi(us) L.: of uncertain affinity.

DUCTILE: of a substance which may be drawn or spun out.

dulcis L.: sweet; pleasant.

DUMOSE: of bushy habit. From L. **dumosus**, bushy.

DUNE: a ridge of wind-drifted sand, characteristic in shape, capable of movement as such. Usually a feature of flat, open land especially of the beach or desert.

DUPLEX: two-fold; double.

DUPLICATE: doubled; in pairs; duplex.

DURAMEN: the heartwood (q.v.) of a tree.

DYNAMIC: relative to motion. cf. static.

dys- Gk. as in **dystrophic**, mic-; contrary to (hence nutritionally below optimum).

e-: as in **ebracteate**, **enucleate**, **estrophiolate**, without; not having.

e.g. **exempli gratia**: for example.

ec- Gk.: as in **ecdemic**, out; out of (hence not native).

ECAD: see ecotype.

ECHINATE: of a surface when marked by long and sharp, spine-like projections. From Gk. **echinos**, a sea-urchin; a hedgehog. **Echinulate**: the diminutive condition.

eco-: as in **ecodeme**, **ecology**, a habitat. From Gk. **oikos**, a home.

ECODEME: see under deme.

ECOLOGY: the science concerning the relationship between organisms and environment, **autecology** when the relationship of the individual alone is considered, **synecology** when the relationship concerns communities and their structure, development and causes of distribution. See also phytogeography.

ECONOMIC BOTANY: the science concerning plants both useful and harmful to man (or potentially so) from aspects of the chemistry, botany, utilization, commerce, origin and distribution.

ECOPHENE: see ecotype.

ECOSPECIES: a group of ecotypes which, although interfertile, either do not cross with other ecospecies or produce progeny with reduced vigour. Approximates the taxonomic species.

ECOSYSTEM: a biotic system maintained by the balance of organic life with its environment.

ECOTONE: a transition zone, or marginal area, between two plant communities.

ECOTYPE: a group of plants essentially of the same genetic constitution with members (ecads) differing in appearance and reproductive vigour due to the influences of their varying environments.

ecto- Gk.: as in **ectotropic**, outside, external (hence curving outwardly).

ECTOPHYTIC: living on the surface of a plant.

ECTOTROPHIC: in general, feeding from an external source. See also mycorrhiza.

EDAPHIC: relative to the influence of soil or substratum, e.g. on plant growth.

EDAPHON: the flora and fauna of a soil.

edule, edulis L.: edible.

ef- (before f) L.: as in **effluent**, ex-, away from.

EFFLORESCENCE: of a hydrated salt, the loss of water (of crystalization) to the atmosphere when its vapour pressure is greater than that of water vapour contained by the atmosphere.

EGG, EGG CELL: the female gamete, haploid fusing (as a nucleus) with a male gamete to form a diploid zygote.

elach(os) Gk.: as in **elachanthus**, small.

elaio(n) Gk.: as in **elaioplast**, oil.

ELAIOPLAST: a leucoplast (q.v.) secreting an oil.

elaeodes: epithet, olive-like.

ELASTIC: reversible extensible, i.e. capable of being stretched but returning to the original state. cf. plastic.

elator L.: comparative of **elatus**: of tall stature.

ELECTROLUMINESCENCE: the emission of light from electrical energy discharged through excitation of electrons within a molecular structure. 'cold' light.

ELECTROLYSIS: the dissociation of an electrolyte by the passage of an electric current between two electrodes, a positively-charged **anode** and a negatively-charged **cathode**, the anions (-ve) of the electrolyte being liberated at the anode, the cations (+ ve) at the cathode. At the electrodes, these ions reform as atoms which may be deposited as solids or liberated as gases. Electrophoresis.

ELECTROLYTE: a substance (e.g. a salt, acid or base) which in solution acts as a conductor of an electric current through its dissociation to ions.

ELECTRON: the negatively-charged, almost mass-less particle of an atom, forming through orbital movement, an outer shell to its nucleus where the proton carries an equal but opposite charge and the neutron no charge.

ELECTROSTATIC: relative to the interactions of electric charges.

ELEMENT: the simplest (or fundamental) unit of a compound substance or structure able to combine with but not be further reduced to, or by, other substances or structures except by means of a different order or in a different context, e.g. for a chemical element, by means other than by chemical reaction.

eleuthero(s) Gk.: as in **eleutherosyachys**, separated, not united.

ELLIPTICAL: of a flat surface in the shape of an ellipse, i.e. a section of a geometric cone when cut by a plane oblique to the axis. Of a leaf-blade, usually corresponding to one tapered equally at both ends, broadest in the middle, and from 2 to 3 times as long as broad.

ELLIPSOID: of a solid (3-dimensional) object elliptical in each rotation plane.

ELUVIAL: of soils, relative to the horizon where there is accumulation of organic matter but where leaching is prominent. Often used to denote the A horizon.

ELUVIATION: the leaching of soil solutes.

elytro(n) Gk.: as in **elytrophorus**, a sheath.

EMARGINATE: of an apex when sharply, or shallow and broadly, notched.

EMASCULATION: of a bisexual flower, the removal (e.g. by hand) of stamens in order to prevent self-fertilization.

EMBRYO: the phase of organic development arising normally from a zygote while still within the parent and complete (from embryo plants other than bryophytes) when the development of a root-shoot system leads to ultimate independence as the young (sporophytic) plant. Within a mature seed, the embryo is composed typically of an axis with one or more lateral cotyledons, a terminal bud (plumule of angiosperms) and a root-tip or radicle. See also epicotyl, hypocotyl, suspensor, pro-embryo, and under Division for the 'embryo plants' (**Embryophyta**). From Gk. **embryon**.

EMBRYOGENY: the growth and development of an embryo.

EMBRYOLOGY: the study of sexuality, fertilization processes, the development of embryo and their significance to taxonomy.

EMBRYO SAC: the female gametophyte of angiosperms, a tissue containing an egg development from a megaspore and into which nuclei from the pollen-tube are discharged at a fertilization.

EMERGENCE: of anatomy, an outgrowth formed from a cortex or epidermis, e.g. a prickle.

EMERSED: rising from the surface, Emergent.

EMULSIFYING AGENT: a stabilizing agent for an emulsion with the property of decreasing the surface tension at the interface of the oil and water phases, e.g. a detergent (q.v.) sodium alginate (see under alga), certain gums.

EMULSION: a two or more phased system of liquids, e.g. oil in water, or water in oil.

en- Gk.: as in **encapsuled**, in, on, into or against (hence invested by a gelatinous envelope or capsule).

enchyl- as in **enchylaena**, succulent. From Gk. **en**; **chylos**, juice.

ENDEMIC: confined in natural distribution to a localised geographic region, applied strictly when maximum distribution has not been attained. cf. relic.

ENDERGONIC: of a process when requiring free (utilizable) energy for its progress, as all processes of biosynthesis. cf. exergonic.

endo(n) Gk.: as in **endophytic**, inside, within (hence living within a plant).

ENDOBIOTIC: living within the tissues or cells of another organism.

ENDOCARP: the innermost layer of pericarp.

ENDODERMIS: a uniseriate layer of cells separating the stele and cortex of primary growth, the cells with thin walls incorporating in parts a wax-like substance impervious to water (see Casparian strip) or, especially of monocots, with walls secondarily thickened by suberin or (later) cellulose in addition, the passage of water in this case being controlled largely by isolated thin-walled cells (passage cells) unthickened except for the Casparian strip.

ENDOGAMY: inbreeding. Cross-fertilization by individuals very closely related, the effect being an increase in homozygosity. cf. exogamy.

ENDOGENOUS: originating from a source well below the superficial later of a structure. cf. exogenous.

ENDOLITHIC: within rock. Of organisms when able to penetrate and live within the cracks and fissures of rocks, e.g. certain algae, bacteria).

ENDOPLASMIC RETICULUM: an extension of the double-layered membrane of a nucleus throughout cytoplasm either as folded sheets of membranes or as narrow tubes, and within which ribosomes (q.v.) are localised.

ENDOREIC: with internal flow. Applied to drainage basins with no connection to the sea.

ENDOSMOSIS: of a cell, the intake of water from an external region of lower concentration, with the wall acting as an osmotic membrane.

ENDOSPERM: a layer of cells formed initially within an embryo sac by fusion of the second male nucleus with the two polar nuclei at fertilization. A storage region, chiefly of starches and oils, providing nutrient for the developing embryo. See also aleurone, ruminant.

ENDOSPORE: of a bacterium, a highly resistant resting body formed in single number within the cell and with a capacity for dormancy usually for many years.

ENDOTHERMIC: of a process or reaction occurring with (and dependent on) the intake of heat from the surround. cf. exothermic.

ENDOTROPIC: deriving nutrient from within, e.g. of a mycorrhizal fungus.

ENDOZOIC: living with an animal.

ENDOOCHORY: the dispersal of seed or spores through ingestion by animals and eventual freeing.

ENERGY: a concept of a fundamental property inseparable from matter (directly proportional to its mass) except under such conditions as radioactivity and atomic fission, known from its manifestation, 'the capacity to do work'. Its unit is the **quantum**, the most familiar being the **photon** of light energy, although some prominence now is given by the physicists to quanta of the atomic nucleus, lepton pairs and mesons. From Gk. **energōs**, working.

Energy is conceived as the motivating force of all changes of physical and chemical states, all movement, all changes in equilibrium, and is transformable from one form to another, its total throughout the universe remaining at the constant. Familiar examples of its forms are kinetic,

potential, mechanical, electrical, electromagnetic, radioactive, atomic, thermal, radiant, chemical, etc. Within the atom or molecule, forms of energy are electronic (given by the orbital movement of the electron), vibrational, rotational, the transference of energy here believed to occur only in multiples of quanta. For and mass, energy is considered as of two components, one (free energy) available for conversion to some other form, and unavailable or bound energy measured as **entropy**. Heat as an accompaniment of all energy-conversions represents a dissipation of free energy and an increase in entropy.

The capacity to conserve free energy from chemical reaction and to re-utilize it is a criterion of the living organism. In living processes, the biosynthesis of organic compounds with high potential chemical energy from inorganic substances of low energy is fundamental to growth and development. The physical environment provides the raw materials, sunlight the energy source. Through photosynthesis, radiant energy is converted to chemical energy and through respiration this energy is released to be held and controlled by the organic phosphates. The flow of energy has a single pathway to virtually all forms of life.

-ennial: as in **biennial**, yearly (hence of two years duration). From L. **annus**.

ENSATE, ENSIFORM: sword-like, i.e. of a structure when linear, rigid, and pointed. From L. **ensis**, a sword.

-ensis: as in **australiensis**, belonging to; originating from.

enter(on) Gk.: as in **enteric**, an intestine.

ENTIRE: of a margin free from irregularity.

ento(s) Gk.: as in **entozoic**, within (hence living within an animal).

entomo(n) Gk.: as in **entomogenous**, an insect (hence originating from, or living in or on, insects).

ENTOMOPHILOUS: pollinating through the agency of insects, chiefly beetles (pollination then termed **cantharophily**), honeybees (**mellitophily**), carrion and dung flies (**saprophily**), hawkmoths (**sphingophily**).

ENVIRONMENT: of an organism, the collective conditions influencing its growth and development both internal (the relationships of its co-ordinated parts) and external (e.g. Atmospheric temperature, light, humidity, precipitation, composition, wind-movement; soil (or substrate) temperature, moisture, nutrient status, reaction, pH, aeration, physical properties).

ENZYME: a protein (simple or combined) acting, through catalysis, as a precursor of metabolic reactions, i.e. an organic biocatalyst. Frequently linked with an activating agent essential for its functioning, either a **prosthetic group** which may include a heavy metal (e.g. iron, magnesium, manganese, zinc) or a vitamin (e.g. thiamine, riboflavin), or the activating agent may be a co-enzyme (q.v.). The complete enzyme is the **holo-enzyme** when compound, the protein part is the **apo-enzyme**. Although of high molecular weight, the molecule of an enzyme is small enough to form in water a non-turbid electrolytic solution. As a rule, it has a specificity for a particular group of compounds or a single compound or its part, and can be denatured by heat, irradiation, ultra-violet light, etc. In general it requires for its most efficient functioning a specific temperature and pH range.

The group name of the enzyme usually is compounded from the type of reaction it catalyses (the substance of the reaction being the **substrate**) suffixed by **-ase**. Some 650 or more enzymes already have been isolated from plants of which the few following are representative.

I. Assimilation.

Carbohydrases (substrate a carbohydrate), e.g. **fructosidases** (invertase) sucrose to glucose; **amylases**, starch to maltose and fructose; **cellulase**, cellulose to cellobiose; **nucleosidases**, nucleotides to pyrimidine or purine base and ribose.

Proteases (peptides and proteins to amino acids and peptides respectively, or (**transaminases**) transamination of amino acids, e.g. **pepsin**, protein to polypeptide; **papain** (protein and polypeptides to amino acids (the animal-derived rennet and trypsin have similar effect).

Esterases (substrate an ester, catalysing, e.g. to acid and alcohol) **lipases** fats to fatty acid and glycerol; **phosphorylases**, hexose sugars and inorganic phosphates to esters of sugar phosphates.

Amidases (substrate an amido-compound), e.g. **urease**, urea to ammonia and carbon dioxide.

II Dissimilation.

Dehydrogenases, oxidation by removal of hydrogen; **carboxylases**, e.g. pyruvic acid to acetaldehyde and carbon dioxide. See also co-enzyme, cytochrome.

Enzymes extracted from higher plants of economic value include the proteolytic **papain** from papaya fruit (of **Carica papaya**) used in control processes of various industries (treatment of hides, tenderising of meat, etc.) and clinically usually obtained from the germinated seed of barley used in the brewing and distilling industries. Various amylases, proteases, cellulases, pectinases are derived by the fermentation industries from fungi (e.g. the molds and yeasts) and bacteria (e.g. the lactic **streptococci** and have a wide range of applications to industrial and clinical fields. From Gk. **en**, in; **zyme**, a ferment.

EPACRID: a member of the family **Epacridaceae**, characteristically a hard-textured shrub of heath communities with ericoid, parallel-veined leaves. While temperate Australia is a focal centre for the family, its 23 genera of 350 species in addition are dispersed in New Zealand, islands of the Pacific, and the Andean region. Included (in the Australia flora) are **Astroloma**, **Andersonia**, **Brachyloma**, **Epacris**, **Leucopogon**, **Styphelia**, **Woollsia**, etc. The name is derived from Gk. **epi**, upon; **acros**, the top, hence found on hilltops.

EPEIROGENETIC: relative to the major geological changes in the earth's crust (diastrophism) which result in the formation of continents through vertical movement.

EPHARMONIC: relative to morphological adaptation (or modification in form) to a specific ecological condition. **Epharmosis**: the process of acquiring such adaptation. See also convergence.

ephemer(os) Gk.: as in **ephemeral**, short-lived.

epi- Gk.: as in **epibiotic**, upon; over (hence living on the surface of another organism). **ep-** is used before a vowel or h.

EPICALYX: an involucre, usually formed by a whorl of bracts, at the base of a calyx, and seemingly forming a second calyx. A feature of certain members of **Rosaceae**, **Malvaceae**, and **Sterculiaceae**.

EPICARP: the outer layer of a pericarp. Also exocarp.

EPICOTYL: of an embryo, the part above the cotyledon/s which is the ultimate stem. In monocots and conifers, often limited before germination to a minute meristematic apical region. In dicots, the part within the terminal bud or plumule.

EPIDEMIC: of disease when of temporary general and intense severity. Also used as the noun.

EPIDEMIOLOGY: a phase of pathology concerning the factors leading to the causes and spread of infectious diseases.

EPIDERMIS: the outermost tissue of primary growth, commonly uniseriate the cells with a large central vacuole and cytoplasm restricted to a peripheral lining of the wall which is thickened and cutinised. Forms a continuous covering (except for stomates and lenticels when present) to the primary plant body and its parts (flowers, fruit, seed) and is extended from a root to root-hairs. Its function primarily

concerns control of water and gas exchange with the atmosphere, and protection from mechanical abrasion.

EPIGEAL: of germination when the cotyledons carry the seed-coat above the surface of the soil; characteristic of dicots and conifers. cf. hypogeal.

EPIGENOUS: developing on a surface; originating from a superficial tissue.

EPIGYNOUS: of floral parts (viz. stamens) when arising from the rim of a floral tube, the tube adnate with an ovary **inferior** by virtue of its position below other floral parts.

EPIGYNY: the epigynous condition, e.g. of **Myrtaceae** and **Umbelliferae** where both corolla and stamens are epigynous: of **Caprifoliaceae** and **Rubiaceae** where the corolla is epigynous and the stamens epipetalous (although by position necessarily epigynous).

EPI LITHIC: living on the surface of a rock, as a lichen or moss.

EPINASTIC: of a leaf when dorsi-ventral, relative to the more rapid growth of the upper surface which causes a downward curvature.

EPIPETALOUS: borne on, or arising from, petals, as the stamens of many epacrids. **Epipetaly:** the fusion of stamens with petals.

EPIPHYLL: a plant epiphytic on a leaf, e.g. an alga, lichen or moss.

EPIPHYLLOUS: in the nature of or relative to an epiphyll.

EPIPHYTE: a plant nutritionally independent but completely dependent on another plant for mechanical support (e.g. an epiphyll) or of higher plants (e.g. ferns, bromeliads, orchids) where no soil connection is made (cf. liana). Of higher plants, the development of means to conserve water is usual, e.g. the humus-collecting brown paper-like sterile fronds of the Elk or Stag Horns, the 'cistern' formed by the water-absorbing leaves of the bromeliads, the pseudo-bulbs of orchids or, in general, the cutinisation of the epidermis. It is probable that the host contributes some nutrient from decay of its superficial tissues where contact is made. The habit (**epiphytism**) may be obligate, or of periodic nature (then **hemi-epiphytism**), e.g. certain figs (**Ficus** spp.) of the rainforest begin as epiphytes but in time develop a liana-like root-system which eventually reaches the ground to become fully absorptive, a phase usually lethal to its host, virtually 'strangled' to death by this root-system.

EPIPHYTIC: in the nature of, or relative to, an epiphyte.

EPITHET: of nomenclature, the qualifying name (trivial) given to a generic name to form the name of a species, or to the name of a species to form the name of a sub-species or variety, so forming a binomial or trinomial.

The epithet may be an adjective (e.g. **albus**) which must agree in gender with the generic name, an adjective in the form of the present participle of a verb (e.g. **accedens**, **praecox**), a noun in the possessive (**benthamii**), or a noun in apposition (i.e. explaining further), e.g. **saxicola**, **fruticetorum**, **golbulus** where here in the gender is not necessarily in agreement with the generic name.

While as a general rule the specific epithet agrees in gender with the generic name, there are exceptions, e.g. the ending of **Eucalyptus** is masculine but since it is customary to treat the names of trees as feminine, the epithets when adjectives are feminine, e.g. **E. crebra**, **E. alba**, **E. mariniata**, etc. Conforming to the general rule are (masculine): **Juncus maritimus**, **Eriochilus scaber**, **Eriostemon trachyphyllus**; (feminine) **Acacia alata**, **Gunniopsis quadrifida**, **Monotaxis grandiflora**; (neuter) **Hypocalymma cordifolium**, **Brachysema aphyllum**, **Polycarpon tetraphyllum**.

When the epithet is a personal name and used as an adjective, the endings **-ianus**, **-iana**, **-ianum**, in agreement with the gender of the generic name, may be used (e.g. **dielsianus**, **muelleriana**,

andrewsianum) of when the name ends in a vowel the **i** is omitted (e.g. **mickiena**). Used as a substantive, **ii** is the suffix when the name ends in a consonant (e.g. **banksii**, **maidenii**), **i** when ending in a vowel, y, or -er (e.g. **moorei**, **blackelyi**, **muelleri**) except when the vowel is an a when **-e** is the suffix (e.g. **campderae**). The name when feminine and substantive takes a feminine suffix (e.g. **tindale**, **beatricis**).

EPIZOIC: living on the surface of an animal either non-parasitically (e.g. as an alga on a hydroid) or parasitically (e.g. as a dermatophyte).

EPIZOOCHORY: the dispersal of seed or spore through its carriage on the surface of an animal.

equi-: as in **equilateral**, equal (hence equal-sided). From L. **aequo**.

equin(us) L.: of a horse.

EQUITANT: of parts (e.g. leaves) in series when folded sharply along their central lines (e.g. mid-ribs) in the fashion of a saddle and each enclosing the succeeding part (or part opposite in addition) or the axis.

EREMAEN: relative to the arid zone of the continent.

EREMAEN ZONE: of Australia, a region extending roughly from the western coast at latitudes 22-26°S. to longitude 145°E. where it merges with the temperate inland. In the north limited by the tropical coast and inland, and in south meeting the coast between longitudes 125-135°E.

eremo(s) Gk.: as in **eremophila**, desert, wasteland.

erg(on) Gk.: as in **erg**, **energy**, work.

ERGOT: a general name given to a certain pathogenic fungi of **Ascomycetes** which invade the florets of grasses and form within, at the disruption of the ovary, a dark-coloured **sclerotium**, e.g. **Calviceps paspali** specifically attacking paspalums. The sclerotium (also called an ergot), or over-wintering stage of the fungus, eventually falls to the ground to remain until late spring or early summer when it germinates. Germination involves the formation of several pin-like structures (**stromata**) within the head of which are a number of cavities, each cavity containing an **ascogonium** and an **antheridium**. With break-down of the intervening walls, fusion of female and male nuclei developed within these structure ensues, and this is followed by development of a fruiting-body, **perithecium**, with certain cells (**asci**) forming **ascospores**. The ascospores may be carried by wind or other means to young florets whose infection promotes a flow of a sugary liquid ('honey-dew') giving the characteristic stickiness to the inflorescence of the grass. The 'honeydew' contains innumerable summer spores (**conidia**) which may be dispersed by physical contact; its ingestion by cattle leads to a paralyzing disease.

Ergot of pharmacology, derived initially from sclerotia formed in rye infected by **Claviceps purpurea**, contained a number of peptide-like alkaloids chiefly of the groups ergotamine and ergotoxin and derivatives of lysergic acid - these have clinical uses, especially in gynaecology.

erici-: as in **ericifolia**, of the heath **Erica** (**Ericaceae**).

ERICOID: stiff, slender and (often) sharp-pointed. From a likeness to the heath plants of **Erica** (or their Australian counterparts, the epacrids of a closely related family) where often needle-like and xenomorphic by the development of a strongly cuticularised upper epidermis.

erin(os) Gk.: as in **erinaceous**, a hedgehog (hence prickly).

erio(n) Gk.: as in **eristemon**, wool.

ermine(us) L.: white.

erodi(os) Gk.: as in **erodium**, a heron.

EROSION: in general, the wearing-away by physical abrasion, e.g. the breaking down of rock to soil by the abrasive forces of wind and water. Of soil, its continuous removal by one or more of the eroding forces **wind:** removal of surface soil when vegetation is insufficient to obstruct wind flow (applies particularly to open lands with sandy soils). **Water:** gradual and uniform removal of surface soil by run-off (sheet erosion), or the forming of channels and ultimately gullies by the combined effect of heavy rain and run-off in the uneven removal of surface soil (gully erosion). **Gravity:** movement of soil under its influence (**soil creep**), **Anthropogenic:** acceleration of normal (natural) erosion by over-cultivation or over-grazing, removal or destruction of the original vegetative cover without replacement, so promoting the erosive action of wind and water and destruction of the physical and biotic properties of the soil.

erubesc(o) L.: to approach in colour a rich red rose.

ereunt(us) L.: of blood-red colour.

erumpo L.: as in **erumpent**, to burst forth.

erythr(os) Gk.: as in **erythrocorys**, deep red.

ESCARPMENT: an abrupt, cliff-like slope terminating an elevated land of low relief, e.g. the Darling Escarpment which marks an edge of the Great Plateau as it falls to the coastal plain. In a general sense, also scarp.

-escen(s) L.: as in **erubescens**, **erubescens**, approaching the nature or property of. The suffix **-escence** forms the noun, e.g. erubescence.

esculent(us) L.: favourable for human consumption; esculent.

ESSENTIAL ELEMENT: of plants, one of the chemical elements required as a raw material and biocatalyst for biosynthesis. For terrestrial higher plants carbon, hydrogen, oxygen (derived either from the atmosphere as carbon dioxide and water or from the soil as a carbonate and water), nitrogen (from the soil through nitrification), potassium, calcium, magnesium, iron, phosphorous, sulphur (from the soil as rock-derived mineral and their salts) - these are the macro-elements. In addition although not required for all plant growth but known to be essential for some plants, the minor or oligo-elements (so-called because their requirement is in relatively low concentration) copper, zinc, manganese, molybdenum, boron, chlorine, sodium, cobalt, vanadium.

ESSENTIAL OIL: a volatile (ethereal), aromatic, usually liquid secretion of certain plants stored in various regions, sometimes emulsified within vacuoles or cytoplasm but more generally within cavities (oil glands) formed by the break-down or separation of cells, occasionally in semi-solid form in combination with resins as an oleo-resin. Such oil-bearing plants occur throughout the kingdom, often with a particular concentration in certain families (e.g. of angiosperms, **Compositae**, **Labiatae**, **Lauraceae**, **Myrtaceae**, **Rutaceae**, **Cruciferae**, etc.). The significance of the oil to the plant is unknown but evidence suggests it may form a reserve pool from which certain components may be withdrawn as required, e.g. by freeing through catalytic reactions. Other suggestions include that it is a by-product without further concern to metabolism, that it has allelopathic or bacteriostatic qualities of advantage to survival or the plant storing it, that it may help to regulate water-loss by modification of the immediate atmosphere external to the plant through its vapour pressure. Very little is known of its nature **in vivo**, however.

Chemically, the essential oil is a complex mixture with principal constituents referable chiefly to the terpenic group but its manner of synthesis is not known. The oil may be of different nature, e.g. the cyanogenic alkyl isothiocyanate occurring with glycosides of mustard oils (e.g. of the seeds of **Brassica nigra**, source of the mustard of commerce), of a sulphur derivative such as methyl sulphide of the oil of onion and alkyl sulphide of oil of garlic. When of the terpenic group may be a hydrocarbon (e.g. the terpenes cymene, limonene, phellandrene, pinene) or an oxidation product of a hydrocarbon, e.g. an alcohol (citronellol, eudesmol, geraniol, menthol, nerolidol, terpineol) or an ester of the alcohol with an aliphatic or aromatic (e.g. geranyl acetate), an aldehyde (e.g. citronellal, citral) a ketone (e.g. thujone), a phenol (e.g. thymol, eugenol), or an ether (e.g. cineole).

The commerce of essential oils had its origin in the Orient (chiefly Egypt, Persia, India), was probably introduced to Europe, in the 14th century, and by 1600 methods of extraction had been developed for, e.g. oils of turpentine, juniper, rosemary, spike lavender, sandalwood. While the principal method of extraction is by distillation with steam, other methods are extraction by solvent, e.g. lard or tallow (the **enfleurage** of the previous flower oil industry) and extraction with alcohol to form a **concrete**, or a volatile organic solvent (e.g. petroleum ether), or expression by pressure methods. Steam has the advantage that it is selective for the oil but the disadvantages that nothing is known of the possible changes during the destructive process and that a high-boiling fractions may not 'cover-over'. Much of the demand has come from the perfumer (the term 'essential' having come from the use of the oil as an essential of compounded perfumes) and the manufacturer of soaps, disinfectants and detergents; some oils are in demand as flavouring agents or as various pharmaceutical preparations.

While the Australian flora is rich in oil-bearing species (e.g. of **Eucalyptus**, **Melaleuca**, **Leptospermum**, **Backhousia**, **Baeckea**, **Boronia**, **Eriostemon**, **Santalum**, **Eremophila**, etc.) very few of their oils have reached or maintained commercial interest. These few oils, the principal uses and sources including the following steam-distilled from foliage with the exception of sandalwood (distilled from the heartwood).

- (i) as constituents of disinfectant, deodorants, detergents, or solvents (industrial oils).
Piperitone (also used in synthesis of thymol and menthol) and phelandrene: chemical forms of **Eucalyptus radiata** and **E. dives** (respectively the Narrow-leaved and Broad-leaved Peppermints).
- (ii) as blending or fortifying agents of perfumes, or perfumed soaps and other pharmaceuticals (perfumery oils).
citral: **Eucalyptus staigeriana** (the Lemon-scented Ironbark of tropical Queensland), **Leptospermum petersonii** (Lemon-scented Tea Tree, L. '**citratum**'), **Leptospermum liversidgei**. Production of these is now very limited.
citronellal: **Eucalyptus citriodora** (Lemon-scented Gum), Lemon-scented Tea Tree.
cymene, pinene, terpinene: **Melaleuca alternifolia** (Narrow-leaved Paperbark).
geranyl acetate: **Eucalyptus macarthuri** (Paddy River Box).
linalool, nerolidol: chemical forms of **Melaleuca quinquenervia** (Broad-leaved Paperbark).
terpenic alcohols: **Santalum spicatum** (Australian Sandalwood).
- (iii) as antiseptics, medicinal soaps, inhalants, embrocations (medicinal oils).
cineole (British Pharmacopoeia requirement a minimum of 70 percent: chemical forms of **Eucalyptus radiata** and **E. dives**, **E. fruticetorum** (Blue Mallee).
Prescribed cineole content maximum 20 percent.
pinene, terpinene, cymene: **Melaleuca alternifolia** (source of Tea Tree Oil).
methyl eugenol: **Melaleuca bracteata** (Black Tea Tree).

Closely related species may vary widely in the constitution of their oils and quantitative differences are common among members of the same species. It is usual for progeny to retain the chemical identity of their parents (hence oil composition has a genetic basis). Research in Australia has concentrated on the selection and establishment of 'elite' trees of known (and desired) characteristics but progress in establishing plantations has been extremely slow. More desirable than present methods is the scientifically based cropping of lavender at Lilydale, Tasmania which has been developed by expert management to a soundly successful industry. Additional to the problem of competition with oils produced overseas on a more economic basis (the sources including plantations from seed imported of Australian native oil-bearers), the substitution of natural production by chemo-synthesis further reduces the prospects of the industry at the present level.

ESTERIFICATION: in simplest sense, the reaction of an acid with an alcohol or solid of low melting point, usually water-insoluble but alcohol-soluble, frequently possessing a distinctive odour and flavour, e.g. acetic acid and ethyl alcohol, under appropriate conditions, yield ethyl acetate and water.

ESTROPHIOLATE: of a seed when without a strophiole (q.v.).

ESTUARINE: relative to the mouth of a tidal river where it widens out to meet the tide, i.e. of an estuary. Applied also to communities of, or near, an estuary.

ETHER: a water-insoluble, alcohol-soluble, usually aromatic liquid of the form R-O-R' where R and R' are identical or different radicals either alkyl when derived by loss of a hydrogen atom from an aliphatic hydrocarbon (see under ethyl) or aryl when derived by loss of a hydrogen atom from a hydrocarbon of the benzene series.

ETHNOBOTANY: a phase of botany concerned with the history of utilization of plants by primitive man for his food, clothing, building, medicine, and religious rites. From Gk. **ethnos**, a nation.

ETHYL: a radical of the group CH₃-CH₂ (or C₂H₃-), e.g. of ethanol or ethyl alcohol C₂H₅OH. The reaction of ethanol under appropriate conditions with sulphuric acid leads to the formation of diethyl ether (C₂H₅OH + HOC₂H₅ = C₂H₅.O.C₂H₅ + H₂O).

ETIOLATION: an abnormal condition of green plants due to a severe reduction in chlorophyll leading to maximum growth with minimum differentiation. Evidenced by marked elongation of the shoot which appears white (blanched) or yellow from the unmasking of carotenoids within the chloroplasts. Protochlorophyll, a chemically-related precursor of chlorophyll, is formed in small amounts and may be converted to chlorophyll when optimum growth conditions (e.g. optimum light) are restored.

ETIOLOGY: the phase of pathology concerning the causes of disease.

-etum, -etorum L.: as in **arboretum**, **pinetum**, **populetum**, **fruticetorum**, a habitat or place of growth, a community.

eu- Gk.: as in **eucalyptus**, well, full, true (hence of the operculum 'well' covering the unopened flower).

EUCARPIC: of a fungus when its reproductive structure arises from part of the vegetative thallus.

EUCARYOTIC: of a cell when possessing a definite nucleus, a feature marking the eucaryote which, of plants, is sharply divided from the procaryote, a bacterium or blue-green alga.

EUPHYLLOUS: of a leaf when fully functioning as such.

EUPLOIDY: of polyploidy (q.v.) when the chromosome number is an exact multiple of that basic to the species. cf. aneuploidy.

eury(s) Gk.: as in **euryops**, broad, wide.

EURYTOPIC: widely distributed geographically.

EUSTATIC: relative to movements of sea-level due either to changes in the volumes of the oceans or to changes in the capacity of their basins, the rise or fall being experienced uniformly over the world.

EVANESCENT: of very brief duration. Ephemeral.

EVAPOTRANSPIRATION: the loss to the atmosphere of moisture from both the soil (evaporation) and its vegetative cover (transpiration).

EVERGREEN: of foliage when replenished for a short period each year and then held for a year or more, or replenished at periods throughout the year. cf. deciduous.

EVERTED: of a structure when turned inside out.

ecolco L.: as in **ecolculus**, to roll out; to spread; to open.

EVOLUTE: unfolded; turned back.

EVOLUTION: see organic evolution.

ex- L., Gk.: free from; away from; out.

exalat(us) L.: of very tall stature.

EXARATE: furrowed or grooved.

excedens L.: reaching above.

excels(us) L.: tall; lofty.

excelsior L.: the comparative of **excelsus**.

EXCENTRIC: positioned to one side of a central point. Eccentric.

exceco Gk.: as in **exoecaria**, to blind (hence a reference to a reputed feature of the sap).

EXCURRENT: extending beyond, or projecting, as a mid-rib when extended beyond the apex of a mucronate leaf. Of a stem or trunk, extending to the summit, i.e. beyond its lateral branches as shown by the Bunya and Norfolk Island Pines. cf. deliquescent.

EXERGONIC: of a process of reaction progressing with the liberation of free energy, as in respiration and fermentation. cf. endergonic.

exigu(us) L.: small and narrow; exiguous.

eximi(us) L.: of optimum size or beauty.

exo- Gk.: as in **exocarp**, outer; outside (hence the outer layers of pericarp).

EXOAMY: outbreeding, i.e. cross-fertilization by individuals related but of different lineage, the effect being an increase in heterozygosity. cf. endogamy.

EXOGENOUS: originating from a source superficial to the parent body.

EXOREIC: with external flow. Relative to drainage basins which carry drainage to the sea.

EXOSMOSIS: of a cell, the withdrawal of water to an external region of higher concentration, with the wall acting as the osmotic membrane. See also plasmolysis. cf. endosmosis.

EXOTHERMIC: of a process or reaction when proceeding with the freeing of heat. Of a compound when formed with the evolution of heat. cf. endothermic.

EXOTIC: not native, usually implying an unacclimatised introduction by human agency.

EXPLANT: a tissue culture, i.e. a group of cells growing independently of the parent from where taken.

EXPOSURE: of ecology, the degree of exposure to weather, especially to drying winds and direct sunlight.

EXsertED: projected beyond, as stamens or style when longer than the tube of the corolla, or of a capsule (e.g. of a eucalypt) when the valves project above the rim of the receptacle.

EXsICCATE: free from moisture. **Exsiccatum**: a dried herbarium specimen.

EXTINE: (also exine) see pollen-grain.

extra- L.: as in **extra-cellular**, outside, beyond.

EXTRA-AXILLARY: arising above an axil.

EXTRACTIVE: in general, a substance derived by some method of extraction, e.g. by a solvent. In the economic sense, usually indicates an extracted plant product as, e.g. alkaloid, gum, kino, phenol, resin, saponin, tannin, fixed oil, volatile oil.

EXTRAPOLATION: the insertion of a measure outside, but based on a series of parameters. cf. interpolation.

EXTROVERSE: of an anther when dehiscent towards the petals or circumference of the flower.

EXTRINSIC: of a factor when influencing or acting from the outside. cf. intrinsic.

EXUDATE: a substance (e.g. kino, gum, resin, moisture) forced through superficial tissues.

EYE: a bud, especially when used in propagation from a tuber (e.g. of potato) or as a cutting.

F₁: the first filial generation, i.e. progeny from the cross-fertilization of the P₁ or first parental generation.

F₂: the second filial generation, i.e. progeny from the crossing or selfing of the F₁.

-facient L.: as in **tumefacient**, making (hence tumour-producing).

FACTOR: of a process, a condition which influences its progress, **limiting** when deficient to such a degree that the rate of progress will be increased with increase of the factor, **inhibiting** or **retarding** when, by its presence, the rate of progress is depressed or inhibited. Each factor may exert an influence over one or more factors, this **interaction of factors** generally the base in biological processes. Of genetics, a gene.

FACULTATIVE: not obligate, especially as to nutrition or habit, i.e. able to adapt from one mode to another as conditions demand. Of a parasite when able to be saprophytic, or a dwarf not genetically fixed as such and able to respond with increased vigour to favourable growth conditions, or a cell functional under both aerobic and anaerobic conditions.

FAHRENHEIT: of a system of temperature recording where the melting point of pure ice is taken as 32 degrees (32°F) and the boiling point of water as 212°. In conversion to centigrade (q.v.) scale (1°F = 9/5°C) apply formula:

$$^{\circ}\text{C} = \frac{5(^{\circ}\text{F} - 32)}{9}$$

falc(is) L.: as in **falciform**, a sickle.

FALCATE: of a lamina when flat and curved (like a reaper's hook, or sickle).

falco(nem) Gk.: as in **falcorostrum**, a falcon (hence beaked, the beak like a falcon's).

fallax L.: false.

FALLOW: arable land left uncropped either for restoration or with the object of destroying weed growth.

FAMILY: of taxonomy, a category with level below an order but above a genus. As a taxonomic group, one uniting genera assessed as having monophyletic origin (i.e. derived from a common ancestral stock) or from a single genus when no other genera are believed related. The highest taxonomic group to which the rules of priority and typification apply by the International Code, the name is compounded from the name of a genus of the family, suffixed with **-aceae** (e.g. **Myrtaceae**, from **Myrtus**, **Proteaceae** from **Protea** etc.) except for a few sanctioned by long usage for which may be substituted a conventionally-formed name, e.g. **Arecaceae** for **Palmae**, **Poaceae** for **Graminae**, **Lamiaceae** for **Labiatae**, **Apiaceae** for **Umbelliferae**, **Asteraceae** from **Compositae**. Grammatically

a plural adjective used as a noun, the name of a family implies a plural sense, e.g. the **Arecaceae** include over two hundred genera of palms. cf. the family, **Areaceae**, includes . . .

Subordinate units of the family are sub-family (ending in **-oideae**), tribe (**-eae**), sub-tribe (**-inae**), as in **Myrtaceae - Leptospermoideae - Leptospermeae -Eucalyptinae** indicating the family, sub-family, tribe and sub-tribe for **Eucalyptus**.

FAMILY, AUSTRALIAN-CONFINED: of the angiosperms, the following are restricted to the Commonwealth. Monotypic: **Austrobaileyaceae, Akaniaceae, Brunoniaceae, Cephaltoaceae, Dysphaniaceae, Irvingbaileyaceae**. More than one genus: **Cartonemataceae, Gyrostemonaceae, Petermanniaceae, Tremandraceae**.

farina L.: meal, flour, starch.

FARINACEOUS: resembling or with the texture of flour.

FARINOSE: floury or mealy, or producing a flour or meal.

fascians L.: binding.

FASCIATE: united or massed laterally.

FASCIATION: abnormal growth or normally cylindrical structures (e.g. stems and roots) to flattened, ribbon or thallus-like structures.

FASCICLE: a bunch or cluster. **Fasciculate**: massed in a fascicle.

fasciculus L.: a small bundle.

FASTIGIATE: of habit when branching is erect and close together, so forming a columnar, conical or pyramidal shape.

FAT: of plants, a water-insoluble, non-volatile organic compound of carbon, hydrogen and oxygen (at least when simple) emulsified in cytoplasm, serving as an energy-rich storage product convertible through a complex series of catalytic reactions to a sugar. It has a particular concentration in seed (within the endosperm or embryo) and here appears to be synthesised from translocated sugars.

Chemically an ester, a triglyceride, formed by the reaction of a fatty acid with an alcohol (chiefly glycerol). By hydrolysis through the enzyme group of lipases, may be reduced to the component fatty acids and glycerol.

A fat at normal temperature is either liquid (then a **fixed oil**) or solid (or semi-solid). When liquid, it may dry on exposure to air rapidly, or very slowly, dependent on its oxygen intake, or it may remain a liquid. Rapidly drying oils form elastic, thin films and, as drying oils, have applications to the paint, lacquer, and varnish industries. The slowly-drying (or semi-drying) oils, the non-drying oils, and the solid fats have uses as food materials, illuminants, soaps, and candles. By special chemical techniques, the physical nature of the fat may be modified, e.g. the non-drying castor oil when dehydrated may be used as a drying oil in addition to sundry applications to leather, linoleum, oilcloth, textiles, etc., and as a hydraulic fluid. Fixed oils may be converted to solid fats by hydrogenation (addition of hydrogen) of their fatty acids, e.g. coconut, cottonseed, peanut, soybean, safflower oils when hydrogenated are used as basic components of margarines.

Examples of the fat familiar to Australian commerce include: Drying oils - candlenut (**Aleurites moluccana**), tung (**Aleurites fordii**), linseed or flax (**Linum usitatissimum**), soybean (**Glycine max**), safflower (**Carthamus tinctorius**).

Semi-drying oils - corn (**Zea mais**), cottonseed (**Gossypium** spp.), sesame (**Sesamum indicum**), sunflower (**Helianthus annuus**).

Non-drying oils - olive (**Olea europaea**), peanut (**Arachis hypogaea**).

Solid fats - coconut (**cocos nucifera**), palm oil (**elaeis guineensis**). The two solid fats are derived from the dehusked fruit (of coconut, copra), the others from seed.

FATTY ACID: an organic acid, usually aliphatic, with a carboxyl group able to link with the hydroxyl group of an alcohol to form, with the elimination of water, a fat as the ester. Ranges from water-soluble liquids in lower members (e.g. formic H.COOH , acetic CH_3COOH , the simplest) to water-insoluble solids soluble in organic solvents of the highest members with increasing number of carbon atoms (e.g. stearic $\text{C}_{18}\text{H}_{36}\text{O}_2$). When conforming to the formula $\text{C}_n\text{H}_{2n}\text{O}_2$, (as stearic, and butyric $\text{C}_4\text{H}_{34}\text{O}_2$), the fatty acid is termed **saturated** (others are lauric, myristic, palmitic, valeric). When with fewer hydrogen atoms (e.g. oleic, $\text{C}_{18}\text{H}_{34}\text{O}_2$), the acids are **unsaturated** (others are linoleic, linolenic).

FAULT: of geology, a fracture in the earth's crust which results in a displacement of rocks.

fauna: the species of animals within a community of defined geographic area.

FAVEOLATE: with a structure resembling a honey-comb.

favus L.: a honeycomb.

FELDMARK: a community of sub-glacial regions (i.e. up to the limit of perpetual ice and snow) characterised by an incomplete (open) coverage with a dominance of mosses and lichens, and perennial evergreen dwarf shrubs together with rosette-reduced herbs. For the Australian Alps, dwarf angiosperms forming associations include **Epacris petrophila** with **Veronica densifolia**, **Coprosma pumila** with **Colobanthus benthamianus**. Also fjaeldmark or fellfield.

FERAL: relative to a plant or animal reverted from domestication to the wild.

FERMENTATION: the catalytic oxidation of organic compounds to form organic or inorganic compounds through the action of enzymes (ferments) contributed especially by metabolically-active fungi and bacteria. The end product is determined both by the nature of the substrate and by the presence or absence of oxygen utilizable as the oxidising agent, e.g. the manipulation and control of the conditions leading to the fermentation of agricultural crops and molasses (a syrupy extract from raw sugar) may produce ethyl or butyl alcohols, acetone, citric or other organic acid, ascorbic acid, riboflavin or other vitamin, lactic acid, or the stock food, ensilage or silage, of high protein value. On the production of soft fibres (jute, hemp), the fermentative action of soil-dwelling bacteria is controlled for the separation of the softer tissues from the bark and fibres (the process of rotting). Carbon dioxide may, or may not, be formed. e.g. from yeast, this end-product is used in the baking industry for 'raising the dough', but in wine-making where alcohol is the desired end-product, its formation is suppressed except for the sparkling wines.

In one sense, respiration when anaerobic, a process less efficient than aerobic respiration because of the relatively large amounts of substrate required to produce an equivalent energy output, but undergone by both plant and animal cells when under certain conditions. According to environment, micro-organisms when facultative anaerobes may adopt either mode. See also alcohol, cereal, bacterium, fungus, respiration.

FERMENTATIVE: relative to the process of processes of fermentation.

FERN: a terrestrial, epiphytic, or aquatic pteridophyte (q.v.), usually perennial, with true roots and leaves, and stem a rhizome creeping or ascending, sometimes arborescent but without a cambium. A representative of a group much diversified and the largest and most complex of the spore-bearing vascular plants. Primarily of warm regions with moist or shaded habitats, in Australia of greatest abundance in the rainforests of the tropical north-east. Its group is considered as at class level (**Filicopsida** of some authors, **Pteridopsida** of others), the families listed here are intended to be representative of the broad characters expressed but in view of the currently-active revision, are not inclusive of all ferns occurring in the Commonwealth.

The initial separation is based on the origin of the sporangium, whether from a single cell (then **leptosporangiate**) or from a group of cells (**eusporangiate**). The first group is much the larger, the

eusporangiate ferns making up two orders, **Ophioglossales** and **Marattiales**, each with a single family. The 'adder's tongue' family of **Ophioglossaceae** almost exclusively is of terrestrial, perennial herbs with short, unbranched, fleshy rhizomes, thick and fleshy roots and single or few leaves. Of its three genera, Australia is represented by **Ophioglossum** and **Botrychium**. The leaf is made up by a petiole, a sterile frond, and a fertile lateral part or 'spike' simple and linear in **Ophioglossum** (hence 'adder's tongue') where the sterile lamina is simple and relatively undivided, and in **Botrychium** (Parsley or Grape Fern) pinnately divided, the sterile lamina pinnately or palmately divided. Sporangia borne by the spike are large (one or two millimetres), thick walled, marginal and fused with the spike in **Ophioglossum**, marginal and terminal, spherical, and borne on short thick stalks in **Botrychium** (hence 'grape fern'); dehiscence is by a simple transverse slit. The prothalli (gametophytes) are subterranean, tuber-like, usually long-living, always associated with mycorrhizia.

The second eusporangiate group, the **Marattiaceae**, have a natural occurrence in Australia only in the tropical north. In general appearance, the members approach more the 'typical' ferns and vary from very small to arborescent and among the largest of ferns. In common with the **Ophioglossaceae**, the stem is fleshy and stipulate (thin and sheathing in the latter family but in **Marattiaceae**, thick and fleshy and usually bearing dormant buds at the base, persistent as the bases of the petioles). In common with other ferns, there is circinate (uncoiling) development of the leaves, and sporangia are borne on the dorsal side of the lamina. Sporangia are large, thick-walled and arranged in definite clusters (**sori**) along the veins, rarely with a suggestion of a protective enclosure (indusium) but often fused to varying degree in closed structures (**syngania**). Prothalli are photosynthetic, thalloid structures associated with mycorrhizia, long-living. Two members of the tropical north-east of Queensland are of special note, **Angiopteris evecta** and **Marattia fraxinea**. These have large bi- or tri-pinnate leaves (fronds) twelve or more feet long in **angiopteris** which, when fallen, leave behind the petiole-bases to form, with the thick fleshy stipules, a capping to the rhizome, the whole forming a mass almost globular and about three or more feet diameter, with thick, fleshy, cord-like roots.

The leptosporangiate group (**Filicales**) is considered to have had a relatively modern origin, the first three families, although not closely related, are the most primitive and bridge the gap between the eusporangiate and leptosporangiate groups. Leaves (or more commonly called fronds) are of a petiole (or stipe) which may be articulated to the rhizome, and a lamina which may be simple, pinnately or palmately divided to segments or lobes, or to entire leaflets (primary pinnae and secondary pinnae when pinnate) or compoundly divided (decompound). Sometimes when pinnate there may be a single leaflet only. The venation may be simple or forked, free when the veins meet the margins of the lamina, reticulate or forming a closed system of mesh-like areoles (areoli). Development of the frond is from a long-persistent apical meristem, it is coiled at the top and unrolls progressively as the lower part matures (i.e. is circinate), phyllotaxy is spiral or alternate. Frequently the one plant may bear fronds of two kinds (is dimorphic) the difference commonly is between the sterile and fertile fronds, e.g. the broad flat brown scale-leaves (nest-leaves) and the forked, erect green fertile fronds of the Stag or Elk Horns of **Platycerium**. Deciduous buds often are formed on the fronds.

Sporangia develop on the margin of the lamina (or lobe segment of) or on its dorsal surface, i.e. are **marginal** in the first case and **superficial** when on the dorsal surface. Usually they form circular, reniform or linear clusters (**sori**) on a raised part (**receptacle**) of the lamina which may become elongate or laterally enlarged, located either over a vein ending or along the back of a vein. When sporangia occur over a large part of the dorsal surface (i.e. are superficial) but not limited to sori, they are described as **acrostichoid** (i.e. resembling **Acrostichum**) or, when in a series of sori, form a **coenosorus**. Sporangia are rounded or flattened, sessile or more usually borne on a stalk (**pedicel**); the wall is a uniseriate layer of cells often with a crest or band (**annulus**) unspecialised, transverse or oblique, or vertical and then broken by the pedicel. Sometimes a special opening region (a **stomium**) is formed by the annulus. The function of the annulus is to open the wall for the release of spores or, when highly developed, to actively disperse them. **Maturation** of the sporangia within the sorus (or on the frond-segment when not in a sorus) may be simultaneous (the condition then **simple**), progressive on an elongate receptacle (**gradate**) or not uniform and then **mixed**. **Dehiscence** of the sporangium varies from longitudinal to transverse, the spores are either flattened on two sides (**bilateral**) or on four sides (**tetrahedral**), often the wall with tuberculate projections. The sorus often is associated with a protective **indusium** formed from the lamina which may be an

upraised fold or ridge cup-shaped or 2-lipped, lateral scale-like structure, an umbrella-like projection from the pedicel, or a reflexing of the lamina margin to form a covering (in this a **false indusium**).

The prothallus is usually thalloid, green, monoecious, with the antheridia and archegonia on the lower side, the archegonia on the thickened central cushion or ridge, the antheridia not so localised.

Stipules are absent from the rhizome, but flat scales (sometimes clathrate) and hairs, reddish-brown or rusty, often are present.

Osmundaceae: (Todea, Osmunda, Leptoteris) Royal Ferns. Terrestrial, with trunk (e.g. the arborescent **Todea barbara**) or rhizome erect, without scales. Fronds pinnate, large (up to six feet or more in **Todea**), uniform or dimorphic. Sporangia simple, borne by a short and thick pedicel, not in sori (in **Todea** superficial along the minor veins, later usually covering the while of the lower surface of the fertile part of the frond), subglobular, with an annulus no more than a group of thick-walled cells at one end, dehiscing by a deep slit from the apex to the side opposite. Prothallus green, lobed.

Schizeaceae: (e.g. **Schizaea, Lydogium**). Terrestrial or climbing; rhizome erect or creeping, dichotomously branching, with simple hairs or flattened scales. Fronds simple, dichotomous, bipinnate, or fan-shaped with palmate or pinnate segments, dichotomously veined, with simple hairs or flattened scales. Sporangia large, solitary in 2 to 4 rows, marginal but becoming dorsal by the growth of the lamina segment above and beyond forming a false indusium, sessile or on a lateral segment (**sporangiphore**), with a cap-like annulus dehiscing by a vertical slit, the annulus with a stomium. **Schizea**, a group of small ferns on poor sandy soils, often with grass-like, sometimes fan-shaped lamina, the petiole wiry. Prothalli of this genus are filamentous, with the gametes being formed in terminal structures on short lateral branches, the archegonia entirely exposed; in other genera the prothallus is thalloid and lobed.

Gleicheniaceae: (Gleichenia, Sticherus, Dicranopteris). Terrestrial, sometimes xerophytic; rhizome long and creeping, or erect and up to six or more feet high, forked (falsely dichotomous), sparsely hairy or scaled. Fronds large, scrambling and often forming dense clumps or tangled communities, pinnate and falsely dichotomous, hairy or scaled. Sori superficial on unspecialised fronds, usually flattened, rounded and with from one to twelve sporangia borne by a short pedicel, simple in maturation, each sporangium large, broadly pear-shaped, with a complete annulus dehiscing by a longitudinal slit. Sori without an indusium. Prothallus as **Osmundaceae**.

Hymenophyllaceae: (e.g. **Hymenophyllum, Macroglena, Sphaerocionium**). Terrestrial or epiphytic small, usually in very moist habitats within rainforest. Rhizome long and creeping, often wiry, sometimes short and thick, hairy. Fronds simple, lobed or divided pinnately or dichotomously, or pinnate usually (except at the veins) of a uniseriate layer of cells and almost transparent (hence filmy ferns), without stomata, with or without hairs. Sori marginal, terminal on the ultimate segments of the frond at the tip of a vein which extends into a columnar receptacle, with a tubular, cup-shaped or 2-lipped indusium. Sporangia sessile or on a short pedicel, gradate, with a complete annulus opening by a more or less longitudinal slit. Prothallus thalloid and lobed, filamentous or ribbon-like.

Cyatheaceae: (e.g. **Cyathea, Alsophila**). Tree-ferns with erect trunks up to 60 or more feet high, often adventitious roots forming the outer layer of the trunk. Mostly of rainforest or high rainfall regions, tropical or temperate. Fronds large and palm-like, the lamina decompound, often with chaffy scales. Sori orbicular, superficial, the sporangia on short pedicels, gradate, with a complete annulus dehiscing transversely, with or without an indusium. Prothallus thalloid.

Families from **Dicksoniaceae** to **Blechnaceae** (once grouped as the **Polypodiaceae**) have in common: sori with or without a true indusium; sporangia small, borne on slender pedicels; maturation gradate in the first, otherwise mixed; annulus with stomium actively discharging the spores by transverse dehiscence; prothallus thalloid, not lobed, short-lived. There is a frequent occurrence of sterile filaments (**paraphyses**) within the sporangia, hair-like when simple but developed to umbrella-like, stellate, clathrate or fan-shaped. Spores often with a folded membrane (**perispore**).

Dicksoniaceae: (e.g. **Dicksonia**, **Culcita**, **Dennstaedtia**). Tree ferns (e.g. **Dicksonia antarctica**) with trunk erect and with fronds forming a crown, or not arborescent but terrestrial and with rhizomes usually creeping when erect, the fronds terminal, otherwise scattered. Lamina pinnately divided. Trunk and rhizome covered with simple hairs. Sori marginal; indusium 2-valved.

Hypolepidaceae: (including the bracken **Pteridium esculentum**) sometimes included in the **Dicksoniaceae** differing by the sori being borne on a connecting minor veinlet and covered by both the reflexed margin and an inner indusium.

Lindsaeaceae: (e.g. **Lindsaea**). Terrestrial, mainly tropical, with creeping rhizome, sometimes climbing or epiphytic, with a covering of brown scales intermixed with bristly-like scales. Lamina simple, pinnate or pinnately divided, usually with simple hairs. Sori marginal or almost so, terminal on simple veins or an interconnecting veinlet, sometimes in coenosori, with a true indusium.

Pteridaceae: (e.g. **Pteris**-). Terrestrial, often in forests. Rhizome erect or creeping, with opaque scales often with a thinner, paler border. Lamina usually pinnately divided. Sori submarginal in series (coenosori) on a veinlet connective the vein-ends, covered by a false indusium.

Sinopteraceae: (e.g. **Cheilanthes**). Small terrestrial, usually xerophytic, with tufted or creeping rhizome bearing narrow scales; petioles dark-coloured and glossy. Fronds uniform or dimorphic, the lamina usually small and narrow, decompose. Sori sub-marginal, covered by a false indusium.

Adiantaceae: (e.g. **Adiantum**). Terrestrial usually amongst rocks. Some xerophytic, others of the rainforest. Rhizome erect or creeping, with a covering of bristle-like or woolly hairs, or brown to black opaque scales. Petioles dark-coloured and glossy. Lamina simple or pinnately or palmately divided, with palmate venation, hairy or scale, often with a waxy powder. Sori marginal, in shallow notches or deep grooves borne on the lower surface of a false indusium. Included are the maidenhairs of **Adiantum**.

Vittariaceae: (e.g. **Vittaria**). Terrestrial, or epiphytic, usually amongst rocks. Rhizome creeping, with clathrate scales. Lamina simple, linear. Sori elongated along the veins, in a false indusium formed by a double margin of the frond, protected when young by paraphyses. Tropical and sub-tropical.

Davalliaceae: (e.g. **Davallia**, **Rumohra**, **Nephrolepis**, **Anthropteris**). Terrestrial, climbing, or epiphytic. Rhizome usually fleshy, long and creeping or sometimes short and erect, with a dense covering of brown or black clathrate scales. Lamina simple or pinnately-divided or decompose. Sori marginal, with a true indusium.

Grammitidaceae: (e.g. **Grammitis**). Small to fairly large epiphytes, or small and in rock crevices. Rhizome creeping, usually short, erect or ascending with glossy brown scales. Lamina simple and narrow, forked, or pinnately divided, hairy. Sori superficial, sometimes immersed in cavities or in deep vertical grooves of the lamina, without an indusium.

Polypodiaceae (e.g. **Platyserium**, **Microsorium**, **Pyrrosia**). Many epiphytic in rainforest, often large. Rhizome creeping, long or short, with scales. Fronds uniform or dimorphic, the lamina simple, lobed, forked, or pinnate. Sori superficial, ranging from localised to the vein-junctions to covering a section of the lamina, without an indusium. Included is the Elk- or Stag-horn **Platyserium bifurcatum**, a bracket fern with sterile fronds (scale leaves) forming an enclosure for gravity or wind-drifted moisture-retentive humus.

Aspidiaceae: (e.g. **Polystichum**, **Lastereopsis**, **Athyrium**). Terrestrial or climbing. Rhizome creeping or erect, with a covering of opaque scales. Fronds uniform or dimorphic, the lamina simple or pinnately divided, decompose or fan-shaped. Sori dorsal, or terminal on the veins of the lamina, rarely without an indusium.

Thelypteridaceae: (e.g. **Cyclosorus**). Terrestrial. Rhizome usually creeping sparsely covered by scales with unicellular, usually needle-like, hairs on their margins. Lamina pinnately divided, often

with simple, white, needle-like hairs and with round glandular hairs. Sori dorsal on the veins, rarely terminal, with an indusium often with needle-like or glandular hairs.

Aspleniaceae: (e.g. **Asplenium**). Terrestrial or epiphytic. Rhizome short, creeping or almost erect, with a covering of clathrate scales. Lamina simple, lobed, or pinnately divided. Sori elongate along the veins, with an indusium likewise elongate. Include the Bird's Nest Fern (**Asplenium nidus**), a large epiphyte of the rainforest.

Blechnaceae: (e.g. **Blechnum**, **Doodia**). Terrestrial, Rhizome usually short and erect, creeping or twining, sometimes forming a short trunk, with a covering of usually thick, dark coloured or black scales. Fronds uniform or dimorphic. Lamina simple, lobed, or more frequently pinnately divided. Sori short, usually in a linear series (**coenosorus**) borne on veins parallel with the mid-vein (costa) of the frond-segments, with an indusium.

The following are the Water-ferns, unique in that spores are formed in special reproductive structures, **sporocarps**, and are dimorphic, the mega- and micro-spores forming distinct female and male prothalli. They are the heterosporous ferns. The habitat is aquatic (floating) or semi-aquatic (i.e. rooted in mud).

Marsileaceae (e.g. **Marsilea**). Semi-aquatic, lining permanent and non-permanent fresh-water basins. Rhizome slender or thick and woody, creeping and long, with a covering of hairs, forming roots and developing circinate leaves at the nodes. Lamina with a long petiole, in **Marsilea** (Nardoo) of 2 pairs of opposite obovate leaflets, in other genera filiform or 2-lobed. Sori in special, usually globular or oblong, tough and strongly protective sporocarps sessile or pedunculate on the petiole, solitary or in numbers. Each sorus with an indusium, containing both micro- and mega-sporangia, the former producing numerous, microspores, the latter a solitary megaspore; annulus either absent or rudimentary. Megaspore germinating to a much reduced prothallus producing a single archegonium.

Salvinaceae: (Salvinia). Tropical. Floating. Stem slender, branched, closely covered by 3-whorled leaves, two of which are floating, the third in filamentous segments, hairy, submerged, without roots. Sporocarps in clusters or rows on the submerged leaf-segments. Sorus pedicellate and surrounded by a thin-walled indusium, with either numerous microsporangia or few megasporangia. Megaspore germinating on the surface, becoming a conspicuous green prothallus.

Azollaceae: (Azolla). Floating. Stem slender, readily fragmented, overlapped by crowded imbricate leaves which are circinate, alternate in 2 rows, divided into an upper photosynthetic aerial lobe with the symbiotic alga **Anabaena** on the lower surface, the second lobe submerged and of a uniseriate cell layer, with simple roots. Sori in groups of two or four on the lower lobe of the first leaf of each branch, enclosed by an indusium, larger when with several microsporangia, small when with a solitary megasporangium. Megaspore germinating under water, the prothallus formed never fully free from the spore.

Economic: Apart from the oleoresin obtained from the rhizome of Male Fern **Dryopteris felix-mas** used as a taenicide (i.e. against tapeworm) overseas, the potential of the group at least in pharmacology is not yet realised. Much use has been made of their ornamental wealth, the commerce from which is not insignificant.

fer(o) L.: as in **transfer**, **pomifera**, **coniferous**, to carry, to bear.

FERRUGINOUS: with the colour of rusted iron.

FERTILITY: of reproduction, the potential for active production of viable spores and gametes. Of soils, the potential for the supply of available nutrient to plants. cf. sterility.

FERTILIZATION: of reproduction, the fusion of reproductive cells to form a zygote. See also embryo sac for angiosperms, pollen tube for angiosperms and gymnosperms, archegonium for gymnosperms, pteridophytes, and bryophytes, antheridium for pteridophytes, bryophytes, fungi, algae. Of soils, the provision of nutrient additional to that already available for the growth of plants.

FIBRE: in general, a strand or filament. As a component of a tissue, one of the two cell-types of sclerenchyma (see also sclereid) found within cortex, phloem and xylem (both primary and secondary) of angiosperms, and usually only secondary growth, occasionally cortex, of gymnosperms. It may be scattered or in groups, when in phloem and cortex may be in separate strands or in cylinders, and in monocots may occur as an ensheathment to a vascular bundle. When in secondary xylem is a **wood-fibre** typically with a much thickened wall to the almost complete occlusion of the lumen, or a **fibre-tracheid** when resembling a fibre of phloem, the wall very thick and with very small pits.

As an item of commerce, the term **bast fibre** refers to a fibre strand when originating from a primary or secondary phloem, a cortex, or the periphery of a vascular bundle (usually then a vascular bundle with associated fibres from the leaf of a monocot) **surface fibre** when actually a hair from an epidermis or seed-coat, **wood-fibre** when a fibre strand from secondary xylem. A fibre-strand may be of considerable length, e.g. the bast fibre of manila varies from 6 to 12 feet long, but the **staple** (i.e. the uniformity in length of a sample) is highly variable. The length of individual fibres also is variable, e.g. 2 to 12 mm for manila, less than 1 up to 8 mm for jute and sisal and, as an exceptional case, from 60 to 250 mm for ramie. While the staple primarily decides the use of bast and surface fibres, other considerations are the length, tensile strength, pliability, durability, and the economic factors governing its production on a commercial scale.

The economic history of fibre plants began when man first learnt their utility for some of his essential needs, e.g. for blindfolding, netting, shelter-construction. Present-day numbers of fibre-yielding plants exceeds 2,000 of which at least 500 are potential commercial species. Most of Australia's local production is for the pulping industries where the wood-fibres of trees both native (e.g. eucalypts) and cultivated (e.g. pines) are used in the making of paper and paper board, and particle and fibre building boards. Of the textile fibres, only cotton and flax have been cropped and milled on a large scale, the potential existing for the establishment of either native or introduced and established fibre-plants but high costs of production in this country impede progress. Some of the commercial bast and surface fibres well-known here are noted below.

(a) Soft fibres. i.e. soft but pliable, with or without lignified walls, extracted (by retting) chiefly from dicot stems. Chief usage as fabrics, netting, cordage.

Jute: from **Corchorus** spp. (Family **Tiliaceae**) especially **C. capsularis** and **C. olitorius**, annuals up to 15 feet high. Second only to cotton in utility but production practically confined to small areas in Pakistan and India. Introduced to western commerce **circa** 1832 but origin very much earlier. Widely used in Australia for wool packs, wheat sacks, and hessians (or burlap).

Flax: source for the textile fibre linen is from **Linum usitatissimum** (**Linaceae**). Of ancient and unknown origin but probably later than cotton. Up to recent years grown (in Australia, especially W.A.) for the fibre but the bulk is now for extraction of the fixed oil, linseed, from the seed.

Hemp: from the dioecious annual herb **Cannabis sativa** (**Cannabaceae**). The resin extracted from largely the female inflorescences contains isomers of tetrahydrocannabinol with psychoactive effects on man. According to potency, the drug is available as marijuana (or bhang) when of low grade and potency, ganja when of higher quality, and hashish (or charas) when of highest (and most potent) grade. History similar to flax. Native to central and western Asia and widely cultivated, i.e. India, China, Japan.

Ramie: from **Boehmeria nivea** (**Urticaceae**) chiefly from China and India. Sunn 'Hemp': from **Crotalaria juncea** (**Papilionaceae**) chiefly India but grows wild in tropical Australia where introduced.

Kenaf: from **Hibiscus cannabinus** (**Malvaceae**) chiefly India and Africa.

- (b) Hard fibres, i.e. not necessarily 'harder' than the 'soft fibres' but usually with lignified walls and from the leaves and/or stems of (mainly) tropical or sub-tropical monocots. Chief usage cordage and ropage, matting, sacking.

Manila (abaca): from **Musa textilis** (**Musaceae**). Sometimes called manila hemp from its entrance to the trade through the port Manila as a substitute for hemp. Well-known as marine rope.

Sisal: from **Agave sisilana** (**agavaceae**). Originating from Mexico but chief production centres are Indonesia and Africa. Mainly cordage, ropage.

New Zealand Flax: from **Phormium tenax** (**Agavaceae**). Cordage and twine, matting.

Coir: from the coconut **Cocos nucifera** (**Palmae**). Fibres from the fronds used in textiles, matting, cordage and ropage. Fibres from the husk of the fruit have the necessary stiffness and flexibility for broom and brush-making.

Bass or Piassava: from the petioles of several palms chiefly the Brazilian **Attalea funifera** (as Bahia Bass). Broom and brushware.

Bassine or Palmyra: from petioles of the palm **Borassus flabellifer** of Ceylon and the eastern coast of India and Burma. Broom and brushware.

Millet Broom or Broom millet: from **sorghum vulgare** (**Graminae**) widely grown in Australia, originating from Africa and Asia.

Raffia: not strictly a fibre but strips from the leaf-epidermis of the raffia palm **Raphia pedunculata** (native to Madagascar).

Rattan and bamboo: sometimes classed with fibres, are the stems or petioles of the tropical Asian climbing palms of **Calamus** spp. and the woody **Bambusa** (**Gramineae**) respectively.

(c) Surface fibres.

Cotton: from hairs of the seed-coat of several horticultural strains of **Gossypium** spp. (**Malvaceae**), especially the diploid **G. herbaceum** and **G. arboreum**, and the tetraploid **G. barbadense** and **G. hirsutum**. Originating from India at least 5,000 years ago, a most versatile crop. Of seed or raw cotton, the long fibres (lint) are for fabrics and other textiles as cotton drill and cotton duck, the short fibres (linters) are for medicated cotton and filing material for upholstery. The seed yields an edible fixed oil, the residue (cotton seed cake) a stock food. See also under cellulose.

Kapok: the 'floss' from the seed of either **Bombax malabarica** (Indian Kapok) or **Ceiba pentandra** (Java Kapok) both trees of the **Bombacaceae**.

fibr(a) L.: as in **fibroid**, **fibrous**, fibre.

FIBRIL: in general, a fibre when very short in length or small in diameter. See also under cell wall.

FIBRILLOSE: with very fine fibre- or hair-like structures (fibrillae).

FIBROSE, FIBROUS: made up of fibres, or with an abundance of fibres.

FIBROUS ROOTED: of a root system when the component roots are adventitious with no single root dominant, each root producing lateral roots and so forming a tufted mass.

fici-: as in **ficifolia**, fo **Ficus**, the fig.

-fidus L.: as in **bifid**, **bifidus**, divided.

FIDELITY: of ecology, the selectivity of a species for a particular community, e.g. Mulga (**Acacia aneura**) is selective to shrub steppe or arid regions of the continent.

FIELD CAPACITY: of soil, the amount of water (expressed as a percentage) held following normal drainage of excess (or gravitational) water.

FILAMENT: in general, a thread-like structure. Of a stamen, the sterile support of an anther.
Filamentous: of a filament, or thread-like.

fil(um) L.: as in **filiformis**, a thread.

filici-: as in **filicifolia**, of a fern. From L. **filix**.

FILTRATE: of a solution or liquid mixture, the portion with molecular size small enough to pass through the pores of the filter used in filtration (e.g. a filter paper, filter press, vacuum filter, porcelain filter, fritted glass filter, collodion filter, etc.).

fimbria(e) L.: a fringe, a border.

FIMBRIATE: bordered by fine hairs or thread-like segments.

fim(us) L.: as in **fimicarius**, dung (hence dung-inhabiting).

FISSILE: readily split, or with a tendency to split.

FISSION: in general, the splitting apart (cleavage) of a structure.

FISTULAR: of a structure hollow throughout its length.

FIXATION: of histology, the preservation of structural detail as close as possible to that present in the living tissue or organism, to a degree determined by the 'fixative' (e.g. formalin -acetic acid, -alcohol, chromic acid, etc.).

FLABELLATE, FLABELLIFORM: in the shape of a fan.

FLACCID: withered and limp.

FLAGELLUM: (plural flagella) of plants, a filamentous, lash-like structure of certain motile cells, varying in number from one to many, commonly of two forms one (of bacteria) formed by a single fibril, the other of nine peripheral and two central fibrils. Lateral hair-like structures may be present, the flagellum then known as a **tinsel flagellum**, or such structures may be absent, the flagellum then termed **whiplash**.

flamme(us) L.: flame-coloured, fiery-red.

flacid(us) L.: light yellow.

flav(us) L.: as in **flaverius**, **flavescens**, **flavus**, yellow.

FLAVONOID: a group of yellow or orange pigments commonly found in flowers and fruits and in association with anthocyanins, usually a water-soluble crystalline solid chemically related to flavone $C_{15}H_{10}O_2$ occurring uncombined, or as a glycoside when usually colourless. Also anthoxanthin.

flavogrise(us) L.: yellowish-grey.

flavovirens L.: yellowish green.

FLEXUOSE: bending or curving away in a wavy or zig-zag manner.

FLOCCOSE: appearing like tufts of soft wool, e.g. of hairs.

FLOCCULATION: of a colloid, a reversible precipitation from solution when the pH is adjusted to the isoelectric point, dissolution to the flocculate occurring when the pH is changed. Of soil, the formation of loose aggregates (floccules) by colloids where there is sufficient adsorption of mineral cations (e.g. of calcium, magnesium). The floccules may be broken up (deflocculated) by high or low pH ranges and the colloids leached to lower levels of soil.

FLOOD PLAIN: an alluvial plain formed by the accumulation of sediment carried by rivers during flood.

FLORA: the species of plants present within a community or vegetation of a geographic area. In the sense of a published work, a compilation of such species usually arranged in accordance with a system of classification and with citations of locations and herbarium specimens vouchering for these locations. See also floristic.

FLORAL: relative to a flower. From L. **flos**, a flower.

FLORAL CUP: a cup-like termination of a floral shoot which bears on its rim the perianth and stamens (when present and not borne by the perianth), the ovary enclosed at least partially by the cup either adnate with, or free from it. Also hypanthium, receptacle, torus.

FLORAL EMBLEM: for the Commonwealth, Golden Wattle, **Acacia pycnantha**. Although not necessarily official, for the Australian states generally accepted are: Western Australia - Kangaroo Paw **Anigosanthos manglesii**; Northern Territory - Blue Waterlily **Nymphae gigantea** or, alternatively, Sturt's Desert Rose **Gossypium sturtianum** (vermillion Gum **Eucalyptus minata** also has been proposed); South Australia - Sturt Pea **Clialanthus formosus**; Queensland - Cooktown Orchid **Dendrobium bigibbum**; New South Wales - Waratah **Telopea speciosissima**; Victoria - the heath **Epacris impressa** (Mountain Ash **Eucalyptus regnans** also has been proposed); Tasmania -Blue Gum **Eucalyptus globulus**.

FLORAL TUBE: in general, a floral cup in the form of a tube. Applied also to a certain type of perianth (e.g. of **Liliaceae**) when the sepals are united to form a tube.

FLORET: in general, a very small flower when a member of a compact inflorescence, especially the capitulum (head) of **Compositae**. Also the individual flower of a grass together with the innermost enclosing bracts (lemma and palea).

FLORIFEROUS: bearing or producing flowers.

FLORICULTURE: the cultivation of plants for flower-production, particularly when marketed to the florist's trade (forestry).

FLORIGEN: a hypothetical growth substance transmitting a stimulus to flora growth-points, present evidence however indicating that the hormonal control of flowering may be a dual mechanism of promotion and inhibition, perhaps through the interaction of a gibberellin and the kinin dormin (abscisic acid). See also phytochrome.

FLORISTIC: relative to members of a particular community or vegetation, i.e. of a flora. See also association, alliance, structure.

flos L.: as in **flosplenus**, a flower (hence double-flowered).

FLOWER: a determinate stem-tip bearing appendages specialised for reproduction. The reproductive structure of angiosperms, composed (when complete) of perianth, androecium and gynoecium borne on a receptacle. Its development parallels that of a leafy shoot, the growth region as apical determinate meristem, the floral units formed in the same manner as normal leaves but with internodes very much reduced. Initiation of its development appears to concern an interrelationship of photoperiodic response and a hormonal control mechanism (see phytochrome).

fluitans L.: floating.

fluminalis, flumine(us) L.: of a river or creek.

FLUORESCENCE: the emission of light from an object or substance when absorbing light from another source (e.g. ultra-violet) for the period it is exposed to the exciting radiation, usually the fluorescent light of longer wave-length than the exciting light. cf. phosphorescence.

fluvialis, fluviatis L.: of a river or creek (a **fluvius**).

flux(us) L.: flowing, passing away.

FOG: a layer of moist air in contact with a surface of land, cooled below its dew-point (q.v.) by (in general) the horizontal movement of warm air over a cold surface, or a surface of land sloping to high elevations, or by the rapid cooling of the land by radiation of heat at night when there is little or no wind currents. The moisture of the air, condensed as water droplets or ice crystals and adsorbed by the surfaces of dust particles, is held as a suspension and may be precipitated by a further cooling of the atmosphere or dispersed by evaporation by a rise in temperature. When the adsorbing nuclei of dust particles are further increased by particles from smoke especially of industrial areas, a life-injurious **smog** will result when there is insufficient dispersing wind movement.

FOLDING: of the earth's crust, a movement of basement rock caused by compression during orogenesis (q.v.) or by uplift during epeirogenesis (q.v.). When the resultant fold is in the nature of a simple uplift (or warp) to a plateau, a **monocline**. When forming a simple arch, the fold is an **anticline** and when forming a hollow or trough, a **syncline**. When the magnitude of folding is large, the prefix **geo-** is affixed to the fold, e.g. geosyncline.

foli(um) L.: as in **myrtifolius**, **ericifolia**, **grandifolium**, a leaf.

FOLIACEOUS: resembling a leaf in form and texture.

FOLIAGE: of a leaf-bearing plant, the leaves collectively borne at a specified time.

FOLIAR: relative to a leaf or leaf system.

-foliate: as in **unifoliate**, -leaved (hence bearing a single leaf).

FOLIATION: the production or bearing of leaves.

-foliolate L.: as in **unifoliolate**, -leafed (hence bearing compound leaves reduced to single leaflets).

FOLIOSE: leafy; bearing a number of leaves.

FOLLICLE: a capsular fruit formed from a single carpel, containing one or more seeds and splitting open along a single lateral line (suture). e.g. the fruit of the **Proteaceae**.

FOLLICULAR, FOLLICULATE: resembling, or consisting of, follicles.

FOLLICULOSE: bearing follicles.

fomes L.: tinder; kindling wood.

FOOT CANDLE: of light, a unit of intensity (illumination or luminous intensity) equal to one lumen (q.b.) per square foot. Equivalent to 10.77 lux (q.v.).

FORB: an herbaceous plant other than a grass.

FORESHORE: either the part of the shore between high and low tide or (in an extended sense) between the tidal limit and adjacent land when cultivated or built upon.

FOREST: a closed community dominated by trees with crowns flat-topped and interlacing, and with boles of length equal to or greater than the depth of the crowns. In Australia, native forests occur to

greatest extent in the coastal belt, and may be termed Hardwood, Rain, Cypress, Pine, Riverain Forests.

FORESTRY: the science and art of establishing and maintaining forests for the production of timber or other economic need, e.g. pulping for the paper industry or for manufacture of building boards.

FOOD PLANT: grown commercially or in use in Australia as a vegetable, or as a food adjunct (condiment, spice, flavouring agent) one of the following. Given also are the parent species, the family, and geographic origin as far as is known. See also separate entry for fruit (when in the domestic sense or the fruit used as a vegetable, i.e. requiring such preparation as cooking) and cereal.

(a) Root crops.

(i) Fleshy taproots used as vegetables.

Beetroot (**Beta vulgaris** spp. **vulgaris** forma **rubra**. Fam. **Chenopodiaceae**) - Europe.

Another form yields beet sugar, others chards and mangel-wurzels (mainly stock feeds).

Carrot (**Dacus carota**. Fam. **Umbelliferae**). Europe.

Parsnip (**Pastinaca sativa**. Fam. **Umbelliferae**). Europe.

Radish (**Raphanus sativus**. Fam. **Cruciferae**). Europe.

Salsify or Oyster Plant (**Tragopogon porrifolius**. Fam. **Compositae**). Southern Europe.

Swede Turnip (**Brassica napus** var. **napobrassica**. Fam. **Cruciferae**). Europe.

Sweet Potato (**Ipomoea batatas**. Fam. **Convulvulaceae**). Tropical America. (actually tubers arising from adventitious roots).

Turnip (**Brassica rapa** spp. **rapa**. Fam. **Cruciferae**). Europe.

Yam (**Dioscorea alata** chiefly. Fam. **Dioscoreaceae**). Tropics and sub-tropics.

(ii) For condiments or flavouring.

Angelica (**Angelica archangelica**. Fam. **Umbelliferae**). Syria.

Horse-radish **Armoracia rusticana**. Fam. **Cruciferae**). South-east Europe.

(iii) Other uses.

Cassava (**Manihot esculenta**. Fam. **Euphorbiaceae**). South America. Source of tapioca.

Chicory (**Cichorium intybus**. Fam. **Compositae**). Europe. When roasted, used as an adulterant of coffee.

(b) Bulbs as vegetables or salad greens.

All examples of **Allium**. Fam. **Liliaceae**. Chiefly Mediterranean.

Chives, **A. schoenoprasum**. Europe, Asia.

Chives, Chinese, **A. odorum**.

Garlic **A. sativum**. Its adventitious bulblets are known as cloves. (See also under flower bulbs).

Leek **A. porrum**. Probably Europe, Western Asia.

Onion **A. cepa**.

Shallot **A. ascalonicum**.

(c) Tubers used as vegetables

Artichoke, Jerusalem (**Helianthus tuberosus**. Fam. **Compositae**). North America.

Potato (**Solanum tuberosum**. Fam. **Solanaceae**). America.

Taro (**Colocasia esculenta** Fam. **Araceae**). South-east Asia.

(d) Rhizomes as food adjuncts.

Ginger, Green, Dry (**Zingiber officinale**. Fam. **Zingiberaceae**). South-east Asia.

Sarsaparilla (**Smilax** spp. Fam. **Smilacaceae**). Tropical America.

Tumeric (**Curcuma longa**. Fam. **Zingiberaceae**). South-east Asia, East Indies. An ingredient of curry powder, a flavouring or colouring agent.

(e) Aerial stems used as vegetables.

Asparagus (**Asparagus officinalis**. Fam. **Liliaceae**). Temperate Europe, western Asia.

Kohl Rabi (**Brassica caulocarpa**. Fam. **Cruciferae**). Unknown origin. Also called Turnip-rooted Cabbage from its short, turnip-like stem coloured white or purple.

Sea Kale (**Crambe maritima**. Fam. **Cruciferae**). Western Europe.

Extracted.

Sugar Cane (**Saccharum**. Fam. **Gramineae**. Hybrids of **S. officinarum**, **S. robusta**, **S. spontaneum**, **S. barberi**, **S. sinense**). New Guinea, India, Into-China. Source of cane sugar.

Sago (chiefly the palms of **Metroxylon** of Indonesia and the Philippines. See also under cycad.

(f) Leaves as vegetables.

(i) the crucifers, varieties of **Brassica oleracea**. Fam. **Cruciferae**, its ancestor the wild extant colewort close to kale.

Cabbage (var. **capitata**) the large vegetative bud on a short axis. Coastal western Europe.

Cabbage, Chinese (var. **pekinensis**, the common chou; var. **chinensis**, Pakchoy; var. **junceae**, Gaichoy). Asia.

Brussels Sprouts (var. **gemmifera**) the compressed leaf-buds axillary on a long stem ? origin.

Kale or Borecole (var. **acephala**). Europe.

White Mustard (**Brassica hirta**). Eurasia.

(ii) Salad Greens.

Lettuce (**Lactuca sativa**. Fam. **Compositae**). Southern Europe, western Asia. Descended from wild lettuce **L. scariola**, includes head, cos, and cut-leaf lettuce.

Orach (**Atriplex hortensis**. Fam. **Chenopodiaceae**). Asia.

Spinach (**Spinacia oleracea**. Fam. **Chenopodiaceae**). South-west Asia.

Spinach, New Zealand (**Tetragonic tetragoniodes**. Fam. **Tetragoniaceae**). Australia, New Zealand, South America, Japan.

Spinach, Summer (**Amaranthus tricolor**. Fam. **Amaranthaceae**). Probably tropical Asia. The Chinese Yin-choy.

(iii) Leaves or herbage for flavouring. Culinary herbs.

(a) Labiates, i.e. of Fam. **Labiatae**. Essential oil-bearers.

Balm (**Melissa officinalis**). Southern Europe.

Basil, Sweet (**Ocimum basilicum**). ? India, Africa.

Hoarhound (**Marrubium vulgare**). Europe, central Asia.

Marjoram (**Origanum majorana** syn. **Majorana hortensis**). Mediterranean.

Pennyroyal (**Mentha pulegium**). Europe, western Asia.

Peppermint, English Mint (**Mentha piperita**). Temperate northern hemisphere.

Sage (**Salvia officinalis**). Mediterranean.

Savory (**Satureja hortensis**). Mediterranean.

Spearmint, Garden Mint (**Mentha viridis** (syn. **M. spicata**)). Temperate Europe and Asia.

Thyme (**Thymus vulgaris**). Mediterranean.

(b) Other than labiates. Essential oil-bearers.

Bay (**Laurus nobilis**. Fam. **Lauraceae**). Asia Minor.

Cress, Garden (**Lepidum sativum**. Fam. **Cruciferae**) ? origin.

Cress, Water (**Nasturtium officinale**. Fam. **Cruciferae**) ? origin.

Parsley (**Petroselinum crispum**. Fam. **Umbelliferae**). Mediterranean.

Poppyseed (**Papaver somniferum**. Fam. **Papaveraceae**). Europe, Asia.

Sesame (**Sesame indicum**. Fam. **Pedaliaceae**). Tropical northern hemisphere.

Tarragon (**Artemisia dracunculus**. Fam. **Compositae**). Western Asia.

Wintergreen (**Gaultheria procumbens**. Fam. **Ericaceae**). Eastern North America.

The bulb-crops chives, garlic, leek, shallot may be included here also.

(iv) Leaves for beverages

Tea, Black, Green (**Camellia sinensis** (syn. **Thea sinensis**). Fam. **Theaceae**) China.

(v) Petioles used for vegetables.

Celeriac (**Apium graveolens**. Fam. **Umbelliferae**). Temperate Europe, western Asia. The blanched leaves with petioles.

Rhubarb (**Rheum raphaniticum**. Fam. **Polygonaceae**). Asia

- (g) Immature inflorescences.
- (i) As vegetables. Of the crucifer **Brassica oleracea**.
 Broccoli, Heading (var. **botrtis**).
 Broccoli, Sprouting (var. **italica**). Immature flower-head borne on thick, fleshy stalks.
 Cauliflower (from of **B. oleracea**) with unknown origin. Hypertrophic development of aborted flowers.
 - (ii) Flower buds for species and condiments.
 Capers (**Capparis spinosa**. Fam. **Capparidaceae**). Mediterranean.
 Cloves (**Syzygium aromaticum**. Fam. **Myrtaceae**). Moluccas. Cultivate chiefly Zanzibar for use as a spice and for essential oil.
 - (iii) Involucral bracts, **Compositae**.
 Artichoke, Globe (**Cynara scolymus**). North Africa.
- (h) Fruit for flavouring or species. Essential oil-bearers.
- (i) Members of **Umbelliferae** with mericarps used in flavouring.
 Angelica (**Angelica archangelica**). Syria.
 Anise (**Pimpinella anisum**). Mediterranean.
 Caraway (**Carum carvi**). Europe, western Asia.
 Celery (**Apium graveolens** var. **dulce**). Origin unknown.
 Coriander (**Coriandrum sativum**). Southern Europe.
 Cumin (**Cuminum cyminum**). Mediterranean.
 Dill (**Antherum graveolens**). Mediterranean.
 Fennel (**Foeniculum vulgare**). Mediterranean.
 - (ii) Mainly as spices.
 Allspice (**Pimenta officinalis**. Fam. **Myrtaceae**). West Indies, Central and South America.
 Anise, Star (**Illicium verum** Fam. **Illiciaceae**). ? China.
 Juniper (**Junipera communis**. Fam. **Cupressaceae**). Northern Hemisphere. The cones used in flavouring.
 Pepper, Black, White (**Piper nigrum**. Fam. **Piperaceae**). India or Malaysia.
 Roselle (**Hibiscus sabdariffa**. Fam. **Malvaceae**). Southern Europe. used mainly in jams and preserves.
 Vanilla (**Vanilla fragrans**. Fam. **Orchidaceae**). Tropical America.
- (i) Seeds used in flavouring or as spices.
- Cardamon (**Elettaria cardamomum**. Fa. **Zingiberaceae**). India.
 - Lotus, East Indian or Chinese (**Nelumbo nucifera**. Fam. **Nelumbonaceae**). South Asia to Australia.
 - Mustard, Black or Table (**Brassica nigra**. Fam. **Cruciferae**). India, Eurasia.
 - Mustard, White (**Brassica hirta**). Eurasia.
 - Mustard, Indian (**Brassica juncea**). Asia.
 - Nutmeg and Mace (**Myristica fragrans**. Fam. **Myristicaceae**). Moluccas. The seed provides a spice, its aril mace.
 - Tonka Bean (**Dipteryx odorata**, **D. oppositifolia**. Fam. **Papilionaceae**). South America. The woody, 1-seeded, drupe-like pod with seed used in flavouring and as a source of coumarin for perfumery.
- (i) Seeds used for beverages.
- Coffee, Arabian (**Coffea arabica**. Fam. **Rubiaceae**). The seed ('bean') of the berry. Tropical Africa.
 - Cocoa, Chocolate (**Theobroma cacao**. Fam. **Sterculiaceae**). Tropical America. The seed of the capsule.
- (ii) Grain crops (of **Gramineae**) additional to those given under cereal.
- Sweetcorn (**Zea mays**. var. **saccharata**). Several hybrids of maize (**Zea mays**) yield grain for starch, cornflour, and breakfast foods additional to use as stock-feed.

Popcorn (a nutant of **Zea mays** var. **indurata**). The grain when exploded by heating used as a confection.

Sorghum (**Sorghum vulgare**). Several forms used for canning.

(j) Extracts from bark. The three given of **Lauraceae** yield essential oil.

Cassia, Chinese Cinnamon (**Cinnamomum cassia**). Southern China. For flavouring.

Cinnamon (**cinnamomum zeylanicum**). India, Malaysia, Spice.

Sassafras (**Sassafras albidum**). Eastern North America. A flavouring for beverages.

For Mushroom, Morel, Truffle, Yeast, see under fungus.

FORM, FORMA: a category subordinate to a species and subspecies. A sub-group within a species displaying a minor character, e.g. of habit, pubescence, colour, etc. Also Race.

FORMATION: of ecology, a unit of structure grouping all stable communities of the same structural form without regard to floristic composition. For Australian conditions, groups recommended are grassland, savannah, alpine herbfield, fen, bog, feldmark, heath, saltbush, scrub, mallee, woodland, sclerophyll forest, rainforest.

formic(a) L.: as in **formicifera**, an ant (hence attracting ants by some sugary principle, the plant being described as formicarian).

formos(us) L.: finely formed; of elegant appearance.

FORNICATED: of a structure when in the form of an arch.

FOSSIL: a rock (usually sedimentary) possessing the remains or casts (impressions) of organic life belonging presumably to a former geologic age.

FOSSILIFEROUS: fossil-bearing, e.g. diatomaceous earth, coal, crude oil.

FOSSILISATION: the process of preserving, through sedimentation and stratification of rock, organic remains or impressions. See also petrification.

FOVEATE: of a surface when pitted by a series of cavities or depressions (L. fovae).

FOVEOLATE: the diminutive form of foveate, i.e. the depressions (foveola) very small.

FREE: in general, separate; not attached. Of parts not joined to other structures, applied strictly when not of the same kind, e.g. stamens free from petals. cf. distinct.

FREQUENCY: of ecology, the percentage of individuals of a particular species present in the sampling of a defined area. cf. density. Of a wave-motion, e.g. of radiant energy, the ratio of velocity to wavelength.

FROND: usually applied to the leaf of a fern, but has been used also for the leaf of a palm, for the minute acaulescent members of **Lemnaceae** (e.g. the pond-weeds of **Lemna** and **Woolfia**), and for the thallus of an alga or lichen when foliaceous.

FROST: of ground, the precipitate of ice-crystals formed from atmospheric moisture when the latter is cooled to a dew-point below freezing (32°F) from its contact with ground brought to a sufficiently low temperature by its re-radiation of heat to the upper atmosphere at night. Factors which promote the excessive loss of heat include: long night-low temperature, absence of cloud cover or fog, low concentration of atmospheric moisture (these factors when not limiting normally promoting the reflection of heat back to earth), absence of wind-movement, wind-movement normally tending to redistribute heat uniformly.

FROST INJURY: of plants, the destruction of cells or tissues by the freezing effect of frost, due to the disruptive impact of ice-crystals on the physical structure of the protoplasts. Ice-crystals may be

formed during the thawing of a frozen protoplast or a precipitation of solutes within the cells may occur when water is continually removed through the freezing of water in the intercellular spaces.

FRUCTESCENCE: the maturing stage (maturation period) of fruit or spores.

FRUCTIFICATION: in general, a reproductive structure within which are produced spores or seed. Applied especially to spore-forming structures.

fructifer(us), fructuos(us), frugifer(us) L.: fruit-bearing (fructiferous, frugiferous).

fruct(us), frux, fruges L.: fruit.

FRUIT: a mature gynaecium together with accessory structures when present. Is **simple** when of one carpel, or of several united carpels of a simple gynaecium, **aggregate** when the carpels of a single gynaecium are free in the flower but coherent in fruit (e.g. of Blackberry and other **Rubus** spp.) **multiple** when of more than one gynaecium coherent on a common axis (e.g. the cone-like head of samaras of **Casuarina** or follicles of **Banksia**). The fruit is **dry** when differing from the **fleshy** or succulent type by a greater abundance of sclerenchyma and drying-out of cell-contents during ripening, and a frequent lignification or suberisation of the cell-walls. See also accessory fruit.

Fruit of commerce, cultivated or generally known in Australia include the following. Given also are the botanical fruit type, and the geographic origin as far as is known.

I. Fruit simple.

A. Dry.

- (i) Legume. All of **Papilionaceae**, mainly used as vegetables (i.e. cooked) and known generally as the Pulse Crops.

Bean

Broad (**Vicia faba**). Algeria or south-east Asia.

French, Haricot, Kidney (**Phaseolus vulgaris**). Tropical America.

Jack (**Canavalia ensiformis**). West Indies.

Lima (**Phaseolus limensis**). Tropical America.

Mung (**Vigna mungo**) ? India.

Scarlet Runner (**Phaseolus coccineus**). Tropical America.

Sieva (**Phaseolus lunatus**). Tropical America.

Snake (**Vigna sesquipedalis**). Southern Asia.

Sword (**Canavalia gladiata**). India.

Tonga (**Dolichos lablab**). India.

Velvet (**Mucuna pruriens**). ? Southern Asia or Malaysia.

Lentil (**Lens esculenta**). South-east Asia.

Pea (**Pisum sativum**). Southern Europe.

Pea, Chick (**Cicer arietinum**). Southern Europe.

Peanut (**Arachis hypogaea**). South America.

Soybean (**Glycine max**). Southern Asia or Malaysia.

- (ii) a legume or pod of **Caesalpiniaceae**.

Carob Bean (**Ceratonia siliqua**). Syria.

Honeylocust (**Gleditsia triacanthus**). Humid eastern USA.

Tamarind (**Tamarindus indica**). ? Tropical Africa, southern Asia.

- (iii) Capsule.

Okra (**Hibiscus esculentus**. Fam. **Malvaceae**). Tropical Africa.

- (iv) Follicle.

Macadamia (**Macadamia intergrifolia** and **M. tetraphylla**. Fam. **Proteaceae**). South-east Queensland.

- (v) Nut (or, as the coconut, nut-like).

Coconut (**Cocos nucifera**. Fam. **Palmae**). Melanesia.

Barcelona, Filbert (**Corylus avellana**, **C. maxima**. Fam. **Corylaceae**). Europe, western Asia.

Chestnut, european (**Castanea sativa**. Fam. **Fagaceae**). Southern Europe, North Africa, western Asia.

I. Fruit simple.

B. Succulent or fleshy

(i) Berry.

Avocado (**Persea americana**. Fam. **Lauraceae**). Tropical Central America, West Indies.

Banana (**Musa** spp. Fam. **Musaceae**) Malaysia, Islands of the Pacific, and Indian Ocean. Usually referable to either **M. paradisiaca** var. **sapientum** or **M. nana**. Plantain, a var. of **M. paradisiaca**, used for cooking. The cultivated fruits are parthenocarpic.

Bilimbi, Cucumber Tree (**Averrhoa bilimbi**. Fam. **Averrhoaceae**). India, Malaysia.

Capsicum, Pepper (**Capsicum frutescens**. Fam. **Solanaceae**). Tropical America, West Indies. Includes Paprika (var. **grossum**) Sweet Pepper; (var. **longum**) Chilli, Red Pepper, Cayenne.

Currents, Black (**Ribes nigrum**. Fam. **Grossulariaceae**). ? origin.

Currents, Red (**Ribes rubrum**). ? origin.

Egg Fruit (**Lucuma nervosa**. Fam. **Sapotaceae**). North and South America.

Egg Plant (**Solanum melongena**. Fam. **Solanaceae**). India.

Five Corner, Carambola (**Averrhoa carambola**. Fam. **Averrhoaceae**). ? Malaysia, India.

Gooseberry (**Ribes grossularia**. Fam. **Grossulariaceae**).

Grape, European or Wine (**Vitis vinifera**. Fam. **Vitaceae**). Western Asia. When dried, raisins, sultanas, currants.

Guava (**Psidium guajava**. Fam. **Myrtaceae**). Tropical America.

Mangosteen (**Garcinia mangostana**. Fam. **Guttiferae**). Malaysia.

Pawpaw (**Carica papaya**. Fam. **Caricaceae**). Central America, West Indies.

Passion Fruit (Fam. **Passifloraceae**). Tropical America.

Bell Apple, Yellow Granadilla (**Passiflora laurifolia**).

Granadilla (**P. quadrangularis**).

Golden Passion Fruit (**P. edulis** forma **flavicarpa**).

Purple Passion Fruit (**P. edulis**).

Persimmon (**Diospyros kaki**. Fam. **Ebenaceae**). China, Japan.

Pomegranate (**Punica granatum**. Fam. **Punicaceae**). Southern Asia.

Rose Apple (**Syzygium jambosa**. Fam. **Myrtaceae**). Indonesia.

Sapodilla (**Achras sapota**. Fam. **Sapotaceae**). Tropical America.

Star Apple (**Chrysophyllum cainito**. Fam. **Sapotaceae**). Tropical America.

Tomato (**Lycopersicon lycopersicon** (Syn. **L. esculentum**). Fam. **Solanaceae**). Western South America.

Tree Tomato (**Cyphomandra betacea**. Fam. **Solanaceae**). Peru.

(ii) Fruit a drupe

For some the seed or kernel is known as a 'nut'.

Almond (**Prunus amygdalus**. Fam. **Rosaceae**). Eastern Mediterranean, ? Asia.

Brazil Nut (**Bertholletia excelsa**. Fam. **Lacynidaceae**). Northern Brazil.

Cashew (**Anacardium occidentale**. Fam. **Anacardiaceae**). Tropical America. The fruit is borne on a swollen and enlarged receptacle, the 'apple'.

Date (**Phoenix dactylifera**. Fam. **Palmae**). ? North Africa.

Litchi (**Litchi chinensis**. Fam. **Sapindaceae**). China.

Mango (**Mangifera indica**. Fam. **Anacardiaceae**). Southern Asia. The seed may be mono- or poly-embryonic.

Olive (**Olea europaea**. Fam. **Oleaceae**). Asia Minor, North Africa.

Pecan (**Carya illinoensis**. Fam. **Juglandaceae**). South-east USA to Mexico.

Vi Apple, Hog Plum (**Spondias cytherea**. Fam. **Anacardiaceae**). Polynesia.

Walnut (**Juglans regia**. Fam. **Juglandaceae**). South-east Europe to China. The fruit known also as a tryma.

(iii) Stone Fruit. All of **Rosaceae**.

Apricot (**Prunus armeniaca**). ? Western China..

Cherry, Sour (**P. avium**). ? Northern India, Iran.
 Cherry, Sweet (**P. cerasus**). ? Northern India, Iran.
 Nectarine (**P. persica** var. **nectarina**). ? Caucasus.
 Peach (**P. persica**). China.
 Plum.
 Cherry, Myrobalan (**P. cerasifera**). South-west Asia.
 Damson (**P. insititia**).
 European (**P. domestica**). ? Iran. When dried, prune.
 Japanese (**P. salicina**). China, Japan.

- (iv) The fruit a Pepo. Known as a gourd, usually classed as a vegetable. All of **Curcubitaceae**. Strictly as an accessory fruit.
 Choko (**Sechium edule**). Tropical America.
 Cucumber (**Cucumis sativus**). Southern Asia. When young, the source of the gherkin.
 Marrow or Squash (**Cucurbita maxima**). ? South America.
 Pumpkin (**Cucurbita pepo**). ? America.
 Pumpkin, Crooked-Necked, Gramma, Bugle (**Cucurbita moschata**). ? Central America.
 Rockmelon (**Cucumis melo**). ? Southern Asia.
 Snake Gourd, Guada Bean (**Trichosanthes anguina**). India.
 Watermelon, Jam Melon, Citron (**Citrullus vulgaris**). Tropical Africa.
- (v) A pome of **Rosaceae**. Strictly an accessory fruit.
 Apple (**Malus x domestica**, the hybrid of **M. sylvestris** with **M. pumila**). Western Asia.
 Loquat (**Eriobotrya japonica**). China, Japan.
 Pear (**Pyrus communis**). Eurasia, or northern Iran.
 Quince (**Cydonia oblonga**). Western Asia, ? northern Iran.
- (vi) A hesperidium of **Rutaceae**. The citrus crops. Mainly south-east Asia.
 Citron (**Citrus medica**).
 Grapefruit (**C. paradisi**). West Indies.
 Kumquat (**Fortunella margarita**. oval: **F. japonica**, round).
 Lemon (**Citrus limon**).
 Lime (**C. aurantifolia**).
 Mandarin (**C. reticulata**).
 Orange,
 Sweet (**C. sinensis**).
 Sour or Seville (**C. aurantium**). S.E. Asia.
 Trifoliate, Deciduous (**Poncirus trifoliata**). Used as a rootstock.
 Shaddock (**Citrus grandis**, many hybrids of). S.E. Asia, Malaysia.

II. Fruit compound.

- (i) Accessory (Composite). See also Pepo, Pome above.
 Cape Gooseberry (**Physalis perubiana**. Fam. **Solanaceae**). Tropical America. A berry enclosed by a husk-like inflated calyx.
- (ii) Accessory aggregate.
 Fig (**Ficus carica**. Fam. **Moraceae**). Southern Arabia. Fruit an aggregate of achenes enclosed by an enlarged hollow receptacle, sometimes known as a synoconium. May also be parthenocarpic.
 Strawberry (hybrids of **Fragaria vesca**, **chiloensis**, **virginiana**. Fam. **Rosaceae**). Northern hemisphere. An aggregate of achenes embedded in a fleshy receptacle.
- (iii) Aggregate.
 Examples all of **Rosaceae**, the fruit composed of a number of small drupes (drupelets or drupels) borne on a receptacle.
 Blackberry (probably derived from **Rubus vulgaris**).
 Loganberry (**Rubus ursinus** var. **loganbaccus**, probably a mutation, or a hybrid of a blackberry with a raspberry).

Raspberry,
 Red (**Rubus idaeus**). Europe.
 Black (**R. occidentalis**). Eastern North America. Australian raspberries include **R. parvifolius** and **R. rosifolius**.

(iv) Multiple.

Excepting **Monstera**, the examples are formed from a number of baccate (berry-like) fruits developed from separate flowers and accessory in persistent sepals and bracts, the structure known as a **syncarpium** or (rarely) a sorosis.

Breadfruit (**Artocarpus altilis**. Fam. **Moraceae**). Polynesia.

Cherimoya (**Annona cherimola**. Fam. **Annonaceae**). Tropical America.

Custard Apple (**Annona reticulata**). Tropical America. Sugar Apple (**Annona squamosa**) also may be known in Australia.

Jack Fruit (**Artocarpus heterophyllus**. Fam. **Moraceae**). India.

Monstera (**Monstera deliciosa**. Fam. **Araceae**). Mexico, Central America. In Australia, the plant used much more as an ornamental. The 'fruit' is an aggregation in a cone-like mass of unenclosed baccate true fruits.

Mulberry, Black (**Morus nigra**. Fam. **Moraceae**). Asia Minor, Iran

Pineapple (**Ananas comosus**. Fam. **Bromeliaceae**). Tropical America.

FRUITING BODY: of a fungus, the sexually reproductive structure.

frut(ex) L.: as in **frutescens**, a bush, a shrub.

fruticetorum L.: a place of shrubs, a thicket or scrub.

fruticos(us) L.: as in **fruticose**, bushy.

fucat(us) L.: painted, coloured.

fuc(us) L.: as in **fucivorous**, an alga (hence of an organism when feeding on seaweed).

fugi(ens) L.: as in **centrifugal**, **calcifuge**, avoiding, moving away from.

fulge(o) L.: as in **fulgens**, to glitter, to shine.

fulig(o) L.: as in **fuliginosus**, **fuliginous**, soot (hence with the texture or colour of soot).

fulv(us) L.: tawny, yellowish-brown.

fume(us), fumid(us), fumos(us) L.: smoky.

FUNGUS: (plural fungi) a plant of simple organization but with well-defined nucleus and genetic system, reproducing sexually by spores or asexually by spores, fragmentation, fission, or budding, obligate to a saprophytic or parasitic mode of nutrition by an absence of light-fixing pigment (i.e. heterotrophic), mainly aerobic and soil-dwelling.

Because of its saprophytic or parasitic nature, the fungus in relation to the biosphere is of fundamental importance. On one hand its role in breaking down organic waste is essential in maintaining the balance of environmental factors essential to life. Through the conversion of waste (aided by bacteria), the humus of soil and the carbon dioxide content of the atmosphere are sustained. Associated with an alga to form a lichen, it may be a primary coloniser of a rock surface as the first stage of soil formation. Through an association (a mycorrhiza) with roots of vascular plants, a mutually beneficial nutrient-exchange system appears to be established for at least a number of plants. When parasitic, however, destruction of living organisms reaches alarming levels. Although in relative minority, the various moulds, mildews, blights, anthracnoses, rusts and smuts, and the agents of damping-off, wood-rot, and other decay present problems in the establishment of economic crops and storage of their products. To a lesser extent, the fungus is pathogenic to animals, e.g. as an agent of dermatomycosis, pneumomycosis, otomycosis, certain sometimes fatal deep mycoses as cryptococcosis, various lesions and allergic complaints of the higher animals

including man.

To industry, the fungus has a diverse utility, e.g. in fermentation including brewing, wine-making and distilling, in the making of bread and cheese, the production of alcohols. To pharmacology it is the source of certain antibiotics (e.g. the aspergillins, penicillins, citrinin), vitamins (e.g. riboflavin, biotin, thiamin), organic acids (e.g. citric, gallic, gluconic), enzymes (e.g. invertase, amylase, pectinase, and the cellulose digesting enzyme systems). Several mushrooms, morels and truffles, and yeasts provide foods, the yeasts especially have been considered sources of fats. An ability to synthesise protein from carbohydrate and inorganic nitrogen has suggested a possible means of converting rice and other available carbohydrate sources of protein-starved populations. As a biological tool, the fungus receives wide application in techniques concerning biosynthesis, genetics, physiology.

Classification. The true position of the fungus in the Plant kingdom and its affinity with the bacterium remain inconclusively answered. Its evolution and inter-relationships are unknowns, although a polyphyletic origin appears most probable. Modern treatments recognise a division, **Mycota**, which includes two subdivisions **Myxomycotina** (slime moulds) and **Eumycotina** (true fungi). The following brief sketch is given to illustrate the gross features of the major groups.

The **slime moulds** (Class **Myxomycetes**). Vegetative (somatic) phase a usually coloured **plasmodium** (i.e. a multi-nucleate protoplast enclosed by an ultra-thin flexible membrane) motile by a creeping and flowing (amoeboid) movement. Nutrition phagocytic, hence the group sometimes considered with the **Protozoa** of the animal kingdom. When mature and under certain environmental conditions, the plasmodium is converted wholly to usually coloured intricately-designed fruiting-bodies (**sporangia**) within which meiotic division initiates the formation of a number of haploid, thick-walled, non-motile resistant spores. Each spore germinates to an amoeboid cell, either a non-motile **myxamoeba** or a uni- or bi-flagellate **swarm-cell**, nutritionally phagocytic. Fusion of two myxamoebae or two swarm-cells (which eventually lose flagella) results in a diploid **zygote** which, by repeated mitotic division, forms a diploid multinucleate plasmodium. Under unfavourable environmental conditions, survival is possible by the conversion of the plasmodium to a hardened resting-body, a **sclerotium**.

A majority of myxomycetes (sub-class **Myxogastromycetidae**) formed spores fully enclosed by the outer wall (**peridium**) of the sporangium but a small group (sub-class **Ceratiomyxomycetidae**) of a single genus **Ceratiomyxa** of one or two species bear spores unenclosed by a common wall. Members of the class are world-wide in distribution, mainly associated with decomposing plant material under moist conditions. The peridium of the Australia-occurring **Physarum**, **Fuligo**, **Didymium** is calcareous.

Other slime moulds. Two orders of uncertain affinity also are known as slime moulds. These are the **Acrasiales** (the cellular slime moulds) and the **Labryinthulales** (the net slim moulds). the somatic phase of the former is a free-living myxamoebae which is converted to a fruiting-body (**sorocarp**) consisting of, when simple, a stalk which carries at its tip the spores in a group. The cellular slime mould are soil-dweller, bacteria-feeding, perhaps with greater affinity with the **Protozoa**. The most widespread genus is **Polysphondylium**.

The somatic phase of the net slime mould is a simple oval or spindle-like amoeboid cell which secretes a mucus. This mucus forms a filament which, in contact with others formed in the same way, fashions the net along which division of the cells occurs. Most are marine or fresh-water saprophytes of phagocytes apparently confined to the northern hemisphere, e.g. **Labyrinthula**.

The True Fungi (Eumycotina). The thallus varies from a single cell (e.g. the yeasts) to a multicellular, branched, filamentous mass (a mycelium of hyphae) developing a sometimes conspicuous fruiting-body (e.g. the mushrooms and bracket fungi). The cell wall often has the polysaccharide **chitin** the main component, usually with some cellulose and sometimes with **calose**. Nutrition is by direct absorption of part of the substrate made soluble by a previous outflow of enzymes through the cell wall when saprophytic, but when parasitic usually absorbing directly through the cell wall of the host (or from its protoplast when penetrating the wall), often producing absorbing outgrowths (**haustoria**) from the hyphae which invade a host's tissue.

Spores borne asexually are produced within sporangia (the spores then **sporangiospores**) or at the ends or sides of hyphae (the spores then **conidia**). Sexual reproduction involves essentially the union of two protoplasts (**plasmogamy**) with haploid nuclei, fusion of the two nuclei (**karyogamy**) to form a diploid **zygote** nucleus, meiotic division of the zygote and restoration of the haploid condition in the four daughter nuclei resultant of the division. When terrestrial, spores are dispersed chiefly through air-currents and animal carriers. Their germination (when hypha-forming) is by production of a tube-like outgrowth (a **germ-tube**) which elongates to a filament (a **hypha**).

Differentiation of the 9,000 odd genera is based on the reproductive stage.

I. **The sporangium fungi.** Three groups representing the traditional **Phycomycetes**, a class now in disfavour because of its heterogenous nature. The first group appears to provide a link with the slime moulds but its true position is unsettled. The second and third groups represent sub-classes **Oomycetidae** and **Zygomycetidae**, the latter accepted as a natural group (and given by some the status of a class). The **Oomycetidae** are separated into orders on the basis of the type of flagellum, but these orders appear as classes in some recent classifications.

i. **Plasmodial endoparasites.** Vegetative phase a plasmodium developed within the host. Asexually reproductive by either motile spores (**zoospores**) formed within motile sporangia (**zoosporangia**) or by cleavage of the plasmodium into resting-spores which germinate to swarm-cells. Both swarm-cells and zoospores (as is the case of the swarm-cells of the biflagellate **Myxomycetes**) with two unequal flagella of whiplash type produced at the fore (anterior) end of the cell, but differ from the myxomycetes in that no fruiting-bodies are formed for the production of resting-spores. Obligate endoparasites of vascular plants, algae and fungi, causing excessive development (hypertrophy) of tissues or cells, e.g. **Plasmodiophora brassicae** causing club rot of **Brassica** spp., **Spongospora subterranea** causing scab of potatoes. A single order and family. Order **Plasmodiophorales**.

ii. **Chytrids, water moulds, downy mildews, white rusts.**

Thallus coenocytic, a single cell or a pseudo or true mycelium. Asexually reproductive by zoospores formed within motile or non-motile sporangia. When the case, sexually reproductive by fusion of like (isogamous) or, more commonly, unlike (anisogamous) flagellate gametes (**planogametes**), by fusion of a motile gamete (**antherozoid** or **sperm**) with a non-motile egg (**oosphere**) to form a usually thick-walled resting spore (an **oospore**) or by contact of two gametangia, the nucleus of one migrating to and fusing with the nucleus of the other.

A. Zoospores and planogametes uniflagellate, the flagellum produced from the after (posterior) end of the cell and of whiplash type.

(i) Thallus unicellular or produced to a branched filamentous anchoring and absorbing system of rhizoids or, when more advanced, the system resembling a true mycelium. i.e. forming a **rhizomycelium**. Where known, sexual reproduction by a variety of methods but resulting in a resting spore or a thick-walled resistant sporangium. Habitat aquatic or of soil, several parasitic on vascular plants, e.g. **Physoderma zeaemaydis** causing Brown Spot of maize, **Synchytrium endobioticum** causing hyperplasia (warting) of potatoes. The chytrids. Order **Chytridiales**.

(ii) Thallus a true mycelium. Sexual reproduction where known by fusion of planogametes: resistant sporangia formed. Aquatic or of soil. (**Allomyces**, **Blastocladia**, etc.). Order **Blastocladiiales**.

(iii) Thallus a true mycelium. Sexual reproduction by fusion of a sperm with a non-motile egg to form a thick-walled **oospore**; no resistant sporangia being formed. Mostly aquatic. (**Gonapodya**, **Monoblepharis** etc.). Order **Monoblepharidales**.

B. Zoospores uniflagellate, the flagellum produced from the fore end of the cell, of tinsel type. Sexual reproduction not known with certainty. Members, though few in numbers, diverse

and with features of other orders. Fresh water or marine. (**Hyphochytrium**, **Rhizidiomyces**, etc.). Order **Hyphochytrium**.

C. Zoospores biflagellate, one flagellum directed backwards and of whiplash type, the other directed forwards and of tinsel type.

(i) Thallus unicellular or filamentous. When unicellular wholly converted, and when filamentous the filament divided by septa into cells some or all converted, to sporangia or gametangia (i.e. the thallus holocarpic). Sexually reproductive by union (sometimes through a conjugation tube of gametangia, usually by the migration and fusion of the male protoplast to and with the female, to form a thick-walled resting spore. Aquatic, parasitic within plant or animal hosts. (**Lagena**, **Lagenidium**, etc). Order **Lagenidiales**.

(ii) Thallus when primitive unicellular and with a rhizoidal system, holocarpic, but for most a well-developed mycelium with a rhizoidal system (holdfast) only part of which is converted for reproduction (i.e. the thallus eucarpic). Cell wall of cellulose. Sexual reproduction by union of gametangia to form oospores (except when primitive), the gametangia (antheridia and oogonia) developed by the same (homothallic) mycelium or by different (heterothallic) mycelia, when homothallic on the same or different hyphae. Soil or water-dwelling saprophytes, or parasites of plants (e.g. **Aphanomyces**) or small animals (e.g. **Saprolegnia** with a species parasitising fish and their roe). The water moulds, some producing conspicuous mycelia. Order **Saprolegniales**.

(iii) Features of the previous order but differing in the septum-like plug of a carbohydrate (identified as cellulin) occurring at constrictions along the hyphae. The few members are saprophytes of soil or water. (**Leptomyces**, **Sapromyces**, etc.). Order **Leptomitales**.

(iv) Mycelium well-developed, often with an absorbing host-penetrating haustorium. Sporangia typically rounded, in the more advanced borne on sporangiophores deciduous at maturity, in some cases germinating directly without formation of zoospores (i.e. the sporangium functioning as a spore) but zoospores formed in most. Sexual reproduction through antheridia and oogonia on the same or different hyphae, the oogonium bearing a single oospore. Aquatic, or of soil and then often pathogenic to vascular plants, e.g. **Pythium debaryanum** a causative of damping-off of seedlings and Root Rot of wheat, **Phytophthora infestans**. Late Blight of potatoes, **P. cinnamomii** Root Rot of conifers, **P. parasitica** Downy Mildew of crucifers, Brown Rot of potatoes, etc., the downy mildews of the family **Peronosporaceae**, obligate parasites including **Plasmophora viticola** infesting grapes, **Peronospora tabacina** Blue Mould of tobacco, **P. trifoliorum** of lucerne and the White Rusts of **Albugo**, e.g. **A. candida** of crucifers. Order **Peronosporales**.

iii. Bread moulds, insect-parasiters.

Thallus a mycelium coenocytic or at first coenocytic but becoming septate producing non-motile asexual spores either from sporangia or as conidia. Sexually reproductive by the complete fusion of two gametangia borne by the same or different mycelia and morphologically identical, the product a resting spore, (**zygospore**).

(i) Mycelium well-developed. Asexual spores aplanospores formed in terminal sporangia or sometimes in reduced sporangia (**sporangioles**) which function as conidia. Rarely without sexual reproduction. Of soil or plant debris, mainly as saprophytes, e.g. **Rhizopus stolonifer** (**R. nigricans**), the common bread mould, used by the fermentation industry of production of fumaric acid, **R. oryzae** for alcohol, and other species for lactic acid. Some, e.g. **Mucor**, **Absidia**, parasitic on other fungi, higher plants, or animals. Order **Mucorales**.

(ii) Mycelium not usually well-developed, at some stage often becoming septate and fragmenting to hyphal bodies. Asexual reproduction by sporangioles functioning as conidia, or by true conidia borne on, and effectively discharged from, conidiophores. Where known, sexual reproduction by fusion of hyphal cells or hyphal bodies to form zygospores; sometimes without fusion but forming morphologically similar **azygospores**. Chiefly parasites of insects, some saprophytic, e.g. the fly fungus **Entomophthora muscae**, a saprophyte of dead flies. **Basidiobolus ranarum** has been isolated from subcutaneous lesions of man. Order **Entomophthorales**.

(iii) Mycelium slender, often forming a host-penetrating haustorium. True conidia formed but not discharged. Sexual reproduction as in previous order. Parasites of lower animals of water or soil. (**Acaulopage**, **Zoopage**, etc.). Order **Zoopagales**.

II. **The sac fungi**. Thallus a single cell, a chain of cells, or (more usually) a septate mycelium, the cell wall of chitin as the main component. Asexual spores conidia (summer spores) borne in conidiophores, but asexual reproduction also may be by fission, budding, fragmentation, or spores other than conidia, none of which is flagellate. Sexual spores **ascospores** formed by fusion of nuclei from an antheridium and the female gametangium, an **ascogonium**, usually in definite number in sac-like **asci** (singular ascus) borne, except when primitive or degenerate, in a fruiting-body, an **ascocarp**.

Mycelium (especially when forming a fruiting-body or sclerotium) sometimes organised into a definite tissue, **prosenchyma** when of open texture, **pseudoparenchyma** when of closed texture, i.e. the hyphae have lost their individual identity.

Unlike the previous groups (usually known as the Lower Fungi) where fusion of male and female nuclei occurs sometime after contact, nuclei of the sac fungi remain in close association without fusion but separately under going several successive divisions to form usually a number of bi-nucleate (**dikaryotic**) cells. Within the mother-cell of the ascus, fusion of nuclei eventually occurs, the resultant (diploid) zygote undergoing meiosis to produce four haploid nuclei. A further division is mitotic so that eight haploid nuclei (typically) are shared equally by eight ascospores produced within the ascus.

Saprophytes and parasites of water, both fresh and salt, soil and a variety of other habitats. Class **Ascomycetes**.

A. Mycelium often absent or poorly developed. No specialised hyphae (ascogenous hyphae) or ascocarps formed. Sub-class **Hemiascomycetidae**.

(i) Ascus arising directly from the zygote formed by the union of two cells, or parthenogenetically from a single cell. Order **Endomycetales**.

The yeasts. To distinguish the yeasts (**Saccharomycetes**) included in this order from those yeasts not known to produce ascospores, the name sporogenous yeasts may be applied. Predominantly unicellular, asexual reproduction is by a process of **budding**, growth of a new cell from an outgrowth of a parent. The daughter cell by contribution at the base may become separate from the parent or itself may share a divided nucleus with an outgrowth of its protoplast which, again by enlargement and constriction, forms a new cell but without separation, the budding process continued so that a chain (sometimes branched) may be developed. A transverse wall may be formed also after division of a nucleus of a parent cell, the fission resulting in two cells, or both fission and budding may occur. The cell so formed is a **blastopore**.

Yeasts are universal in occurrence and of major importance to the fermentation industries (e.g. brewing and baking) from their ability to ferment carbohydrates (e.g. **Saccaromycetes cerevisiae**). Their high content of protein, fats, vitamins of the B group, and the economic nature of their large-scale culture favour the provision of a supplementary food for the human diet.

- (iii) Mycelium developed, the hyphae penetrating the vascular plant on which parasitic. Cells typically binucleate. Asexually reproducing by a process of budding from ascospores to form uninucleate, haploid, yeast-like blastospores. Ascus arising from an ascogenous cell.

A single family and (probably) genus, **Taphrina** with members causing leaf-curl, witches brooms and various malformations of economic plants, e.g. **T. deformans** causing Leaf Curl of stone fruits. Order **Taphrinales**.

- B. The second sub-class **Euscomycetidae** constitute a vastly diverse group with unsettled inter-relationships. For convenience rather than as a taxonomic treatment, four sub-groups (or series) have been presented, the nature of the ascocarp providing the basic distinction.

- (i) **Moulds and powdery mildews**. Asci globular or ovoid, produced at different levels (or in **Erysiphales** in a single basal layer at maturity) and short-lived within the ascocarp, the ascospores released on dissolution or (**Erysiphales**) bursting. Ascocarp without an opening (hence termed a **cleitothecium**) or with a neck-like structure (**ostiole**) terminating in a pore.

Included are some members of form-genera **Aspergillus** (e.g. **Eurotium**, **Satorya**) and **Penicillium** (e.g. **Carpentales**, **Talaromyces**) with known perfect state (see **Deuteromycetes** following). **Ceratocystis** includes many pathogens of economic crops (e.g. **C. paradoxa** causing a disease of pineapples) and causatives of Blue Stain of timber.

The order **Erysiphales** represents a group of powdery mildews often pathogenic to economic plants, e.g. **Erysiphe graminis** of cereals, **Podosphaera leucotricha** of apples, **Unicula necator** of vines, **Sphaerotheca** spp. of several crops. Series **Plectomycetes**.

- (ii) Asci clavate or cylindric, borne in a layer (**hymenium**) lining the base (and often the sides) of the inner wall of the ascocarp, usually persistent. Ascocarp closed by a true wall except for a pore formed by an ostiole through which escape the ascospores (the ascocarp termed a **perithecium**), the neck of the ostiole lined by a fringe of short hair-like structures (**periphyses**).

Two of the orders are of especial interest, one (**Sphaeriales**) of many pathogens of economic crops and ornamental, e.g. **Rosselinia** spp. causing various rots, **Gnomonia** pathogenic on north temperate trees, **Glomerella cingulata** causing Ripe and Target Spot for Apples. The other order, **Hypocreales**, includes **Gibberella fujikuroi** a pathogen of several crops (rice, maize, cotton, etc) and the original source of the growth substances, the gibberellins. **Claviceps purpurea** (order **Clavicipetales**) is a pathogen of cereals and other grasses, and the source of ergot. The larvae-parasitic **Cordyceps** of the same order cause the curious 'vegetable caterpillars' created by the fruiting-bodies arising from the 'consumed' host. Series **Pyrenomycetes**.

- (iii) **Cup fungi, morels and truffles**.

Asci clavate or cylindric, borne in a hymenium of an open (unwalled) ascocarp (an **apothecium**). Ascocarp often highly coloured, of varied shape, and three-layered with a superficial hymenium with asci and paraphyses, an underlying thin layer of interwoven hyphae (a **hypothecium**), and a main supporting fleshy part (**excipulum**). Ascospores released from their asci through an apical pore or a lid-like operculum or a longitudinal slit, in the two latter cases discharged with some force.

The operculate cup fungi of the order **Pezizales** are of interest for their conspicuous cup-like apothecia formed by several of its saprophytic members, e.g. **Morchella** with several species throughout Australia. **Morchella**, and **Tuber** (of the order **Tuberales**) provide the morels and truffles respectively, highly prized in Europe as items of food. The truffles are produced and mature below ground level.

Several plant pathogens are included by the **Helotiales**, e.g. **Diplocarpon earliana** causing Leaf Scorch of strawberries, **Pseudopeziza medicaginis** Leaf Spot of lucerne, **Sclerotinia homeocarpa** Dollar Spot of pastures, **Sclerotinia trifoliorum** Clover Rot. Series **Discomycetes**.

- (iv) Asci clavate, in clusters borne in minute stalked perithecia, short-lived. Thallus usually a simple filament with a basal foot serving as an anchor to the surface of its obligate host, an insect or arachnid. Many widespread members (**Laboulbenia**, **Ceratomyces**, etc.). Series **Laboulbeniomyces**.

- (v) **Bitunicate, stromatic fungi**.

Asci with a double wall (i.e. bitunicate), a rigid outer wall which breaks at maturity below its top to reveal an extended inner wall. Ascospores forcibly ejected through a pore at the apex of the inner wall. Ascocarp an **ascostroma**, i.e. formed within and composed of a cushion-like tissue, a **stroma** within cavities of which are borne the asci.

Within the group are several pathogens of economic plants, e.g. (order **Myriangiales**) **Elsinoe ampelina** Black Spot of vines, **E. fawcettii** citrus scab, **E. venta** anthracnose of berry fruits; (order **Dothideales**) **Mycosphaerella brassicola** Leaf Spot of crucifers, **M. linarum** Pasm of linseed, **M. pinodes** Blight of Peas, **Ophiobolus graminis** Take all of wheat (order **Pleosporales**) **Venturia inaequalis** Black Spot of apples, **V. pirini** Black Spot of pears. Series **Loculoascomycetes**.

- III. **The imperfect fungi**. Sexual reproduction unknown (not observed, or not a faculty of the fungus) but the hyphae septate and (except for a section) with reproduction by conidia, hence either an ascomycete or (more rarely) a basidiomycete. Since the asexual state is known as the imperfect state, the group known as the **Fungi Imperfecti**, of the form-class **Deuteromycetes**. The indicate that the name may be changed when sexual reproduction is observed, the categories are prefixed by the **form**, e.g. form-genus, form-species. This name may still be used when the perfect state becomes known but it implies the conidial state only, e.g. form-genus **Aspergillus** has perfect states referred to genera **Eurotium**, **Emericella**, **Sartorya**. All members of these genera, however, need not have the **Aspergillus** state.

Conidia usually are borne on conidiophores of various forms but in some, arise from a structure, a **pycnidium**, resembling the perithecium of an ascomycete and, in others, the conidiophores may form a closely-packed, cushion-like cluster, often with bristle-like setae (the structure known as an **acervulus**). When conidia are borne by pycnidia, the fungi are referred to form-order **Sphaeropsidales**, a number of its members being important pathogens of economic crops, e.g. **Asochyta**, **Phoma**, **Septoria** causing spotting of several fruits, **Phomopsis citri** melanose of citrus, **Diplodia maydis** rot of maize, **Phoma foveata** gangrene of stored potatoes. Far greater in economic importance is the form-order **Moniliales** (with over 10,000 form-species) covering fungi reproducing by budding (e.g. the 'false yeasts') or by means other than through pycnidia or acervuli.

To the **Moniliales** are assigned fungi of concern to human pathology, e.g. the agents of dermatomycoses (as ringworm, tinea, 'athlete's foot') and deeper mycoses which are sometimes fatal, e.g. cryptococcosis by **Cryptococcus neoformans**, a false yeast which may affect the central nervous system or cause lesions of the lungs. Another 'false yeast' (so-called from a non-production of ascospores) is **Candida albicans** a saprophyte of the mouth which may cause **thrush** and lesions of the mouth and intestines. The form-genera **Aspergillus** and **Penicillium** unassigned to **Plectomycetes** which have received considerable attention for their part in biochemical synthesis, e.g. production of cheese, gluconic acid, various enzymes, antibiotics and conversions of various organic compounds. Some strains are associated with food spoilage and various infections of man and animals, e.g. certain strains of **Aspergillus flavus** associated with peanuts produce powerful toxins (aflatoxins). Of importance as pathogens of economic crops in Australia are the form-genera **Alternaria**, **Botrytis**, **Clasterosporium**, **Cercospora**, **Curvularia**, **Fusarium**, **Helminthosporium**, **Kabatella**, **Nigrospora**, **Polyspora**, **Rhynchosporium**, **Thielaviopsis**, **Verticillium**.

The anthracnose (characterised by localised lesions, necrosis and hyperplasia) of plants are due largely to members of the order **Melanconiales** e.g. **Gloeosporium** and **Collectotrichum** which form conidia in acervuli. **Rhizoctonia** (the soil-dwelling 'damping-off' fungi) and **Sclerotium** (causatives of various roots) are assigned to the **Mycelia sterilia** since there is no known reproductive state, i.e. the thallus alone is known.

- IV. **The basidia fungi.** No gametangia formed (except when primitive or reduced), karyogamy occurring within a typically clavate structure, a **basidium** (plural **basidia**) usually within (in number) a fruiting-body (**basidiocarp**). Basidium originating as a single binucleate septate cell of a hypha, its two nuclei fusing at karyogamy to form a zygote which divides meiotically. Outgrowths, **sterigmata**, singular **sterigma**) typically four in number and appearing as stalked cells projected from the basidium and within which the nuclei (usually a tetrad) of the meiotically-divided zygote migrate. **Basidiospores** arising from these nuclei generally uninucleate haploid cells which, when mature, are forcibly ejected from the sterigmata and dispersed by air currents.

Germination of a basidiospore leading to a septate mycelium of uninucleate cells, a **primary mycelium**. In most, a secondary, and in the higher members, a tertiary mycelium formed, the secondary arising from the primary e.g. by the fusion of two uninucleate cells with independent division of nuclei but without formation of a cross-wall (septum), the cells thus formed binucleate (**dikaryotic**). Commonly at division of a binucleate cell to form two new binucleate cells, a hook-like bridging outgrowth, a **clamp-connection** developed between two nuclei, one of the pairs of daughter nuclei from a divided parent migrating through the clamp-connection. Through this medium, this original parent nuclei are duplicated and distributed within the two new cells.

Tissues (prosenchyma and pseudoparenchyma) commonly formed (fruiting-bodies, sclerotia) as in previous class. Asexual reproduction by budding, fragmentation, or by conidia or other types of spores. Class **Basidiomycetes**.

On the type of basidium developed, the class is subdivided to:

- A. Basidium septate or longitudinally divided, or developed directly from a thick-walled resting spore (**teleutospore**) within which karyogamy occurs, a short tube being produced on which basidiospores are formed. Basidiospores usually germinating to secondary basidiospores.

Jelly fungi, rusts, smuts. Sub-class **Heterobasidiomycetidae**.

- B. Basidium not septate, typically clavate

Mushrooms, toadstools, bracket fungi, puffballs, earth-stars. Sub-class **Homobasidiomycetidae**.

A. Jelly fungi, Rusts, Smuts.

The fruiting-body (**basidiocarp**) may be well-developed (order **Tremellales**) or poorly or not at all developed (**Uredinales**, **Ustilaginales**). The first order is mainly of saprophytes with fruiting-bodies usually gelatinous (hence 'jelly' or 'trembling' fungi) but also waxy or cartilaginous, often coloured. (**Tremella**, **Dacromyces**, **Calocera** etc.).

The teleutospore-forming orders **Uredinales** (the rusts) and **Ustilaginales** (the smuts) have complex life-cycles. The rusts bear spores on sterigmata from which they are forcibly ejected when mature, but spores of smuts are sessile and not ejected. Both are of high importance as pathogens of economic crops, the genera significant to Australian agriculture including the rusts **Puccinia**, **Melampsora**, **Uromyces**, **Phragmidium**, and the smuts **Ustilago**, **Tilletia**, **Urocystis**, **Sphacelotheca**.

- B. Within the **Homobasidiomycetidae** are the most conspicuous and familiar of fungi, conspicuous not so much from their mycelia but from their fruiting-bodies. There are two major groups which differ in the manner of their development of basidia, the **Hymenomycetes** where formed in a layer, a **hymenium**, which may at first be covered by a tissue (**a veil**) but is open during the early formation of the basidiospores, and the **Gasteromycetes** where, in this series, the hymenium is not open, i.e. is enclosed by a **peridium**, the spores freed at the break-down of the fruiting-body. The tissue making up the hymenium-bearing structure is known as a **trama** (plural **tramae**). A

small section (an order **Exobasidiales** of some authors, a family **Exobasidiaceae** of others) has no fruiting-body, the hymenium covering the parasitised tissue of the host (**Exobasidium** spp. causing a galling of **Azalea**, **Rhododendron** and others of the **Ericaceae**).

Of the hymenomycetes, several of **Thelephoraceae** (e.g. the wood-saprophytic **Corticium** and **Peniophora**) have fruiting-bodies with more or less smooth hymenia which resemble patches of paint, but stalked (**stipitate**) and capped (**pileate**) toadstool-like and bracket-like structures are developed in others of the family (e.g. **Stereum**). **Corticium solani** (**Pellicularia lamentosa**) is pathogenic to a number of economic crops and is an agent of 'damping-off' - it has an imperfect state referred to **Rhizoctonia solani**. Other **Corticium** (e.g. **fusi**, **vagum**) are responsible for diseased patches of pastures. **Stereum purpureum** is an agent of wood-rot especially of fruit trees where causing 'Silver-leaf' disease.

Coral fungi. In the **Clavariaceae** (e.g. the soil-dwelling saprophytic **Clavaria**) the fruiting-body is a fleshy club-shaped structure which may branch to a coral-like or cauliflower-like mass. While the hymenium of the previous hymenomycetes is smooth, wrinkled, or more or less roughened, that of the **Hydnaceae** has downward-pointing, spine, wart-, or granule-like projections. Here, the fruiting-bodies may resemble a crust, bracket, toadstool, coral or (e.g. **Odontia**) may form a thin patch. Saporphytes of wood or soil, sometimes edible when fleshy (e.g. **Hydnum**).

Polypores. Again with great diversity in shape of fruiting-bodies the major family of hymenomycetes, **Polyporaceae**, is differentiated by the character of the hymenium which lines the inner surface of pores of tubes. In **Merulius** (usually assigned to a family **Meruliaceae**) it is wax-like or somewhat gelatinous, spread over veins or ridges which form a network of shallow pores. **M. lacrymans**, the agent of 'dry rot' is a well-known destroyer of timber. In the wood-saprophytic bracket-fungi **Daedalina** and **Lentzites**, tubes are formed which divide off plate-like structures which approach the lamella (gill) condition of the family, **Agaricaceae**, following.

As agents of heartwood rot, the polypores are of great concern to forestry. **Fomes** and some **Polyporus** are bracket fungi sometimes forming large woody or corky hoof of plate-like masses on tree-trunks from mycelium deep within the host (e.g. the White Punk of **Polyporus eucalyptorum** recorded with a lateral spread of 45 cm. (18 in.). Other **Polyporus** produce fleshy fruiting-bodies of the toadstool type. A sometimes large sclerotium, hard and horny when dried, are often formed, e.g. 'Blackfellow's Bread', so-called from a questionable source, of **P. myllitae** which may reach 60 cm. (24 in.) and weigh 25 or so lbs. and the false sclerotium (compacted from mycelia and sand) of the Stone-making fungus of the mallee, **P. basilapioides**.

Boletes. A fleshy toadstool is formed by **Boletus** (Fam.: **Boletaceae**) where the hymenium is readily separable from the supporting pileus. The occurrence of highly poisonous members makes the safe eating of the Australian species uncertain. Some, e.g. **B. luteus** found always under or near pines apparently form mycorrhizal associations. Other genera of the family are **Gyroporus**, **Tylopilus**.

Agarics. When the hymenium is inseparable from a fleshy or cartilaginous pileus and is spread over plate-like lamellae (gills), the fungus may be assigned to the **Agaricaceae**. Often the fruiting-body when young is covered by a tissue (**a universal veil**) which is broken away by growth of the pileus but retained at the base of the supporting stipe as a **volva**. The hymenium also may be covered at first by a **partial veil** which later forms a ring or **annulus** around the stipe. **Russula** and **Lactorius** (sometimes assigned to a separate family) differ in the enclosure of spherical cells (**sphaerocysts**) within a brittle pileus which bears a latex.

The agarics (known by the questionably significant names mushrooms and toadstools) mostly are soil-dwelling saprophytes some forming mycorrhizal associations with forest trees. The Honey or Shoe-string Fungus **Armillaria mellea**, which develops root-strangling cord-like rhizomorphs with the ability to spread considerable distances, is very significant to the forester and orchardist as an agent of root-rot. Its stipe bears a definite ring. **Marasmius orades**, does considerable damage to pastures and is noted by the peculiar 'fairy-ring' positioning of its fruiting-bodies.

Amanita is infamous from highly toxic principles contained by some of its species, especially the Angel-of-Death **A. phalloides** (absent from Australia) and the Fly Agaric **A. muscaria** (present)

rapidly acting but of much lower toxicity. A hallucinogenic principle has been isolated from the Fly Agaric and other hallucinogens from other agarics, e.g. of **Psilocybe** spp. **Amanita** may be recognised by the possession of both volva and ring.

The true mushrooms may be referred to **Psalliota**, e.g. the cultivated **P. campestris**, a widely-distributed field mushroom, and **P. arvensis** the coarser Horse Mushroom. Also of interest is the bioluminescent **Pleurotus lampas** frequently found at the base of eucalypts throughout the Commonwealth.

Puff-balls, Stink-Horns, Earth Stars. The gasteromycetes also are saprophytes mainly of soil. The fruiting-body typically has an outer wall (peridium) which opens by rupturing or decay for the release of spores, the inner fertile part is the **gleba** (plural **glebae**).

The nature of the gleba provides a basis for the orders. In the order of stink-horns, **Phallales**, The gleba is gelatinous and is carried upwards on a stalked **receptacle** on break-down of peridium. The name 'stink-horn' refers to the typical horn-like receptacle and the foetid odour from the gleba when exposed and disintegrating for the release of spores. Australian representatives include **Mitinus** and **Phallus**. In others of the order, e.g. **Clathrus**, the receptacle is in the form of a lattice-work basket, in **Lysurus** it is a hollow cylinder from which arise distinct erect arms which bear the glebae, and in **Aseroe** the arms spread horizontally. The receptacle is often of a bright red colour and bears at its base a volva representing the ruptured peridium.

With greater occurrence in Australia is the order **Hymenogasterales** seen above ground only as a mature fruiting-body which is small, more or less globular (e.g. **Hymenogaster**, **Hysterangium**, **Rhizopogon**) or stalked and of various shape (e.g. **Secotium**). The gleba usually is fleshy or waxy and composed of a network of numerous plate-like structures, often borne by a simple or branched stem or columella.

The puff-balls and some earth-stars are included by **Lycoperdales**. The gleba here is powdery and, when mature, is dissolved (autodigested) to leave a mass of spores dispersible ('puffable') by air currents or physical contact. Most of the puffballs occur in **Lycoperdon**. The fruiting-body may be small but may also be large (e.g. **Calvatia gigantea** recorded in Australia up to 40 cm. (16 in.): it may be sessile or stemmed and of various shape. The earth stars, e.g. **Geastrum**, owe their shape to the involucre formed by the ruptured peridium around the globular stemmed or sessile 'puff-ball'.

Two other puff-ball genera, **Scleroderma** and **Pisolithus** are included by the **Sclerodermatales** typified by a peridium thick and hard, and a hymenium of poor organization. In the final order **Nidulariales**, a cup-like fruiting-body is hollow when mature, lined inside by a number of lens-shaped structures, **peridioles**, within which are the basidiospores, e.g. the Bird's Nest Fungi of **Crucibulum** and **Cyathus**. Also occurring in Australia and of the same order is **Sphaerobolus** with minute, spherical fruiting-body containing a single peridiole, which is dehiscence with force by an elastic mechanism of the ruptured peridium.

FUNICLE: of an ovule or seed, a supporting attachment.

funicul(us) L.: as in **funicularis**, **funiculosus**, the diminutive of **funis** (hence cord or string-like).

funi(s) L.: a cord, rope.

furc(a) L.: as in **furcate**, a two-pronged fork.

furcos(us) L.: forked.

furfur L.: as in **furfuraceous**, bran (hence covered by bran-like scales; scurfy).

fusc(us) L.: dusky; blackish.

fuscolute(us) L.: blackish-yellow.

FUSIFORM: of a structure when circular in cross-section, broadest at the middle and tapered evenly to both ends. From L.: **fus(us)**, a spindle (hence spindle-shaped).

Gk.: Greek, the language, transliterated to Latin.

gala Gk.: as in **polygala**, **galactia**, milk.

galban(us) L.: yellowish; greenish-yellow.

GALEATE: bearing a helmet-like structure. From L.: **galea**, a helmet.

GALL: an abnormal growth from a meristem resulting in an aborted organ or organ-like structure or a conspicuous swelling of a part, as, e.g. the organoid galls of coccid-infested eucalypts and acacias, the bulbous stem of citrus infested by the cynipid wasp. In addition to parasitism, agencies may be nutritional or hormonal disturbances. When parasitism is the agency, (e.g. the feeding of the larvae of coccids), it is conceivable that a secretion from the insect either causes an over-stimulation of growth substance controlling the development of tissue, or the secretion itself acts as a growth stimulant. In such cases, the gall becomes an integral part of the insect's life history. Other galling may concern the conversion of structural parts, e.g. stamens and carpels to petal-like parts.

A feature of the organoid type of gall is a frequent high content of tannin, e.g. the 'nutgalls' of oak **Quercus** spp. with from 50 to 70 percent tannins and 2 to 4 percent gallic acid are items of commerce.

GAMETANGIUM: a structure (sometimes a mother-cell) within which are produced gametes, i.e. within which occurs gametogenesis.

GAMETE: a reproductive cell or nucleus and its essential cytoplasm which, as fertilization, fuses with its complement to form a zygote, the first cell of the new individual.

GAMETOPHYTE: the gamete-forming phase of an organism with an alternation of generations, normally arising from a haploid cell resultant from meiosis of a diploid sporophyte, e.g. of an angiosperm, an embryo, sac, the male pollen tube and the cells enclosed within.

gamo(s) Gk.: as in **gamosepalous**, **gamopetalous**, united.

GAMOTROPIC: relative to a turning towards to unite, or mutual attraction, of gametes.

gast(er) Gk.: as in **gastrolobium**, a stomach (hence with an inflated pod).

GATE: in one sense applied to a broad low gap in the land of high relief, e.g. the chief depressions of the Eastern Highlands of New South Wales are the Cassilis Gate and the Lake George Gate.

ge Gk.: as in **geology**, the planet, Earth.

geito(n) Gk.: a neighbour.

GEITONOGAMIC: of pollination when transference of pollen-grain is made from one flower to another of the same plant.

GEL: see under colloid.

GELATINOUS: with the consistency of jelly.

gelat(us) L.: jellied; frozen.

gelid(us) L.: cold.

GEMINATE: occurring in pairs.

GEMMA (plural gemmae): in general, a bud. See also under bryophyte.

GENERIC NAME: the name give to a group at the level of a genus. Although its derivation is arbitrary, it is constructed preferable in agreement with the Latin. Grammatically a substantive (noun) in the singular number, e.g. **Eucalyptus** is the dominant group of hardwood trees in Australia. With a qualifying epithet, forms the binomial indicating the name of a species, e.g. generic name **Eucalyptus**, specific epithet **crebra**, specific name **Eucalyptus crebra**.

In context, a plural may be formed from a generic name either by use of a suitable suffix to the Latinised name, e.g. the **Angophorae** from **Angophora**, the **Eucalypti** from **Eucalyptus**, the **Leptospermia** from **Leptospermum**, or as a vernacular name not italicised, e.g. the angophoras, the eucalypts, the leptospermums.

An intrageneric name is a combination of a generic name and a subdivisional epithet connected by the name of the category, the epithet being either of the same form as the generic name, or as a plural adjective agreeing in gender with the generic name and written with an initial capital letter. The substantive (in singular number) applies particularly to a subgenus or section, e.g. **Hymenophyllum** subgenus **Craspedophyllum**, the plural adjective to a subsection or lower rank, e.g. **Eucalyptus** series **Siderophloia**.

-gen, -genic, genous: as in **pathogen**, a producer of; **pathogenic**, producing; **nitrogenous**, yielding; **homogenous**, of a race of kind.

GENE: the hypothetical unit of inheritance, or hereditary factor, a self-duplicating structural unit (not necessarily the ultimate unit) of a chromosome, occurring in the linear series definable as a regular pattern, recognised by its constant effect on an individual for a particular character, remaining relatively unchanged through successive cell-divisions, occasionally changing in structure (mutating) and producing a variable change in progeny receiving the mutation. The function of the gene is conceived as a control for the type of enzyme produced in space and time, the specificity of this enzyme for a particular biosynthesis having a fundamental influence on differentiation of the cell. From Gk. **genos**, descent. See also chromosome, mutation, nucleic acid, plasmagene.

GENECOLOGY: a phase of ecology concerned with the relationships existing between the genetic structure of populations and their environments.

GENE POOL: the total of genes available for exchange within a population of freely interbreeding members.

GENERATIVE: concerned in reproduction.

GENERIC: relative to a genus.

GENESIS: the development of a cell, tissue, organ, organism or its species.

GENETIC: relative to, or to the factors of, heredity and inheritance.

GENETIC DRIFT: a random variation within isolated populations of limited number of individuals, not attributable to selection.

GENETICS: the science of the causes and effects of inheritance and variation, and the factors determining similarities and differences among individuals related by descent.

GENICULATE: bent sharply; like a knee-joint.

genitalis L.: genital; freely reproducing.

GENOME: of an organism, a complete set of chromosomes considered as a unit.

geno(s) Gk.: as in **homogenous**, a race (hence of a like kind, e.g. by descent from a common stock).

GENOTYPE: the genetic constitution of an individual, fixed except under certain conditions (e.g. mutation), expressed visibly and modified by the environment as the phenotype.

GENUS: a classification, a category above the level of a species but below the level of a family. A group of species linked by genotypic and phenotypic similarities, or a single species with no known affinity with other species.

geo- Gk.: as in **geology**, of the earth (hence the science of the evolution, structure and constitution of the planet Earth and the processes and forces operating to bring about structural changes and the composition of its crust).

GEOCARPIC: bearing fruit which matures underground, as the peanut (groundnut) of **Arachis hypogaea** and the Earth Cress of Australia **Geococcus pusillus**.

GEOLOGICAL TIME: the time covering the development of the planet Earth the present. Through the combined techniques of the physical sciences, a reasonable estimate is possible of the minimum age - this estimate is in the order of 4,500 million years. The first fossils represent a pre-600 million years age (i.e. are from the Pre-Cambrian Era) and are of organisms of fairly complex nature - blue-green algae, aquatic fungi, and primitive animals of the sponges and coelenterates.

Again from the aspect of life's evolution, it is convenient to divide the post-600 million years to units of a time-scale. The primary units of the accepted time-scale are **eras**, each era representing an evolutionary stage in the life of animals (hence the suffix **-zoic**). On the basis of the stratification of fossil-yielding rocks, eras are divided into **periods**, the name derived from either the locality or a feature associated with the locality where first recognised. For convenience, the periods may be divided to Early, Middle, Late or to the corresponding Lower, Middle, Upper sub-units. For finer time-span, periods may be divided to epochs, and epochs to stages. The immensity of the time factor may be demonstrated by the compression of the earth's history to a single year, its origin being January 1st. Within this 'year', the history of many would be recorded for the final forty seconds before midnight, December 31st. (Rhodes, 1962).

With the emphasis on the development of Australia's land flora, where known, the following events are given very briefly for the periods of time, together with the age and duration in millions of years. Such events largely are the interpretations from fossil pollen and plant parts (vegetative and reproductive) fossilised or petrified. There are large gaps in the palaeobotany of Australia, however.

Cambrian (600; 110). Climate in general warm and uniform. Fossils abundant of marine invertebrates (e.g. the arthropod trilobite) and algae. Fossiliferous limestones at great depth (the coral reefs of **Archaeocyathinae** fossils) indicate an east-west isolation by an inland sea through the continent.

Ordovician to Devonian (490 to 400: 140). Climate semi-arid in later stages but with heavy seasonal rain. First records of terrestrial plants (e.g. psilopsids), some with tree habit (lepidodendrids) forming forests, fish and land animals.

Carboniferous (350: 80). Development of the seed-ferns (pteridosperms) and forests of lycopsids and ferns widespread in marshes. Early in the period large araucarian-like cordaites (**Cordaitales**) followed by the earliest-known conifers with features resembling those of **Araucaria excelsa**.

Permian (270: 50). Climate from temperate/sub-tropical to arid but with recurrent glaciation. Disappearance of most of the tree-like lycopsids and ferns (except tree-ferns), psilopsids and lepidodendrids. Appearance of the **Ginkgoales** in Asia. In Australia conditions favourable for the formation of coal.

Triassic and Jurassic (220 to 180: 85). Development of conifers, and, although true origin unknown, the cycadioids, the ancestors of cycads. Some evidence from the Middle Triassic of the first angiosperms but it is possible their true origin is in the former era (the **Palaeozoic**). Rise of the mammoth reptiles, earliest records of birds and pterodactyls, and mammals in the **Jurassic**. In

Australia, vast fresh-water lakes in the east. Up until close of period, land migration between Asia and the continent appears possible.

Cretaceous (135: 77). Climate at first warm-temperate, becoming colder and ending in a glacial period which decimated the reptiles but did not diminish the dominance of the angiosperms. Rise of the primitive mammals. Much of Central Australia inundated by marine invasions which divided the continent to two or three islands.

Tertiary Era (58 to 12: 57). Mildly warm during greater part, humid early but oscillating between sub-tropical and arid at close. Peneplanation of Australia during greater part but at close, epeirogenetic earth movements effecting uplift in south-east (Dividing Range, Mount Lofty-Flinders Range) and formation of Gulf region of South Australia. Large deposits of limestone by marine inundation from the Great Bight. By fall in sea-level, New Guinea (part of the continental shelf) in land contact with the continent. Change in vegetation from the cycad and conifer/**Nothofagus** forests to grasslands of the inland plains. From evidence of the *Cinnamomum* Flora, a pan-continental mesic flora is indicated in addition to a sclerophyllous one (e.g. fossils referred to **Eucalyptus** and **Acacia**. Mammals now prominent.

Quaternary Era (1: 1). **Pleistocene**: marked oscillations in temperature and rainfall but evidence suggests that the great desert of Australia, originating probably from the Tertiary, was always present. Ice sheets formed during the severe glacial periods now restricted to the Australian Alps and the western half of Tasmania. Minor vulcanism in the south-east and east, elsewhere continual erosion and sifting. No mountains formed. Sea-level changes on at least two occasions connect again New Guinea with the mainland.

Recent: marked by widespread aridity, apparently quite abruptly. Elimination of the giant marsupials and much of the flora. Retraction of the surviving flora to more favourable locations. Again the isolation of the east from the west of the mainland but this time by desert. Eventual stabilisation and expansion of flora to the evidence of today.

GEOSYNCLINE: see under Folding.

GEOTROPIC: of growth when responding to the earth's gravitational pull, **positive** when turning towards (e.g. as most roots), or **negative** when turning away (e.g. as erect shoots). See also diageotropic.

ger(o) L.: as in **setigera**, **setigerous**, to bear; to carry.

germ(en) L.: as in **germinal**, a bud (hence relative to reproduction or to a reproductive structure).

GERMICIDE: an agent lethal to bacteria but not necessarily destroying their spores.

GERMINATION: the phase of development which follows the embryonic stage (e.g. as a seed) and promotes utilization of the external environment (e.g. as a seedling). Applied also to the production by a pollen-grain of a tube when contacting a stigma receptive to it, and to the spore of a bacterium or fungus when changing from the resting state to the vegetative state, e.g. by the shedding of absorption of its external wall, or by the production of a germ-tube.

-geton Gk.: as in **potamogeton**, neighbouring (hence neighbouring a river or stream).

GIBBERELLIN: a growth substance (phytohormone) originally derived from the Ascomycete **Gibberella fujikuroi**, a causative of a rice disease in Japan. From this fungus and from several higher plants, other substances (gibberellins) with the common basic compound gibberellic acid have been purified. the influence of these compounds concerns stem elongation and flowering, their application to a number of plants also has been found to effect a positive influence. See also under phytohormone.

GIBBER PLAIN: a flat tract of desert land in arid regions of the continent over which occur numerous large stones (or gibbers). A feature of the Great Plateau of the Australian Shield, the significance of which is not yet determined.

GIBBOUS: of a corolla or calyx when spurred, the spur projecting into a small swelling. **Bigibbous** when there are two swellings, as in **Dendrobium bigibbum**.

gigante(us) L.: of unusual height (gigantic) or very large.

gigas L.: a giant. The prefix **giga-** represents one billion, i.e. 1×10^9 .

GILGAI: a natural soil formation of extensive occurrence in inland Australia where the surface is markedly undulating and, in some cases, presents a series of puffy mounds and depressions. A probable cause is the alternation of swelling and cracking of clay during periods of wet and dry conditions. Sometimes also known as 'crab hole'.

glab(er) L.: without hair; smooth-surfaced. **glabell(us)**, the diminutive, i.e. somewhat smooth almost hairless.

GLABRATE: with a covering of non-persistent, or very sparse, hairs.

GLABROUS: without hair or similar covering.

glacialis L.: of ice; icy. **glacies** L.: ice.

gladi (us) L.: a sword.

GLAND: in general, a small protuberance. Of a tissue, a single cell or group of cells, a cavity formed by the break-down or spatial movement of cells, or the tip of a hair, functioning as a reservoir of certain secretions. See also lysigenous, schizogenous.

GLAUDESCENT: becoming bluish-grey or glaucous.

glauc(us) L.: bluish-grey.

GLAUCOUS: of a surface (e.g. of a leaf) when reflecting a white, pale-blue, or greyish-green colour or sheen given by, e.g. a covering of finely-divided particles of wax or by a structure which disperses (through reflection and refraction) rays of light into certain wave-lengths. **Glaucousness:** the condition of being glaucous.

glob(us) L.: as in **globose**, a globe; a ball (hence globular or spherical).

globul(us) L.: as in **globulifera**, a small spherical structure.

GLOCHIDIATE: of hairs or bristles when ending in two or more hooks.

glochi(n) Gk.: as in **glochidion**, **triglochin**, a spear-like point.

gloia Gk.: as in **zoogloea**, glue (hence a mass of bacteria held by a glue-like substance).

GLOMERATE: in compact clusters.

glom(us) L.: a ball.

gloss(a) Gk.: as in **glossogyne**, **ophioglossum**, a tongue.

GLOSSARY: a vocabulary of technical terms, especially when designed to convey the particular sense intended of a term used in context.

GLUMACEOUS: glume-like; dry and scaly.

GLUME: of a grass, one of the two bracts subtending the spikelet (unit of the spike), distinct from the bracts enclosing the individual florets (from one to several within each spikelet). The bracts enclosing individual florets are a lowermost **lemma** and an upper **palea**.

glut(en) L.: as in **glutinosus**, glue.

GLUTINOUS: exuding, or having the texture of, a glue- or glue-like substance.

glycy(s) Gk.: as in **glycine**, **glyceria**, **glycyrrhiza**, sweet; sugary.

GLYCOLYSIS: the primary stage of respiration where glucose is the substrate for the series of enzymatic reactions.

GLYCOSIDE: a colourless, crystalline derivative of a sugar, water-soluble and dissolved in cytoplasm or sap of certain plants, which yields sugar and non-sugar components on hydrolysis with acid or enzyme. When glucose is the sugar component, the glycoside usually is referred to as a **glucoside**, its non-sugar component an **aglycone**. The aglycone or aglycone frequently is of high toxicity to animals, although sometimes of therapeutic value, e.g. the glycosides of digitalis (from leaves of **Digitalis purpurea**) and strophanthus (from seeds of **Strophanthus kombe**) for their stimulation of heart.

Glycosides of the Australian flora include:

(a) the cyanogenetic (cyanophoric) group when hydrocyanic acid is the aglycone - Rosewood **Heterodendrum oleifolium**, Native Fuchsia **Eremophila maculara**, Jonson Grass **Sorghum halepense** and other sorghums, Blue Couch **Cynodon incompletus** and other couch, Caustic Weed **Euphorbia drummondii**, Burrawang **Macrozamia communis**, and many others which, at some stage of their vegetative or reproductive growth, are regarded as 'poison plants'.

(b) the phenolic group (when this group is the aglycone) - the anthocyanins and rutin (q.v.).

(c) coumarin glycosides when a coumarin is the aglycone or aglucone - aesculin from the common Blackthorn **Busaria spinosa**.

gnaphal(on) Gk.: as in **gnaphalium**, **gnaphalodes**, soft down; felt.

-gnomy, -gnosis, -gnostic: as in **physiognomy**, **diagnosis**, **diagnostic**, knowledge of (from Gk. **gnomon**, to judge).

GOLGI: (body or apparatus) of cytoplasm, a region of the endoplasmic reticulum (q.v.) marked by a series of membranes occurring singly or in number in each cell, regularly in cells of animals but less so in cells of plants. A possible function is in connection with the synthesis of enzymes. A dictyosome.

gompho(s) Gk.: as in **gompholobium**, a club (hence the pod club-shaped).

gon(e) Gk.: as in **gondium**, **oogonium** a reproductive structure; reproduction.

gon(ia) Gk.: as in **trigonal**, **trigonus**, and angle (hence three angled, as e.g. certain thick leaves when viewed in cross-section).

gongylo(s) Gk.: as in **gongylocarpa**, a round (hence round-fruited).

GORGE: a deep opening or valley, usually narrow and steep-sided, formed by the continual erosion by river-water over a period of geological time, e.g. one of the many mountain gorges cut through the sandstone of the Blue Mountains of New South Wales.

gracilis L.: slender, **gracilipes**, slender-stalked.

GRAFT: the union of living parts from different origins to form a structure physiologically acting as a single unit. Of woody plants, a shoot (scion) or bud propagated by its union (grafting) with a larger rooted

plant (stock) through the reorganisation of meristematic tissues of the calluses formed on the severed parts, the cambium, phloem and xylem forming a continuous unit. usually the stock and scion are of the same, or of closely related species, the stock appearing to have no permanent genetic effect on the scion although influencing its physiology.

Natural grafting may occur when two individually-rooted plants grow in such close proximity that a point of contact is reached where union of meristems is possible, e.g. in natural root-grafting where a pressure point arises from regions of individual roots in close contact, mutual translocation being evidence by the continued growth in diameter of the stump of a felled graft-member.

Seed-graft: the union of a scion which substitutes within a germinated seed for the removal original shoot, a method used in the maintenance of clones, e.g. of macadamia.

Graft-hybrid: the individual formed by a grafting where an association of metistems creates a tissue complex of genetically distinct cells (i.e. a chimaera), the appearance of the individual resembling that of both stock and scion.

GRAIN: see cereal.

-gram: as in **thermogram**, a record (hence a record obtained through a thermograph). From Gk. **gramma**.

gram(en) L.: as in **graminivorous**, grass (hence feeding on grass).

GRAMICOLOUS, GRAMINICOLOUS: living in association with grasses, as the rust and smut fungi.

GRAMINACEOUS: relative to a member or to members of the grass family **Graminae (Poaceae)**.

gramine(us) L.: grass-like, or covered by grass.

GRAMINOID: resembling a grass.

GRAM, GRAMME: the standard unit of mass in the metric system representing the mass of a cubic centimetre of pure water at 4°C. Equivalent to one-thousandth of the standard Kilogram, 0.03527 ounces (oz.) or 0.0022 pounds (lbs.). Abbreviated g. or gm.

grandis L.: stately; of great stature.

GRANULE: in general, a particle of very small dimension.

gran(um), diminutive gram(um) L.: a grain.

-graph: as in **thermograph**, a means of recording (hence an instrument for the recording of temperature fluctuations, the record obtained being a thermogram).
From Gk. **graphe**, a drawing or writing.

GRASSLAND: an open or closed community dominated by perennial grasses.

graveolens L.: strong-smelling.

gravi(tas) L.: as in **gravimorphic**, weight (hence of the influence of the gravitational force in determining form).

GRAVITATIONAL WATER: of soil, water in excess of field capacity which drains away under the influence of gravity.

GREEN PLANT: one with chlorophyll as the principal photosynthetic pigment.

GREGARIOUS: growing in close community or in clusters.

gresell(us) L.: somewhat grey.

grise(us) L.: fully grey.

gross(us) L.: coarse, thick.

GROUND WATER: the water below the surface of land, usually indicating that brought by rainfall.

GROWTH: of a cell, organ, or organism, the increase in size and protoplasmic content (including the substances synthesised by, and synthesising for, the protoplasm). Of a multicellular plant, the process involving the self-replication of cells usually within localised regions with accompanying increase in dry weight.

GROWTH RING: of secondary wood, one of a series of concentric zones (shown in transverse section of a stem or trunk) marking an alternation in growth due to the seasonal factor, especially in climates with well-defined winter-summer or wet-dry seasons. The zones are detected by a difference in the cell-types, that laid down in the growth season (early wood) being of wider diameter and thinner walled than the later-formed (late wood) when growth has slowed or ceased.

GROWTH SUBSTANCE: see phytohormone, vitamin.

GUARD CELL: see under stoma.

GUM: of eucalyptus, a member of which sheds its outer bark to leave the trunk smooth to a varying degree, hence usually in the sense of a 'smooth bark'. The name possibly arose from the kino-exuding smooth-barks (e.g. of the bloodwoods) but within a confusing diversity of qualifying names very few groups may be separated of sufficient members with close affinity - these are the Red Gums (q.v.), Snow Gums (e.g. **Eucalyptus pauciflora**, **E. stellulata**), Snappy Gums (e.g. **E. haemastoma**, **E. racemosa**), Mallee-gums (e.g. **E. foecunda**, **E. uncinata**), and one large group make up of White Gums (e.g. **E. ovata**, **E. dalrympleana**, **E. rubida**, **E. viminalis**, the latter two also known as Ribbon Gums), Blue Gums (q.v.).

Of general interest throughout the Commonwealth are: the pan-tropical Ghost Gum **E. papuana**, the tallest tree of the est Karri **E. diversicolor** (up to 250 ft high) confined to a very small region of the extreme south-west, Sugar Gum **E. cladocalyx** naturally occurring in the south-east coast of South Australia but extensively planted as a street and shelter tree, the Blue Gum of South Australia and western Victoria **E. leucoxylon** (botanically an ironbark), the Cider Gum of Tasmania **E. gunnii**, the timber trees of the eastern coast Grey Gums **E. propinqua** and **E. punctata**, Spotted Gum and Lemon Scented Gum (see under bloodwood). Although with a thick papery bark, the pan-tropical **E. minata** is known as Vermilion Gum.

The term has been applied also to **Angophora costata** (as Red Gum) and to **Tristania** spp. (as Water Gum).

GUM: as an extractive, a brittle, amorphous, transparent or translucent substance, usually a polysaccharide complex of various sugars and oxidised sugars (e.g. sugar acids and uronic acids), which absorbs water to swell in a gelatinous mass or forms a colloidal solution. Formed either as a response to gummosis (e.g. acacia gums) or as a metabolic product (e.g. tragacanth). Chemically closely allied is a **mucilage**, differing in that it occurs naturally as a mucus or slime especially of seed, but often refers simply to an aqueous solution of a gum.

The gum of commerce may be used in certain industrial and pharmaceutical processes, e.g. as an adhesive, as a stabilizer (e.g. of ice-cream mixes), an emulsifying agent or other agent used in the paper-making, cosmetic and food fields. It is chiefly an exudate from **Cyamopsis tetragonoloba** (Guar Gum), **Astragalus gummifer** (Gum tragacanth) both of the **Papilionaceae**, or various **Acacia** species (Gum arabic). A number of Australian acacias have been considered for their potential (as so-called wattle gums), viz. **Acacia pycnantha**, **A. decurrens**, **A. mearnsii**, **A. dealbata**, **A. sentis**, **A. homalophylla**, but costs in processing have impeded an industrial development. See also kino, resin, and under alga for phycocolloid.

GUMMIFEROUS: exuding a gum.

GUMMOSIS: a condition causing disintegration of internal woody tissue, the decomposed cellulose being exuded and setting, on exposure to air, to a solid clear or amber-coloured mass. The condition frequently is associated with disease of parasitic or physiologic origin.

GUTTATION: the freeing of water and solute through hydathodes (q.v.) under conditions favouring rapid absorption of water by roots and a reduced transpiration rate or even closure of stomates. These conditions often occur in late spring when there is a sharp gradient in thermoperiodism, guttation occurring at night or early morning.

gymno(s) Gk.: as in **gymnema**, **gymnathera**, uncovered.

GYMNOSPERM: a seed-bearing vascular plant characterised by the non-enclosure of its ovule (and seed) by a structure resembling the ovary formed by carpels of the angiosperm, but exposed except for one or two integuments on the surface of a sporophyll. Frequently, the sporophyll in series with others to form a cone-like structure (strobilus or cone) either a pollen-producing cone or an ovule-bearing cone developed by the one individual (the plant monoecious) or different individuals (the species dioecious). Contrasting again with the angiosperm, the female gametophyte in multicellular (500 or more cells), stores the main food reserves for the seed and, with a few exceptions, produces from two to many archegonia from each of which arises a single egg cell. Its male gametophyte is marked by the development of a conspicuous pollen-tube when the male gametes are non-motile, and often from one to many prothallial cells.

Classification: It is agreed generally that the extent gymnosperm is a member of one of four distinct groups, and in the fossil state is included by the fossil-orders **Cordaitales**, **Cycadofilicales**, and **Bennettiales**. There is no agreement as to the levels of these groups, some authors treating them as classes, others as divisions. Cronquist (1960) recognises two groups at divisional level, the **Cycadophyta** and the **Coniferophyta**.

The division **Cycadophyta** is characterised by pinnately compound fern-like leaves, rare branching stems, little or no secondary growth, and male gametes (sperm) flagellate and motile. It has a single class **Cycade**. The **Coniferophyta** have simple, usually small leaves, branching stems and well-developed secondary growth, and non-motile male gametes (except in **Ginko**). The classes recognised are **Coniferae** and **Chlamydospermae**.

Features of **Coniferae** include simple male cones, simple, compound, or undeveloped female cones, ovules with a single integument, embryos usually with more than cotyledons, absence of vessels within the wood but with frequent presence of resin-canals.

The **Chlamydospermae** feature compound cones for both male and female (most species dioecious), ovules with two integuments with at least the inner forming a conspicuous micropylar tube, embryo with two cotyledons, secondary wood with vessels but without resin-canals. Three genera are included, **Ephedra**, **Gnetum**, **Welwitschia**, each considered to constitute a distinct order and family but sometimes treated under a single order **Gnetales**. There are no archegonia formed by the female gametophyte of **Gnetum** and **Welwitschia**, in the former a nucleus with some cytoplasm functions as an egg-cell, and in **Welwitschia** a single cell acts directly as an egg. **Ephedra**, with several scale-leaved species, occurs throughout the Mediterranean region, Asia and the Americas. **Gnetum**, with several broad-leaved pinnately-veined species, is restricted to tropical regions of Africa, Asia and South America. **Welwitschia** has a single species (**W. mirabilis**) with long, strap-like leaves (strictly thong-like segments split from two initial and persistent leaves) confined to deserts of south-west Africa. See also conifer, cycad, pteridosperm.

GYNAECIUM: the ovule-bearing structure of a flower, made up of carpels (or a single carpel), **syncarpous** when the carpels are fused with one another, **apocarpous** when a single carpel or of two or more quite separate carpels. Often gynoecium (q.v.).

gyn(e) Gk.: as in **gynandrous**, female (hence of a flower, e.g. of certain orchids, when the stamens are fused with the gynaecium).

GYNODIOECIOUS: of a species with some members bisexual and some functionally female only (i.e. male sterile).

GYNOECIUM: see gynaecium which grammatically is more correct in the translation from the Greek, literally the women's part of a house (**oikos**, from which **-oecium** is derived).

GYNOMONOECIOS: of a plant bearing inflorescences of mixed bisexual and female (pistillate) flower.

GYNOPHORE: of a flower, an elongated part of a receptacle which bears the entire gynaecium, as in **Brachychiton** and **Telopea**. cf. stipe, carpophore.

GYNOSTEMIUM: of a flower, a column-like structure formed by a fusion of stamens with style/s and stigma/s. A characteristic feature of the **Orchidaceae** and **Stylidiaceae**. Also gynandrium.

gyps(os) Gk.: as in **gypsophyte**, chalk (hence a plant of calcareous soils).

gyr(os) Gk.: gyr(us) L.: as a **gyrostemon**, a circle (hence stamens arranged concentrically).

GYROSE: turned in the manner of a hook.

haben(a) L.: as in **habenarina**, a thong; a strap.

HABIT: of a plant, the growth-form or spatial arrangement, genetically determined but environmentally controlled. For angiosperms, conventionally designated as tree, shrub, under- (or sub-) shrub, herb, vine, etc. but these are interchangeable, e.g. herbs may have woody stems or be tree-like in stature, vines may be herbaceous or woody. See also life-form.

HABITAT: the external environment in which an organism or its population grows.

haema Gk.: as in **haemadolum**, **haematoxylon**, blood. Hence gifted with (the flush of) blood, and wood of blood (red) respectively.

HAIR: of plants, an outgrowth from the outermost layers of an epidermis, unicellular or multicellular, simple or branched, functionless, absorbing, secretory (glandular), or functioning for some process such as pollination.

hale Gk.: as in **halestorga**, salt water (hence adapted to salt water).

halim(os) Gk.: as in **halimodendron**, maritime.

halmaturina, halmaturum: derived from **Halmaturus**, a name originally proposed for a segregation of the smaller wallabies (i.e. the scrub wallabies or pademelons) as a genus separate from the now inclusive **Macropus**. Both the pademelons and the large kangaroo, **M. fuliginosus** were once frequent on Kangaroo Island, hence the meaning of the epithets is taken as of, or from, Kangaroo Island.

halme Gk.: as in **halmephilum**, brine; salt water.

hal(s) Gk.: as in **halophila**, salt.

HALOPHILOUS: with the nature of a halophyte.

HALOPHYTE: a plant which shows wide tolerance of, or able to adjust to, saline (e.g. salt marshes) or alkaline soils.

hamat(us) L.: as in **hamate**, **hamose**, hooked.

hamul(us) L.: as in **hamulate**, **hamulose**, with a small hook.

hapal(is) Gk.: as in **hapalophylla**, soft.

haplo(os) Gk.: as in **haplobiontic**, simple; single.

HAPLOBIONTIC: of an organism when without a morphological alternation of generations.

HAPLOID: relative to the phase of an alternation of generations in which a reduction in the duplicated chromosome set (or diploid condition) of the sporophyte, through meiosis, initiates the condition when the chromosomes are not duplicated, the condition maintained until fusion of gametes to create the diploid zygote. Expressed symbolically by n .

hapt(ein) Gk.: as in **heptotropic**, to touch (hence responsive to the stimulus of touch as, e.g. a tendril).

HARDENING: of growth, a temporary adaptation for tolerance to low or extremely fluctuating temperature.

HARDPAN: of soil, a hardened or cemented horizon formed by the leaching of solutes from upper layers. When iron (the hydrated oxide of) is the leached solute, an **ironpan**, when clay is the cementing substance, a **claypan**, when calcium carbonate, **limepan**.

HARDWOOD: the wood, typical of angiosperms, with water-conducting tissue made up by a series of thick-walled non-living cells with end-walls broken away to form a tube, the **vessel** or **pore**, no connotation of density being implied. Applied also (usually as an adjective) to the angiosperm which develops this wood, as a distinction from the conifer which develops softwood.

HARDWOOD FOREST: a forest community in which the dominant members are hardwood trees. IN Australia, almost exclusively eucalypts.

harpe Gk.: as in **harpophylla**, a sickle.

hasta L.: as in **hastate**, **hastiform**, a spear.

HASTATE: of a lamina when shaped like a spear or arrow-head but with the basal lobes spreading horizontally.

hastile, hastilis L.: a spear or its shaft.

HAULM: a stem, especially when of a grass.

HAUSTORIUM: of a parasitic angiosperm, e.g. a mistletoe, a structure (e.g. a pad-like disc) developed for the penetration of the tissues of the host and absorption of the host's nutrient. Of a fungus, a branch of a hypha which absorbs nutrient from a host.

HEAD: an inflorescence when the flowers are sessile (or almost so) in compact clusters. Essentially a spike with a much reduced floral axis.

HEARTWOOD: see under wood.

HEATH: a community dominated by erect evergreen shrubs with small sclerophyllous leaves, characteristic of acid soils with low nutritional status, e.g. of sandstones.

hec(a)t(on) Gk.: as in **hectare**, a hundred (hence a hundred ares, and are being a unit of area in the metric system equal to 100 sq. metres and equivalent to 2.47 acres, 1 acre equalling 0.407 hectares).

hedys Gk.: as in **hedysarum**, sweet.

helio(s) Gk.: as in **heliophyte**, the sun.

heli(x) Gk.: as in **helicoid**, a spiral or helix.

helo(s) Gk.: as in **helophyte**, a marsh.

helvol(us) L.: pale yellow.

hem(er)a Gk.: as in **hemeranthus**, day (hence day-flowering).

hemi Gk.: as in **hemi-parasitic**, half (hence at some stage of growth not parasitic).

HEMICELLULOSE: a secondary constituent of the cell-walls of woody tissue and collenchyma accompanying cellulose. A group of polysaccharides chemically unrelated to cellulose, usually named from the monosaccharide of which the member is a derivative, e.g. xylan, araban from the pentose sugars xylose and arabinose, galactan, mannan from the hexoses galactose and mannose.

hepatic (os) Gk.: of the liver.

hepta Gk.: as in **heptamerous**, seven (hence of seven parts).

HERB: a vascular plant wholly or largely without secondary growth throughout its life, the duration of which may be ephemeral, of a season, or of several years.

HERBACEOUS: of growth of a vascular plant when wholly primary, no woody (secondary) tissue being formed.

HERBACEOUS PERENNIAL: a herb with its shoots partially or wholly dying back at the end of a growth season, new shoots being formed after a period of dormancy.

HERBAGE: the leafy shoots collectively of an herbaceous plant.

HERBAL: a published record, usually illustrated, of plants from the aspect of their medicinal properties, especially of medieval times when their illustration and record largely were traditional rather than actual, and up to eighteenth century when they became a basis for the development of botany.

HERBARIUM: a collection of plant specimens, dried (exsiccated), preserved and protected against destructive agents, arranged so that species, genera and families are discernible, each specimen serving as a record basic to the needs of research on, and identification of, taxonomic groups.

HEREDITARY: of a genetic system transmissible from parent to progeny.

HEREDITY: the resemblance among individuals related by descent, i.e. through successive generations.

HERITABILITY: the degree to which alternative changes in a genetic system determine the nature of an organism compared with the modifying influence of the environment.

HERMAPHRODITE: of a sexually-reproductive structure (e.g. a flower) with both male and female parts equally functional. Bisexual.

HESPERIDIUM: a fleshy, indehiscent, simple fruit formed from a multi-carpellate ovary with axile placentation. Its pericarp is of two parts which, for the characteristic citrus fruit, are the yellow oil-gland containing exocarp (**flavedo**) and the white and spongy mesocarp (**albedo**). these two parts make up the rind; a third part, the **endocarp**, other (hence of more than one kind, of a different origin).

HETEROCARPOUS: producing more than one kind of fruit, e.g. Bitter Cress of **Cardamine** spp. develops minute ovate fruits from cleistogamous flowers in addition to the normal linear ones.

HETEROCARYOTIC: of an organism (the heterocaryon, especially of fungi) when its protoplast contains genetically distinct nuclei.

HETEROCHROMOUS: different coloured.

HETEROECIOUS: of a parasite when requiring more than one host for the completion of its life-cycle. cf. autoecious.

HETEROGAMOUS: bearing distinctly different reproductive structures or forming different gametes. **Heterogamy**: the condition.

HETEROMEROUS: of a structure when made up of parts of unequal number.

HETEROMORPHIC: of a structure when appearing in different form at different times. Of similar parts when in two or more forms at the same, or at a different time.

HETEROPHYLLOUS: of a plant bearing, throughout a normal life-cycle, leaves of more than one kind, e.g. the juvenile leaves of most eucalypts replaced by adult ones, the reduction from the bipinnate leaf of acacia seedlings to the phyllode of the adult plant. **Heterophylly**: the condition.

HETEROSTYLOUS: of a species when the styles of individual bisexual plants are of two or more different lengths in relation to the stamens. See also tristylous, pin and thrum. The effect is related to control of self-fertilization.

HETEROTHALLIC: of a thallophyte when self-sterile, i.e. unisexual.

HETEROTROPHIC: dependent for nutritional requirements on organic substances synthesised by photoautotrophic (green) plants, as of parasites, saprophytes, phagotrophic organisms and, in a special way, viruses and bacteriophages.

HETEROZYGOUS: the individual, or hybrid, arising from a fusion of gametes with different genetic systems.

HETEROZYGOUS: of a genetic system when alternative factors (alleles) are present for some of all of the characters carried by the chromosomes.

hexa Gk.: as in **hexamerous**, **hexacyclic**, six (hence of six parts).

HEXOSE: see under sugar.

HIEMAL: of the winter season. Also hibernal. From L. **hiems**, winter.

hier(ex) Gk.: as in **hieracium**, a hawk.

HILUM: of a seed, a mark marking an earlier attachment to a funicle.

hipp(os) Gk.: as in **hippuris**, a horse.

HIRSUTE: of a surface when with stiff, bristle-like hairs. **Hispidulous**: somewhat hispid.

HISTOCHEMISTRY: the chemistry of substances within biological systems at the level of tissues and cells.

HISTOGENESIS: the development of tissues and tissue-systems.

HISTOLOGY: the study of tissues and tissue-systems.

histo(s) Gk.: as in **histolyticum**, a tissue (hence tissue-dissolving).

HOLDFAST: in general, an attachment to a substratum, formed especially by a thallophyte.

holo(s) Gk.: as in **holocenosis**, whole (hence a perspective of a community based on all relevant factors without emphasis on a particular factor).

HOLOCARPIC: of a fungus when its thallus is developed wholly for reproduction, e.g. as a fruiting-body.

HOLOENZYME: of an enzyme (apo-enzyme) when linked with an activating agent (prosthetic group, vitamin, co-enzyme), the complete enzymatic system.

HOLOPARASITIC: of a parasite when obligate, i.e. completely dependent on parasitism.

HOLOPHYTIC: of an organism when synthesising wholly from inorganic sources, as a photosynthesising plant. Autotrophic.

HOLOTYPE: of taxonomy, the individual specimen of which a taxon is based.

HOLZOIC: of an organism when synthesising wholly from organic sources, usually (at least partially) by the ingestion of solid food particles (as by a majority of animals). In one sense, heterotrophic.

homoalo(s) Gk.: as in **homalophylla**, regular.

HOMEOSTASIS: a concept of a regulatory process maintaining physiological organisation at a constant level.

homo(s) Gk.: as in **homogenous**, same (hence of the one kind, or originating from the one stock).

homoio(s): Gk. as in **homeostasis**, **homoeosis**, similar; alike.

HOMOCHLAMYDEOUS: of a perianth when the parts are alike.

HOMOCLIME: a location within a group of locations with similar climate, e.g. for the temperate regions of Australia, homoclimates for the south-west province of Western Australia, and Victoria, are found in the Cape Town region of South Africa, Calparaiso, San Francisco and the Mediterranean. For the sub-tropical to temperate eastern coast, homoclimates are in the east and south-east of the Cape Town region. Uruguay, south-east and north China, and the south-east and central state of United States.

HOMEOSIS: the modification of conversion of parts to a resemblance of other parts as, e.g. the conversions of stamens to petals.

HOMOLOGOUS: of an organ or part (the **homologue**) similar in structure and/or position to another organ or part from a different source, especially when the resemblance suggests a common ancestry. Of chromosomes when controlling the same developmental processes through a similar arrangement of genes although derived from different sources, the homologues coming from different parents and aligning themselves (pairing) at meiosis, i.e. synapsing. **Homology:** the condition.

HOMONYM: of nomenclature, a name applied to a taxon which has had an earlier legitimate application to some other taxon and hence, according to the International Code, not legitimate (i.e. is superfluous).

HOMOSPORY: the production of spores of single kind, i.e. not differentiated as megaspores and microspores. **Homosporous:** the adjective.

HOMOTHALLIC: of a thallophyte when self-fertilizing. i.e. bisexual.

HOMOZYGOTE: the individual arising from a fusion of gametes with identical genetic systems.

HOMOZYGOUS: of a genetic system when the corresponding factors contributed by different gametes are identical for some or all of the characters carried by the chromosomes.

HORIZON: of soil, the later of a profile (q.v.) determined by a difference in texture and usually characteristic of a particular depth. Often designated as a division A, B or C which may be subdivided as A₁, A₂, etc., the A horizon roughly corresponding with the topsoil, the B the subsoil, and C the parent material. See also eluvial, illuvial.

horm(aein) Gk.: as in **hormone**, to activate (see phytohormone).

HORMOGONIUM: (plural hormogonia) of a filamentous protophyte (e.g. a blue-green alga), a part of the filament which, when detached from its parent filament, is capable of independent existence.

horrid(us) L.: rough, savage, forbidding.

HORST: a region of land raised above the general level, often the surrounding land having been depressed by faulting.

HORTICULTURE: the cultivation of fruits and vegetables, ornamental or garden plants, or other plants (e.g. herbs) required for culinary or medicinal uses, on a scale more intensive than that associated with field crop production (agriculture).

HOST: of parasitism, the organism attacked by, or harbouring, the parasite.

HUMICOLOUS: growing in or on soil. From L. **humus**.

HUMIDIFICATION: of a liquid/air system, the transfer of molecules of the liquid in the gaseous phase at the interface (where the vapour pressure is about equal to the vapour pressure of the liquid) throughout the air by diffusion and convection. i.e. evaporation.

HUMIDITY: the water vapour content of the atmosphere, usually expressed as **relative humidity**, i.e. the percentage of the vapour present (absolute humidity) to the maximum amount the atmosphere can hold (at saturation) at the prevailing temperature.

Since evaporation creates a cooling effect, and a decrease of moisture in the air an increase in evaporation, the heat loss is directly related to the water vapour content of the air. Use is made of a **hygrometer** for measuring this heat loss, e.g. the wet and dry bulb thermometer system where one bulb, wrapped in a water-soaked wick, acts as the evaporating surface. The difference between the temperatures recorded by the wet bulb and the dry bulb can be related directly to a table which correlates the heat loss and ambient temperature with the relative humidity.

HUMIFICATION: of soil, the conversion of material to humus.

humifus(us) L.: prostrate (on the ground). From **humus**; **fusum**, to spread.

humil(us) L.: of low stature.

humus L.: earth; soil; ground.

HUMUS: finely divided organic matter from decomposed plant litter together with the mineral matter with which it is incorporated in the soil. Consists chiefly of the organic residues of the litter which have resisted decay the longest and the organic wastes synthesised by soil-inhabiting micro-organisms.

hyalin(os) Gk.: as in **hyaline**, of glass (hence clear, i.e. transmitting light, or translucent).

HYBRID: relative to, or the progeny of, a cross-fertilization by parents with different genetic systems. From L. **hybrida**, a mixed breed.

HYBRIDISM: the observable degree of hybridization between reproductively isolated populations.

HYBRIDITY: the capacity of an individual to hybridize.

HYBRIDIZATION: the production of hybrids from either different species or from individuals of the same species, an effect being a reconstitution or recombination of genetic material which, in addition to a positive or negative influence in vigour and fertility of the progeny, may lead to ultimate divergence from the parental form.

HYBRID SWARM: a segment segregated from the F₁ hybrid population by crossing and back-crossing, the result being a complex series of morphological forms within the segment.

HYDATHODE: a structure (e.g. a water-secreting gland) or a passage where water under pressure is free to pass, concerned in guttation, usually confined to a leaf. From Gk. **hydates**, of water.
hydn(on) Gk.: a truffle (see fungus).

hyd(or) Gk.: as in **hydric**, water (hence with abundant moisture).

HYDROCARBON: a compound where carbon and hydrogen are the sole atom, either aliphatic or cyclic according to the arrangement of carbon atoms in the molecule.

HYDROCARPIC: of an aquatic plant when fertilization occurs above water and fruit production occurs below the surface.

HYDROCHORIC: of a plant (a hydrochore) disseminating through water.

HYDROGENATION: the catalytic reduction of a compound by the addition of hydrogen contributed from its gaseous form.

HYDROLYSIS: the catalytic 'splitting' of large molecules to smaller ones (the hydrolysate) by the addition of water (or strictly by the reactions of the component hydrogen and hydroxyl ions).

HYDROPHILOUS: pollinating through the agency of water.

HYDROPHOBIC: actively repelling or avoiding water.

HYDROPHYTIC: of a plant when growing in (as an aquatic), or at the surface of, water or in soils with a very high moisture content.

HYDROSPHERE: the waters collectively at the earth's surface.

hyet(os) Gk.: as in **isohyet**, rain.

hyetometric: relative to the measure of rainfall.

hygr(os) Gk.: as in **hygric**, wet (hence humid, or adapted to humid conditions).

HYGROMETRIC: relative to the measure of changes in the moisture content (or humidity) of the atmosphere.

HYGROPHYTIC: of a plant when intolerant of dry air.

hyl(e) Gk.: as in **hylophyte**, wood (hence a plant of woodland or forest).

hymen Gk.: as in **hymenanthera**, a membrane.

HYMENIUM: of a fungal fruiting-body, the spore-bearing layer.

HYPANTHIUM: a floral cup or tube.

hyper Gk.: as in **hypertonic**, above, over (hence with an osmotic concentration greater than that of another solution).

hyperici-: as in **hypericifolia**, of **Hypericum**.

HYPERPLASIA: of growth, an excessive development resulting in an abnormal structure, e.g. a gall.

HYPERTROPHIC: of growth when far in excess of normal.

hyph(e) Gk.: as in **hyphal**, a web.

HYPHA: (plural **hyphae**) of a fungus, a filamentous unit of a mycelium.

hypno(s) Gk.: as in **hypnote**, sleep (hence an organism when dormant).

hypo Gk.: as in **hypotonic**, below or under (hence the converse of hypertonic).

HYPOCOTYL: of an embryo or seedling, the part of the axis marking the transition of root and stem development.

HYPOCRATERIFORM: salver-shaped. Of a sympetalous corolla with a long and slender tube and a limb abruptly at right-angles to the tube.

HYPODERMIS: in general, the tissue directly below the epidermis, especially when forming a zone distinct from the underlying cortical layers.

HYPOGEAL: borne underground, as the cotyledon of a monocot when remaining below ground-level on germination of its seed.

HYPOGENOUS: in general, growing at a lower level, e.g. of male part when developing below the female. Of a flowering plant, with floral parts arising from the tip of a floral shoot without the formation of a cup or tube, in consequence the ovary being superior to the other parts. **Hypogeny**: the condition.

HYPOGEOUS: developing within the soil, i.e. below ground-level.

HYPONASTIC: of growth of lamina when there is greater development on the undersurface.

HYPOPHYLLOUS: on the undersurface of a leaf.

HYPOTHESIS: an assumption based on available evidence but not proved beyond doubt.

hyster(os) Gk.: as in **hysteranthous**, following, succeeding (hence of foliage when replenished after flowering).

-i: as in **germicide**, **gummiferous**, and such epithets as **hypericifolium**, **humifusum**, a vowel forming a compound word of Latin origin. As in **nuclei**, **loci**, the plural of a Latin noun (e.g. **nucleus**, **locus**). See also under epithet.

-ianus L.: see under epithet for its use in connection with personal names. Used also as an adjectival epithet for geographic names.

-ic: as in **acidic**, **metric**, **osmotic**, a suffix forming an adjective for words of both Greek and Latin origin.

-icant L.: as in **radicant**, **nigricant**, becoming; approaching. Of epithets, **icans** as in **radican**, **nigricans**.

ichon(s) Gk.: as in **ichnocarpus**, a trace or vestige.

ichthy(s) Gk.: as in **ichthyoid**, a fish.

ICONE: a figure or illustration of a plant.

icos: as in **icosandrous**, twenty (From Greek **eikosi**).

-ic(us): as in **australasicus**, **tasmanica**, **indicum**, belonging to; originating from.

-idae: see under class.

i(d).e(st) L.: that is. i(dem) q(uad): the same as.

idio(s) Gk.: as in **idioblast**, distinct (hence a cell distinct from others within a tissue as, e.g. a secretory cell).

-idium L.: as in **basidium** (plural basidia), the diminutive of. In **stylium** (generic name) from the Gk. **stylos**, a column, a small column formed by the union of stamens with the style.

IGNEOUS: of rocks when formed by the cooling of a molten mass (magma) originating under conditions of the earth's crust either plutonic (involving intense heat at great depth) or volcanic (involving the cooling of lavas at the surface).

ignis L.: fire

il: as in **illuminate**, **illuvial**, towards, into, in; as in **illimitable**, **illogical**, not
The prefix used before **1** equivalent to im-, in-, ir.

illici: as in ilicifolium, of the holly **Ilex**.

ILLUVIAL: of soils, relative to the horizon where leached solutes accumulate but not necessarily richer in nutrient than the eluvial (q.v.) horizon. Often used to denote the B horizon.

ILLUVIATION: of soils, the process of leaching from upper later.

im- L.: as in **implexus**, towards, into; as in **imparipinnate**, not (used before b, m, p). **imberbis**: not bearded.

IMBRICATE: overlapping. Of the margins of laminas when overlapping in bud (cf. valvate), or leaves when closely appressed to a stem.

IMMERSED: of a part when closed (at least partially) by another structure.

IMPARIPINNATE: of a pinnate leaf when its rhachis is terminated by a single leaflet. Odd pinnate.

implex(us) L.: entwined; interlaced.

impress(us) L.: marked by slight depressions (impressed).

in L.: as in **innate**, into, towards (hence inborn). As in **inops**, **inophloia**, not, without. (Used when other than before l, b, p, m,r).

-inae L.: see under tribe.

INBREEDING: breeding through successive generations of the same stock, the effect being a reduction in the chances of variability and an increase in homozygosity. **Inbreeder**: a self-fertilizing plant.

incan(us) L.: flesh-coloured.

INCIDENT: of light when reflected from an object. cf. transmitted.

INCISED: cut deeply into segments as though sliced.

INCLUDED: not projecting above or beyond a particular level, e.g. of style and stamens when not exerted above the tube of a corolla.

incognit(us) L.: unknown; not examined.

incommunis L.: not common, or not gregarious.

inconstans L.: changeable; not fixed.

INCRASSATE: thickened.

INCUMBENT: resting or supported. Of cotyledons within a seed when the back of one rests or is folded against the axis of the embryo. cf. accumbent.

INCURVED: bend or curving inwardly. Of the margins of a lamina when curving above, not below, the upper (ventral) surface. cf. recurved.

INDEFINITE: of number when above a readily obtainable estimate. Of an inflorescence when indeterminate.

INDEHISCENT: of a reproductive structure when not opening for the release of its mature spores or seed.

INDEPENDENT ASSORTMENT: of genes not subject to linkage (q.v.), the random (independent) recombination (assortment) of alleles to spores (higher plants) or gametes resultant from a meiosis.

INDETERMINATE: of growth (of an axis) when not limited by the arrest of the terminal (apical) growth point. Of an inflorescence when growth of the primary axis is not arrested by the substitution of the growth point with a flower. See also racemose.

INDICATOR: of ecology, a species of limited amplitude (q.v.) whose abundance indicates a factor of its environment, e.g. Mulga **Acacia aneura** is an indicator of alkaline soils with heavy texture.

INDICATOR: of chemistry, a substance undergoing a specific detectable change (e.g. colour, change in nature or formation of a precipitate) at a definite stage of a chemical reaction.

indic(us) L.: of India.

INDIGENOUS: naturally distributed within a specific geographic region (as an indigen). Autochthonous. Native.

indigofera: epithet, bearing a pigment the colour of indigo.

INDO-MALAYAN ELEMENT: see Malaysian Element.

INDUMENTUM: a covering formed by hairs.

INDUPLICATE: of laminas, especially in bud, when the margins are folded inwardly at the points of contact.

INDUREScent: slowly hardening or becoming firm.

INDURATED: hardened or firmed by some condition.

INDUSIATE: provided with an indusium (of a sorus, see under fern).

-ineae: see under order.

INEQUILATERAL: unequal-sided

-inerm, inermis L.: unarmed; without spines or prickles (inerm).

INFECTION: of an organism, the entry and development of a pathogen.

INFERIOR: of a structure when at a lower level than another. Of an ovary when it is below the level of origin of other floral parts. See also epigynous.

INFLEXED: curved or bent inwardly or downwardly. Also inflected.

INFLORESCENCE: the part of a floral shoot where the flowers are segregated as more or less distinct units, **terminal** when at the end of the shoot, **axillary** when replacing a short axillary vegetative

shoot, **lateral** when arising directly from the shoot without regard to definite position, **supra-axillary** when arising above the axil of a leaf, **intercalary** when at first terminal but the position changed by the continued growth of the shoot above it, **leaf-opposed** when opposite a leaf. See also racemose, cymose.

infra- L.: as in **infra-specific**, below (hence below the level of a species).

INFRA-AXILLARY: of a branch, structure, or part when below an axil.

INFRUCTESCENCE: the developmental and maturation stages of fruit.

INFUNDIBULAR: funnel-shaped. Of a corolla when appearing like an inverted cone. Also infundibuliform.

INHERITANCE: the transmission of the factors of heredity through successive generations of the same stock.

INHIBITION: of growth or other process, a suppression or arrest of a phase. **Inhibitory**: of an inhibition.

INNATE: of a part when adherent with the apex of its support. Of an anther when its base is fixed to the top of the filament.

INOCULUM: a micro-organism, spore, seed, or biologic substance transferred to a host or substratum.

inops L.: without support, hence lowly or of poor appearance.

ino(s) Gk.: a fibre.

INSECTIVOROUS: feeding on insects, as a carnivorous plant.

INSERTED: of parts attached to, or originating from, other structures, e.g. as stamens when developing from (inserted on) the rim of a floral tube, or leaves developing from a stem.

insignis L.: prominent or distinctive.

INSOLATION: the exposure to radiant energy from the sun.

insolit(us) L.: unusual; uncommon.

insulare, insularis L.: of an island (insular).

integ(er) L.: as in **integrifolia**, whole; entire.

INTEGUMENT: an outer covering. Of an ovule, the outer tissue which becomes the seed coat.

inter L.: as in **interbreeding**, between or among (hence cross-fertilization or cross-fertilizing).

INTERCALARY: between other regions.

INTERCALARY MERISTEM: a growth point between regions of permanent tissue, e.g. the meristem at the base of a leaf lamina when initiating development of a petiole, or (as in many gymnosperms and monocots), elongation of a lamina. Also the meristem near a node of a monocot stem (especially a grass) when initiating elongation of the internode.

INTERJUGARY: between jugae (see jugate). Usually in reference to that part of a rhachis between opposite pairs of leaflets.

INTERNODE: that part of a stem between successive nodes.

INTERPOLATION: the insertion of a measure within a series of parameters, cf. extrapolation.

interstans L.: standing between.

INTERSTITIAL: occurring among, or relative to, cracks or fissures (interstices).

interterrane(us) L.: between regions.

intertext(us) : entwined or entangled.

INTINE: see under pollen-grain.

intra- L.: as in **intraspecific**, within (hence within a species; relative to members within a species).

INTRACELLULAR: within a cell.

INTRINSIC: of a feature or property when essential or inseparable.

intro- L.: as in **introvert**, to within; inwardly (hence turning or bending inwardly).

INTROGRESSIVE HYBRIDIZATION: the back-crossing of hybrids with one or both parents so providing an intermediary where exchange of genetic factors between parents is possible.

INTORSE: facing inwardly towards the axis. Of an anther when dehiscent towards the centre of the flower. cf. extrorse.

INTUSSUSCEPTION: growth by addition of new particles among those already in position. cf. accretion, apposition.

-inus, -ina, inum: as in **ligustrinus**, resembling. As in **australinus**, belonging to; originating from.

INVAGINATE: drawn into, or enclosed in, a sheath.

INVERSION: of chromosomes, a structural rearrangement in which, within a segment, there is a reversal of the linear sequence of genes. A similar situation arises when a chiasma (q.v.) occurs at meiosis between chromosomes which are not homologous - this is **interchange** or **translocation**.

INVOLUCRE: of a flower or cluster of flowers, one or more whorls of bracts at the base.

in vitro: literally, 'in glass'. Relative to an observation made within the limits of an experimental apparatus in contrast with **in vivo** within the environment normal to the subject of the research.

INVOLUTE: of a lamina when the margins are rolled inwardly on the upper surface.

iode(s) Gk.: violet (**ion**)-like.

ION: an atom or group of atoms with an electrical charge through a loss or gain of one or more electrons. When charged both positively and negatively, a zwitter-ion.

ION ANTAGONISM: of nutrients available to a plant, a growth-inhibiting effect created when the concentration of ions of one nutrient (the antagonist) exceeds a critical level determined by the ionic concentrations of other nutrients present, the effect of the antagonist suspended when the introduction of other nutrients readjusts the ionic imbalance.

IONIZATION: the dissociation of an electrolyte to atoms or groups of atoms in equal concentrations of positively and negatively charged ions, the electrolyte usually being an inorganic or organic acid, base or salt.

-ir Gk.: as in **irridate**, toward, into. As in **irregular**, not. Used before 'r'.

IRONBARK: of eucalypts, a member of a botanic group **Siderophloia** from the tropical or temperate eastern mainland. The name is derived from the hard-textured, furrowed, usually dark-coloured bark persistent on the trunk and main branches (**Eucalyptus leucoxylon**, the 'blue gum' of South Australia is an exception): flows of kino frequently are apparent throughout the bark of a mature tree.

Several ironbarks are commercial timber trees providing a very hard, strong and durable timber, e.g. **E. crebra**, **drephanophylla**, **fibrosa**, **sideroxylon**, **paniculata**, **leucoxylon**, the latter three being in addition valuable honey or nectar sources. In addition to Pink Flowering Ironbark of **E. sideroxylon**, ornamental use is found in Silver-leaved Ironbark **E. melanophloia** with broad, silvery, opposite leaves.

IRRADIATION: the exposure to a radiation, e.g. of wavelengths of light.

irritabilis L.: readily responsive to a stimulus (irritable).

IRRIGATION: the distribution of water over the surface of land for the promotion of plant growth and productivity.

IRREGULAR: of parts of the same kind within a structure when different from one another in size or form.

iso(s) Gk.: as in **isomerous**, equal.

ISOBAR: a line joining points of equal barometric pressures.

ISOBILATERAL: with the same structure of either side, e.g. the adult leaves of eucalypts have the same tissue arrangement below their dorsal and ventral surfaces, contrasting with the dorsiventral (q.v.) nature of their juvenile leaves.

ISOCHROMOUS: of the same colour intensity.

ISODIAMETRIC: with equal diameters.

ISOELECTRIC POINT: a point on the pH scale when ionization of an electrolyte is complete (at maximum) by the balance of equal negative and positive charges.

ISOHYET: a line joining points of equal rainfalls.

ISOLATION BARRIER: of breeding, a barrier preventing or reducing cross-fertilization among populations which, as a consequence, tend to maintain their distinct genetic natures. The operations of such a barrier (or isolating mechanism) may be related to a geographic, ecologic, or physiologic condition, or to the survival rates of hybrids when crossing does occur.

ISOMER: a chemical substance, an alternative form by virtue of a different arrangement of atoms within the molecule, e.g. $C_6H_{12}O_6$ represents the isomers glucose, fructose, galactose and mannose dependent on the position of the -OH group within the molecule.

ISOMETRIC: of parts when developing at the same rate.

ISOMORPHIC: of parts or individuals when identical in shape or form.

ISOSMOTIC: of a solution when its concentration equals the concentration of a solution separated from it by an osmotic membrane so that very little exchange by diffusion occurs.

ISOTHEME: a line joining points (locations) of similar biologic periodicity, e.g. similar flowering periods.

ISOTHERM: a line joining points of equal atmospheric temperatures allowing, through a corrections factor, for the decrease of temperature with increase in altitude.

ISOTHERMAL: of temperature when at a constant.

ISOTOPE: of an element, an alternative form by virtue of a different atomic mass, e.g. the element hydrogen normally has a single proton with no neutron in the nucleus of its atom. When a neutron is present there is an increase in atomic weight from 1 to 2. In combination with oxygen to form water, the isotope with greater mass increases the molecular weight from 18 to 20, the water thus known as 'heavy water'. Labelled carbon (C^{14}), a radioactive isotope with atomic weight 14 (12 for normal

carbon) provides a valuable tool in the study of metabolic reactions by acting as a tracer. As with other radioisotopes, it is unstable at a variable rate and, by loss of electrons, protons and neutrons (as beta-particles), is reduced (or decays) to a stable isotope of nitrogen (N^{14}). Its rate of decay, measured as half-life (the time required for half of its atoms to decay) is about 5,000 years.

ISOTROPIC: with identical structure or properties in all planes.

-issim(us) L.: as in **speciosissima**, the superlative degree.

-ium: as in **cilium**, **sporangium**, a suffix of nouns of singular number derived from the Latin.

ixi: as in **ixioides**, of **Ixia** (**Iridaceae**). From Gk. bird-lime.

ixode(s) Gk.: as in **ixoidia**, viscid; sticky.

jub(a) L.: as in **jubatus**, **jubiflora**, a crest.

jubalis L.: yoked together.

JUGATE: of a pinnate leaf when the leaflets are in opposite pairs (**jugae**). Usually prefixed to indicate the number of opposite pairs, as in uni-, bi-, trijugate.

juli(s) L.: as in **juliflora**, down or woolly hair; a catkin, or spike. From Gk. **iulus**.

JUNCEOUS, JUNCOUS: resembling a rush (*Juncus*).

juniperin(us) L.: resembling the juniper (**Juniperus**).

JUVENILE LEAVES: the leaves appearing immediately after the seedling leaves, frequently differing from the later-formed (or adult) leaves in form and size, and sometimes internal structure. In such heterophyllous plants as eucalypts and acacias, the juvenile condition sometimes is maintained throughout life, as in e.g. **Eucalyptus cinerea** and **E. pruinosa**, and the **Bipinnate** group of acacias.

juxta- L.: as in **juxtaposition**, close to.

k: since k and c of many terms with Greek origin are interchangeable, e.g. **kata-**, **cata-**, and modern work favours the latter, see also under c. In this work, where a word of Greek origin is given to illustrate a stem or epithet, c is substituted for k (conventionally equated with the Greek letter) in cases (a majority) where continuity of an alphabetical arrangement is desired.

karyo(n) Gk.: as in **karyology**, a nucleus.

KARYOGAMY: the fusion of nuclei, as at a fertilization.

KARYOKINESIS: the division of a nucleus, as at a mitosis.

KARYOTYPE: the nature of a nucleus defined in terms of visual appearance (size, shape, number, etc.) of its somatic chromosomes.

KEEL: a ridge on the outside of a fold. Of a papilionaceous flower, the two lowermost, usually united, petals.

KETO: of a chemical structure when an atom of carbon is linked by a double bond to an atom of oxygen and to two other carbon atoms by single bonds, the organic compound containing the group known as **ketone**.

kilo-: as in **kilogram**, **kilogramme**, a thousand. From Gk. **chilioi**.

KILOGRAM: (kg.) the standard unit of mass in the metric system equal to 1,000 metres or equivalent to 0.62 miles.

KINENSIS: a process of division, as in cyto- and karyo-kinensis, the division of cytoplasm and a nucleus respectively to form two daughter cells.

KINETIC: relative to motion. cf. static.

KINETOCHORE: a centromere (see under chromosome).

KININ, KINETIN: see under phytohormone.

KINO: a tannin-containing, resinous accretion stored in veins, pockets and cells of bark or wood, e.g. of **Eucalyptus** and **Angophora**. Appears as a gum-like, brown or red jelly or glass-like exudate on exposure to air. Chemically complex, an astringent property (i.e. a tissue-contracting agent) of interest to pharmacology, one commercial source being the River Red Gum **Eucalyptus camaldulensis**.

KNEE: of certain trees of swamp or mangrove communities, an erect structure (often a laterally-flattened, conical expansion) projected above ground-level from a horizontal root. Function not clearly known. The knee of boat-building when of wood often (in Australia) is from the crook formed from, or by, root of the swamp-dwelling Broad-leaved Paperbark (or Tea Tree) **Melaleuca quinquenervia**.

KNOT: of wood, a section of the base of a branch which has become embedded by the radial increase in diameter of the trunk.

KRASNOZEM: of soils, a group occurring sporadically in eastern Australia (e.g. the Dorrigo) where the rainfall exceeds 35 inches, supporting in its virgin state a dense forest cover. Its reaction is acidic, it has good friability and permeability although with little sand, high fertility, commonly reddish-brown in colour (hence also termed red loam), is often deep but with no definite horizons.

KRILIUM: a trade name for a synthetic compound of which vinyl acetate and an ester of maleic acid are the active principles, designed as a (soil conditioner) for the forming of stable aggregates in soils of poor structure.

L.: Latin, the language of (strictly a modified form of).

labell(um) L.: as in **labate**, a lip.

LABIATE: a sympetalous corolla or a synsepalous calyx when the limb (of partially united, or united petals) or free parts of the calyx occur in two parts, an upper part overhanging or arching over the lower to leave the tube partially open, the whole resembling an open mouth with lips. A feature of the **Labiatae** (e.g. **Prostanthera**, **Lavandula**, **Mentha**, **Prunella**, **Westringia**, etc.), the term often applied (as a noun) to a member. Also bilabiate.

LABILE: unstable; readily changing, e.g. as a metabolic product stable only when in the environment of its synthesis.

lac L.: milk.

LACERATE: of a structure when divided irregularly as though slashed.

lachno(s) Gk.: as in **lachnophylla**, wool.

LACINIATE: of a structure when divided into narrow, more or less equal segments. Fringed (by lacinia).

lacrim(a) L.: as in **lacromoid**, a teat from the eye; a tear-drop.

lacte(us) L.: milky; milky-white (**lacteol(us)** the diminutive).

lactis L.: of milk.

LACTEOUS: with the colour or consistency of milk.

LACTIFEROUS: producing or storing a latex or other lacteous substance. Also laticiferous.

lacun(a) L.: a cavity.

lacunos(us), lacunat(us) L.: full of hollows, pitted, lacunose.

LACUNA TISSUE: parenchyma with large intercellular spaces (lacunae).

lacunar(um) L.: of lagoons or water-holes.

LACUSTRINE: relative to waters forming lakes, or to the organic life of, or beside, lakes. From **L. lacus**, a lake.

laena Gk.: as in **branchlaena**, a cloak; a mantle.

laet(us) L.: of pleasing appearance.

LAEVIGATE: see levigate.

l(a)evis L.: smooth.

laev(us) L.: the left-side.

LAEVO-ROTATORY: of an optically-active isomer when rotating the plane of polarised light to the left. Indicated by the letter l, or the symbol - (minus). cf. dextro-.

lagen(a) L.: as in **lagenophora**, a flask.

LAMELLATE: composed of thin plates or scales (lamellae). Also lamellar.

LAMINA: (plural laminae) a more or less flattened expansion; a blade, as of a leaf or a petal. **Laminar**: of a lamina.

lampr(os) Gk.: as in **lamprophyllum**, bright.

lamp(us) L.: a torch.

LANATE: of a surface when covered by long, wool-like hair (L. **lana**).

LANCEOLATE: of a lamina when broadest at the centre, three or more times as long as broad, and tapered evenly from the centre to a more or less acute apex and a rounded base - e.g. the shape of many eucalypt leaves. Literally in the shape of a lance.

laniger(us) L.: with wool-like hairs.

LANGUINOUS: of hairs when down-like, i.e. fine and soft. Also lanuginose. From L. **lanugo**, down-like hair.

lapath(os) Gk.: as in **lapathifolia**, dock (or sorrel) **Rumex** spp.

lappa L.: a burr, hence **lappaceous**, burr-like; prickly.

laricin(us) L.: larch (**Larix**)-like.

lasi(os) Gk.: as in **lasiandra**, **lasianthus**, **lasiopetalum**, woolly; hairy.

latens L.: concealed; hidden.

LATENT HEAT: of a change in the physical state of a substance, the heat either evolved (e.g. the exothermic process of condensation) or absorbed (e.g. by the endothermic process of vaporization).

later L.: a brick.

LATERAL: arising from, or at the side of, an axis or structure.

lateralis L.: lateral

LATERITE: as a component of soil, a red clay-like substance chiefly of hydargylite ($\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$) with some free iron oxide, formed by the weathering of such basic rocks as basalts, brought to the B horizon by intense leaching from the surface under conditions of high humidity with alternating wet and dry seasons. When again brought to the surface, hardens on exposure to air.

LATERITIC: of soils with ironstone (as gravel or in solid form) in the surface layers, frequently the lower layers mottled by kaolins. Such a soil is of low nutritional status and supports in the virgin state a community which varies from sclerophyll forest to heath. Of widespread occurrence in Australia where subsequent weathering or deposition of other material often has changed its nature, e.g. by podzolisation to give a lateritic podzol.

LATERITIOUS: brick-like, especially in colour.

LATEX: the lacteous secretion contained by a laticifer, an emulsion of finely dispersed rubber in greater or lesser amount in association with such products as mucilages, alkaloids, resins, essential oils, and various metabolites including enzymes and other proteins, organic acids, etc. Of commercial interest when the concentration of rubber is high, as in **Hevea brasiliensis** (source of caoutchouc), **Palaquium gutta** (gutta percha) and **Achras zapota** (chicle, a base for chewing gum). In addition, certain proteolytic enzymes have been isolated from certain latex which are of economic value, e.g. papain from Pawpaw (**Carica papaya**), ficin from **Ficus** spp., asclepain from the Milk Weeds of **Asclepias**.

LATICIFER: a cell of sac of bark, cortex, of leaf of many plants within the vacuole of which is stored a latex. May be one of a series of distinct cells (e.g. as in **Euphorbiaceae**, **Moraceae**, **Sapotaceae**) or part of latex-vessel when united in series (e.g. **Convolvulaceae**, **Campanulaceae**, the tribe **Cichorieae** of **Compositae**), or an unsegmented, often coenocytic, elongated latex-tube (e.g. **Apocynaceae**, **Aslepiadaceae**).

latiuscul(us) L.: somewhat broad.

LATORSE: of dehiscence when in a sideways direction, as of an anther when shedding laterally its pollen.

lat(us) L.: broad; wide.

lauchi(s) Gk.: as in **chamaelaucium**, the poplar **Populus**.

laur(us) L.: as in **laurifolia**, the laurel **Laurus**.

laut(us) L.: of elegant appearance.

lavandulace(us) L.: lavender (**Lavandula**)-like.

lax(us) L.: as in **laxiflora**, loose; scattered.

LEACHING: of soils, the displacement of solutes to lower levels through the percolation of water, e.g. the replacement of exchangeable cations (of mineral salts) by hydrogen ions in soils subject to heavy rainfall, the effect being an increase in acidity with consequent decrease in the availability of mineral ions to roots. Applied also to the loss of inorganic and synthesised substances from the

foliage of actively-growing plants by the solvent power of water (e.g. as rainfall) - such solutes, through the soil, may be redistributed to other plants or even back to the original donor.

LEAF: the photosynthetic organ of a majority of vascular plants, forming with the stem an integrated system, the shoot. In structure, typically composed of a single flattened blade (**lamina**) of varying form and division, and a stalk-like **petiole** which joins the stem at a point, the **leaf-base**, sometimes distinctive as a **pulvinus**. The origin of a leaf is from a crescent-shaped **leaf-buttress** derived from and lateral to the apical meristem of the shoot. Its meristem may remain **diffuse**, the lamina then of simple shape, become **localised** to differentiate the lamina to various degrees of lobing or division, or be **intercalary** (q.v.). The internal connection with the stem is through a **vascular system** which extends as a **venation** throughout its lamina. In addition to its role in photosynthesis, the leaf is the organ for transpiration, shows a higher level of respiratory activity than do other parts, and provides an accessory system of exchange with the atmosphere of solutes concerned in the control of salt and moisture relationships within the plant. See also compound leaf, stipule, stoma, cuticle, leaching, photosynthesis, respiration, transpiration.

LEAF-BASE: in a strict sense, the part of a node transitional to a leaf but often denoting that part of a leaf directly connecting with a stem.

LEAFLET: a segment of a compound leaf appearing as an entire leaf.

LEAF SCAR: the site of abscission of a leaf.

LEAF TRACE: a strand of conducting tissue forming an extension of the primary vascular bundle from stem to leaf. Its point of departure from the stem is marked (usually) by a break, **leaf-gap**, in the bundle around and above the trace.

ledi: as in **ledifolia**, of **Ledum (ericaceae)**.

LEE SHORE: the shore towards which wind is directed.

LEEWARD: on the side turned away from the wind: on the lee side. cf. windward.

LEGUME: a dry, one- or several-seeded fruit formed from a unicarpellate ovary, dehiscent along both sutures. The fruit of the **Mimosaceae**, **Caesalpiniaceae**, and **Papilionaceae**, hence often applied to one of the members. See also lomentum, pod.

leio(s) Gk.: as in **leiocarpa**, smooth.

LEMMA: of a grass, the lowermost scale of a floret partially enclosing the complementary palea.

LENTICEL: a space or pore of a periderm functioning for the gaseous exchange (lenticular transpiration) of water and probably solute with the environment external to the plant.

LENTICULAR: in general, in the shape of a lens, i.e. with one surface or both surfaces convex. Also, relative to a lenticel.

lent(us) L.: tough, flexible.

lepidoto(s) Gk.: as in **lepidote**, scaly (hence covered with small scurfy scales).

lepid(us) L.: elegant, of pleasing or neat appearance.

lepis: as in **hypolepis**, a scale.

LEPIDODENDRID: a member of a group of fossil-plants dominant in the Palaeozoic Era when, at least in the Carboniferous Period, they reached large tree size. Leaves were closely spiralled or whorled, simple, deciduous, and ligulate; when shed left the leaf-base as a projecting cone (leaf cushion). The water-absorbing system was a well-developed series of rhizomorphs, roughly equivalent to a

main and permanent root system. Reproductive structures were a cone-like series of sporophylls, usually large and heterosporous. The affinities are with the present-day hycopsids.

LEPROSE, LEPROUS: scurfy, i.e. with mealy scales.

lepto(s) Gk.: as in **leptophyllous**, slender.

lepyrod(es) Gk.: as in **lepyrodia**, scaly.

-let: as in **branchlet**, less than (hence a secondary or tertiary branch).

leuco(s) Gk.: as in **leucanthus**, **leucoplast**, white.

LEUCOPLAST: a plastid (q.v.) without colour, hence usually associated in cytoplasm of tissues not exposed to light, often containing starch grains or oil droplets.

LESION: in general, a wound. Of disease, a localised area of infection.

levis L.: smooth; levig(o) L.: as in **levigate**, to make smooth.

LEY: land holding for a period of years and cover of grass or clover.

LIANA: (plural lianes) a rooted, non-parasitic climbing or twining plant dependent for support on an established erect plant, often having a lethal effect on the host by strangulation of its conducting tissues. Well-developed in the tropical and sub-tropical rainforests where the woody vines Lawyer (**Calamus** spp.), Monkey (**Parsonsia brownii**), Water (**Vitis** spp.), Wonga (**Pandorea pandorana**). Vines are prominent.

LICHEN: a dual organism (consortium) formed by the symbiotic association of one or more fungi (usually an ascomycete) with one or more unicellular green (e.g. **Trehouxia**) or blue-green (e.g. **Nostoc**) algae.

An important primary coloniser of bare areas (e.g. rock faces) of polar to tropical regions, the thallus formed often foliaceous, erect and branched (fruticose), or like a dry crust (crustose). While fragmentation is more usual, reproduction may be sexual through the means normal to the species of the individuals when the spore of the fungus will germinate only when in contact with an alga similar to the symbiotic partner of the parent. A type of asexual reproduction may proceed by a **soredium**, a structure formed by the clustering of algal cells and fungal hyphae which forms a new consortium when separated from the parent.

The problem of naming the approx. 17,000 species of dual organisms is met by giving precedence to the fungal component, the fungus not known to occur in the habitat of the lichen free from symbiosis. The lichen is attributed with extremely slow growth and longevity of high degree, e.g. certain polar species are accredited with an age of some 4,500 years.

The lichen is usually in polysaccharide (e.g. lichenin) content, it may secrete an essential oil, or be pigmented. The resin Oakmoss extracted from the European **Evernia prumastri** and **E. furfuracea** yields an essential oil used as a commercial perfumery oil, especially for soaps. The pigment may be of value as a dye as, e.g. the blue and red dyes of the family **Rocellaceae** which, before substitution by coal tar derivatives (e.g. amaranth) provided the dye of 'litmus paper'. Certain extractives have found valuable as antibiotics, e.g. usnic acid, a common component with relatively high yield, used in the treatment of certain skin diseases.

LIFE FORM: of an organism, the visible expression of adaptive features, e.g. of habitat and perennation.

LIGHT: that form of electromagnetic radiation or flow of radiant energy usually interpreted (in botany) as **visible light**, i.e. the spectrum receptive to the retina of the eye and translatable through the optical system as visual sensation. Exhibits the nature of a transverse wave (e.g. diffraction) and also a photoelectric effect (e.g. its excitation of a photosensitive substance such as selenium which creates from this receptor a flow of electrons which may be registered as an electric current when directed

along a suitable conducting wire). May be considered hence as a transverse wave of particles (photons) with a flow of 186,000 miles per second, each photon a unit of energy or **light quantum** with energy directly proportional to its frequency.

The major source of light is the nuclear fission from the sun in the conversion of the nuclei of its hydrogen atoms to helium atoms and electrons, the waves of energy principally are in the form of gamma or X-rays of very high energy, ultra-violet radiation, visible light, infra-red, and radio waves of low energy, these making up the **solar spectrum**. In terms of wavelengths (the distance between two crests of successive waves) the shortest waves reaching the earth through the atmospheric screen are in the ultra-violet region at about 2900 Angstroms; the visible spectrum is in the region 4,000 to 7,000 Å., and above this is the infra-red region. Ultra-violet radiation (experiences as sunburn, snowburn and eyeburn) is of less importance to major plant life, much being screened off by the atmosphere while the epidermis of the plant provides an effective barrier. For unicellular or micro-organisms (e.g. bacteria and fungi) its effect is much more drastic in doses either lethal to them or inducing harmful metabolic and genetic changes. The infra-red radiation is known by its heating effect of the earth, essential to the maintenance of life; visible light provides, through photosynthesis, the energy essential to living organisms.

Quality of light. The compound nature of the 'white' light of the visible spectrum may be demonstrated from its passage through a glass prism when, by reflection and refraction, its component wave-lengths are dispersed. By visual sensation, the dispersed rays may be registered as a band of colour. A similar effect is obtained when a fine mist of water acts as the dispersing and reflecting medium, an arc (or rainbow) of colours (red, orange, yellow, green, blue, indigo, violet) is perceptible to the eye. The relative proportions of wave-lengths available to the object of reference give the quality of light.

The colour of white light reflected by a substance is determined by the absorption of certain wave-lengths (i.e. the **absorption spectrum** for that substance). When the reflected light appears white, there is no absorption, when e.g. red, all wave-lengths other than that corresponding with the red band are absorbed, the red only reflected, and when appearing black there is no reflection. Chlorophyll absorbs in the violet and red bands to greatest degree, least in the green; the orange-yellow carotenoids absorb from the blue and violet regions. While the yellow to red region of the visible spectrum is most effective in photosynthesis, under certain conditions the green region may be effective also. For all conditions, the correlation of photosynthesis with the absorption spectrum of photosynthetic pigments is not direct.

Intensity of light. Factors other than the quality of light appear of greater significance to the growth of plants, viz. intensity and duration. Intensity is the amount of light received at a specific distance from the light-source (see foot-candle, lumen, lux, phot). For terrestrial plants it is determined initially by the distance of the sun and the angle of its rays to the earth's surface, and by the amount of cloud cover (or fog or smog) in the influence of high intensity is a promotion (in association with such factors as phytohormones) of flowering and fruiting, and inhibition of vegetative growth. See also photoperiod, incident, transmitted, phytochrome.

LIGHT MICROSCOPE: an instrument designed to enlarge the image of an object by transmission of light reflected from the object through an optical system of lens (or a single lens when simple). It is in contrast with the electron microscope by the latter's functioning through a flow of electrons directed by a system of electromagnets. Since the wave-length of the electron flow is considerably shorter than that of visible or ultra-violet light (e.g. 0.05 Angstroms for a 60,000 volt electron flow), far greater magnification and resolution of detail are possible, although far greater elaboration in equipment and preparation are required. The limit of the light microscope is 2,000 diameters (or about 3,000 for ultra-violet light: magnifications of 100,000 diameters by the electron microscope are familiar. The theoretic resolution of 1 Angstrom for the electron microscope, optimum at 100 kV, to 1,000 kV, electron flow, is offset by certain inherent factors consequent of the high voltages required, e.g. vibration of object thermal drift, additional to problems associated with preparation of the object.

LIGNEOUS: relative to woody tissue, or with the texture or nature of wood. Also lignose.

LIGNICOLOUS: living with wood, as a wood-boring larva or wood-rotting fungus.

LIGNIFICATION: of a cell wall, the deposition of lignin.

LIGNIN: a constituent of secondary-thickened cell walls characterising woody tissues. Chemically only partly known but appearing as a complex polymeric amorphous substance including within its molecular structure aromatic rings.

LIGNOCELLULOSE: cellulose combined with lignin. Of concern to the cellulose-extracting industries (e.g. paper-making), the separation is possible (for wood chips or pulp) through chemical treatment, e.g. boiling caustic soda under pressure, alkaline sodium sulphate, neutralised sulphur dioxide.

LIGNOTUBER: of eucalypts and other myrtaceous plants, a conspicuous swelling at the base of the stem, at or below soil-level, bearing dormant buds. An adaptive feature of survival value, the development of the buds to suckers is stimulated by destruction or loss of top growth.

lignum L.: wood. **ligne(us):** woody.

LIGULATE: strap-like: bearing a ligule. From L. **ligula**, a small tongue or strap.

LIGULE: of a grass, a membranous or hairy appendage on the inner surface of a leaf marking the junction of the blade and sheath. Of a ray-floret of certain **Compositae**, the strap-like limb of a corolla. See also locosid.

ligustrin(us) L.: of, or like, privet **Ligustrum**.

lilacin(us) L.: lilac-coloured; lilacine; lilaceus.

limax L.: a snail or slug.

LIMB: the oxide of calcium of quicklime, CaO, formed from limestone by roasting ('limeburning'), reactant with water to form calcium hydroxide (an exothermic reaction). By controlled mixing with water, 'slaked lime' is formed. The 'free lime' of soil is a mixture of calcium and magnesium carbonates.

LIMESTONE: a sedimentary, often fossiliferous rock in which calcite (a form of calcium carbonate) is the pure mineral. Calcite is readily reactant with carbonic acid to form calcium bicarbonate, water-soluble hence readily leached. Commercial limestone is a mixture of oxides of several minerals including calcium and magnesium.

im(us) L.: as in **limicola**, **limosus**, mud or marsh.

limn(e) Gk.: as in **limnobios**, a lake (hence the organisms collectively of a fresh-water lake or pool).

LIMNOLOGIC: relative to the environmental and biological conditions of fresh waters.

linarii: as in **linarifolia**, of the toadflax, **Linaria**.

LINE: of early botanical measurement, the equivalent of one-twelfth of an inch, or about two millimetres.

line(a), lini(a) L.: a line; a thread.

LINEAR: of a lamina when its margins are parallel and length at least ten times its breadth.

LINEATE: marked by fine parallel lines, as a lamina when its venation appears as a series of fine parallel lines. Also lineolate.

lingu(a) L.: as in **linguiform**, a tongue.

LINKAGE: of heredity, the association of genetic factors (multiple alleles) at meiosis which tends to be passed as an inseparable unit (a linkage group) from generation to generation, thus not subject to independent assortment. Separation within the linkage group is possible when **crossing-over**

occurs, i.e. the exchange of corresponding segments between homologous chromosomes through breakage and reunion.

lin(o) L.: as in **linens**, to smear or spread over.

lipar(os) Gk.: greasy; unctuous.

LIPID: in one sense, an ester formed from an alcohol and one or more fatty acids. See fat, wax, phospholipid, and phosphatide, cutin, suberin. Applied also to carotenes, resins, rubber or latex, sterols, terpenes, which have the common feature of being soluble in certain organic solvents but not in water except as emulsions.

lip(os) Gk.: as in **lipoid**, a fat.

liquefaciens L.: liquefying.

l(e)irion Gk.: a lily.

lisso(s) Gk.: as in **lissanthe**, smooth.

lith(os) Gk.: as in **lithologic**, stone (hence relative to the composition and physical characteristics of rock).

LITHOPHILOUS: in a strict sense, adapted to growth on steeply inclined, bare rock, or on stones, shells and similar substrata (see alga, lichen, bryophyte), but sometimes extended to include the chasmophilous condition, i.e. adapted to rocky slopes of cliffs and gorges where roots or rhizoids may penetrate cracks or fissures wherein soil and moisture have accumulated.

LITHOPHYTE: a plant adapted to a habitat or substratum of rock, stone, etc. A lithophilous plant.

LITHOSOL: see skeletal.

LITHOSPHERE: the solid crust of the earth below which is the plastic **asthenosphere**.

litoral(is) L.: of the shore (**litus**, **littus**).

LITRE: the unit of volume in the metric system equal to the volume of a kilogram of pure water at 4°C, equivalent to 35.196 fluid ounces (fl. oz.) or approximately 13/4 pints.

LITTORAL: in a broad sense, relative to the shore-line. In a strict sense, relative to that land below a sea up to the limit of the continental shelf, or to a lake down to thirty feet deep.

LOAM: a soil in which both fine (silt and clay) and coarse (sand) particles are well represented. See also texture.

LOBATE. LOBOSE: divided to lobes. From Gl. **lobos**, the lobe of the ear.

LOBE: of a lamina, a usually rounded part formed by the incomplete division for margin to centre.

-lobium: as in **gastrolobium**, a pod. (From Gk. **lobos**).

LOBULATE: divided to small lobes.

LOCAL: of distribution when confined to a restricted geographic region.

LOCULAR: containing, or made up of, locules.

LOCULE: a cavity formed by partitioning within a structure, especially an ovary, fruit or anther. Also **loculus** (plural loculi). An older term is cell.

LOCULICIDAL: see under dehiscence.

locus L.: a place; a position.

LOCTUS: (plural loci) of a chromosome, the position or site of a gene. For homologous chromosomes, the linear sequence or loci of genes is identical.

LODICULE: of grasses, one of the two or more scales at the base of an ovary.

LOESS: material of fine and uniform granular texture with sand or silt as the major component, probably transported by wind during and after the glacial periods of geologic time.

-logist, -logy: suffixes, student of, and study of, respectively, as in connection with the prefixes **also-**, **phyco-** (algae), **bacterio-** (bacteria), **bio-** (living processes), **bryo-** (bryophytes), **musco-** (mosses), **myco-**, **fungio-** (fungi), **placento-** (fossils), **palyno-** (pollen and other spores), **patho-** (pathogens), **phyto-** (plant life), **pterido-** (ferns and other pteridophytes), etc. From Gk. **lego**, to speak; or **logos**, a word.

loma Gk.: as in **brachyloma**, a fringe or border.

LOMENTUM: a legume or pod when constricted between the seeds (i.e. moniliform), often separating at the constriction into one-seeded articles.

lonch(e) Gk.: as in **lonchophyllus**, a spear.

LONG DAY PLANT: see under photoperiod.

LONGEVITY: the duration in time for a particular phase of growth before loss of viability, used especially of seed to denote the period of dormancy before complete loss of viability.

long(us) L.: as in **longipes**, long in length (hence with long stalks).

loph(os) Gk.: as in **lophantha**, a crest, a tuft.

lor(um) L.: as in **loranthus**, **lorate**, a thong or strap.

loti-: as in **lotifolia**, of the trefoil **Lotus**.

loxo(s) Gk.: as in **loxocarya**, oblique.

LUCID: shining.

LUMEN: of light, a unit of flow rate of luminous flux, one lumen being equal to the flux at a specific angle from a point source of light equivalent to one standard candle. See also lux, phot, foot-candle.

luna L.: as in **lunate**, the moon (hence crescent-shaped).

LUMINESCENCE: the emission of visible light other than through high temperature (as in combustion). See bio-, chemi-, electro-, photo-luminescence.

lurid(us) L.: pale yellow; lurid.

lute(us), diminutive loteol(us) L.: orange-yellow.

lut(um) L.: as in **lutarius**, **lutensis**, mud (hence of muddy places). **lutescens**: becoming muddy.

LUX: of light, the international unit of intensity (illumination or luminous intensity), one lux (1 lx., 1 L.) equivalent to the amount of light received at a distance of one metre from a standard candle, or one lumen (q.v.) per square metre. See also foot-candle.

lyc(os) Gk.: as in **lycopodium**, a wolf (hence wolf's paw, from a reference to the leaf-shape).

LYCOPSID: a pteridophyte (q.v.) differentiated to a definite stem, true leaves and roots, the leaf basically in spiral arrangement and with venation a single, unbranched vein which arises from a single leaf-trace unbroken by a leaf-gap from the vascular system (protostele or siphonostele) of the stem (i.e. the leaf a **microphyll**). Branching of the unsegmented stem is dichotomous, monopodial or sympodial. Sporangia are eusporangiate (i.e. formed from a superficial group of cells), axillary to unmodified or relatively modified leaves, or on the adaxial surface near the base of the leaf, usually the sporophylls collected in a terminal strobilus.

A member of the class **Lycopodiae** or division **Lepidophyta** of some authors, dating back to the Palaeozoic when sometimes reaching large tree size. Extant members are placed in three orders, **Lycopodiales** of two genera, **Selaginellales** and **Isoetales** both monogeneric, the first two usually referred to as the club-moss orders, the **Isoetales** the quillwort order.

Lycopodiales, of a single family with two herbaceous genera (a third, **Huperzia**, is sometimes recognised), are distinguished by homosporous, a prothallus (usually associated with a fungus) free-living (exosporic), an absence of a ligule to the leaf, the non-aggression in some members of the sporophylls is definite strobili, and the development of roots adventitious from a rhizome. **Lycopodium** has about 450 species world-wide, chiefly tropical, in distribution, 8 in Australia (e.g. Mountain Moss, **L. deuterodensum**, **L. cernuum**). Overseas, the spores of several species have been used as 'lycopodium powder' for the manufacture of fireworks and as a dusting powder. Pygmy club-moss **Phylloglossum drummondii** is confined to temperate Australia and New Zealand. It is up to or less than 5 cm (2 in.) in height, has 1-8 linear leaves and a solitary strobilus borne on a leafless peduncle.

Selaginellales feature heterosporous, the microsporangia and megasporangia more commonly together within the same strobilus, a prothallus never entirely free from the wall of the spore (i.e. **endosporic**), a constant arrangement of sporophylls in strobili, a tongue-like appendage (**ligule**) on the adaxial surface of the leaf and the development of adventitious roots from prop-like structures (rhizophores) at the points of branching of the stem. **Selaginella** has about 700 herbaceous species throughout the temperate parts of the world, 9 in Australia, e.g. **S. uliginosa**, **S. preissiana**.

The quillworts of **Isoetes**, the single genus of **Isoetales**, are heterosporous and endosporic, the vegetative structure a corm-like stem with a tuft of linear or awl-shaped, ligulate leaves with broad sheathing bases arising from the upper surface and with a basal rhizophore from which roots are produced in regular series. Exceptional to the class are a vascular cambium and multi-flagellate male gametes (sperm). The 75 species are distributed throughout the temperate parts of the world but poorly represented in Australia, Plain Quillwort **I. drummondii** up to 10 cm (4 in.) in height scattered throughout the temperate state, and Rock Quillwort **I. humilior** widespread throughout the temperate states.

lygod(es) Gk.: as in **lygodium**, flexible.

lyper: as in **lyperanthus**, sad; sombre (hence of flowers suggestive of this mood). From Gk. **lupe**, sadness.

LYRATE: of a pinnatifid leaf when the terminal lobe is large and rounded and the lateral lobes also more or less rounded but successively smaller towards the base of the leaf. From L. **lyra**, the lyre.

LYSIGENOUS: of a tissue when a cavity is formed by the break-down or dissolution of cells.

lysi(s) Gk.: as in **catalysis**, **lysinema**, a freeing; a loosening.

LYSIS: in general, the dissolution of a cell, e.g. by enzymatic reactions. Of a bacterium when ruptured by a bacteriophage.

LYSOGENY: of a bacterium, its association with a bacteriophage.

LYTIC: relative to a lysis.

m: metre; mm: millimetre. m.e.: see milli-equivalent. m. phot: milli-phot. See also under mill(e).

macerans L.: to soften by soaking in water.

MACERATION: of a tissue or organ, the isolation of its components by physical or chemical means.

macro(s) Gk.: as in **macrobiotic**, long (hence long-lived); in **macroscopic** large (hence visible without the aid of a microscope).

MACROELEMENT: see essential element.

MACROMOLECULE: a molecule of repeated structural units as, e.g. the proteins and nucleic acids of biosynthesis. See also polymerization.

MACULATE: of a surface when mottled or spotted.

maculos(us) L.: spotted.

madescens L.: becoming moist.

madid(us) L.: moist.

magnific(us) L.: of magnificent or splendid appearance.

magn(us) L.: of great size.

malac(os) Gk.: as in **malacoid**, soft; fleshy.

MALACOPHILOUS: pollinating through the agencies of snails, slugs, and other gastropods.

MALAYSIAN ELEMENT: of the Australian flora, that part which apparently originated by migration from the Malay Peninsula and Indonesia. This segment is centred in the topical zone with the north-east coast of Queensland a focal point.

MALLEE: of a eucalypt when shrub-like in growth, the habit often associated with harsh conditions of soil and rainfall when a characteristic mallee scrub may be formed. Used also as the noun.

Strictly true mallees are those naturally confined to arid or adverse habitats when the ability to regenerate freely from the lignotuber is an adaptive feature. Most eucalypts develop lignotubers and the few which do not (e.g. Alpine and Mountain Ash, Karri, River Red Gum) do produce a small swelling above their root-system, not fire-resistant, but with a capacity for suckering. The potential to maintain themselves (as mallees) is a feature of most eucalypts when subjected to harsh conditions, the reverse hold that many true mallees, when grown under more moderate conditions, are capable of developing the tree habit.

In Western Australia, a **marlock** is recognised. The marlock is noted for its mallee-like form but poor development of a ligno-tuber. The distinction is not always clear so that the term mallee in common usage usually is inclusive of the marlock. The **Mallets** and **Moorts**, also of the west, again may be included, the Mallets are small trees with a bushy crown, sometimes forming thickets, some (e.g. **Eucalyptus astrigens**) are commercially-important sources of tanbark. Moorts (e.g. **E. platypus**, **E. nutans**) are the marlocks with smooth grey bark, below thirty feet in height. In the east and south-east are recognised **Whipstick Mallees** when small and with slender, whiplike stems (e.g. **E. gracilis**), and **Bull Mallees** (e.g. **E. oleosa**, **E. behirana**) when of larger proportions - the two forms are influenced largely by site, particularly when forming scrub, so that the same species may assume either habit according to the habitat. The two small botanic groups, united largely by features of the anther, Mallee Gums (e.g. **E. foecunda**) and Mallee Boxes (e.g. **E. fruticetorum**, **E. viridis**) are somewhat confusing since Blue Mallee **E. fruticetorum** noted as a source of a valuable essential oil although of highly limited natural occurrence, has a decortivating bark quite unlike the persistent bark typifying boxes. Such mallees again may occur as whipstick or bull types.

MALE STERILE: of a genetic system carrying factors for male sterility, progeny receiving the factors producing sterile male reproductive elements (e.g. pollen-grain). See also cytoplasmic inheritance.

mallo(s) Gk.: as in **mallophora**, wool.

MALT: see under cereal.

MANGROVE: a community (or a member) arising from an estuarine or tidal mud-flat, e.g. formed by the trees **Avicennia marina** (Grey M.) or **Aegiceras corniculatum** (River M.).

MARCESCENT: becoming withered but not falling away.

MARCID: withered.

marcid(us) L.: faded, withered, marcid.

margarit(a) L.: a pearl.

MARGINAL LAND: land yielding from agriculture an average return no more than just sufficient to cover the costs of production. It is thus influenced largely by economic conditions.

MARGINATE: with a distinctive margin or rim.

marg(o) L.: as in **marginal**, an edge.

margy(aron) Gk.: as in **margyricarpus**, a pearl.

mar(e) L.: as in **marinus**, **maris**, the sea.

maritim(us) L.: marine; maritime; littoral.

MATRIX: in general, a medium or ground substance within which an object or structure is formed.

MATURATION: the stage of maturing or ripening.

maxim(us) L.: the superlative of great.

MEDITERRANEAN CLIMATE: in general, a climate with a range of moderate temperatures throughout the year and with winter rainfall. In Australia, applies particularly to the southern parts where rainfall is virtually absent during summer, the average for the warmest month usually in excess of 70°F, and for the coldest month usually above 43°F.

medi(us) L.: as in **medial**, **median**, the middle.

MEDULLA: a central column. The pith of a stem.

MEDULLARY RAY: a radiating projection of pith in herbaceous stems.

mega: as in **megavolt** (MV), a million.

mega(s), megal(e) Gk.: large.

MEGASPORANGIUM: see under sporangium.

MEGASPORE: the larger of dimorphic spores. The spore of heterosporous plants developing to the female gametophyte (not necessarily the larger of the spores).

MEGASPOROPHYLL: see under sporophyll.

meio(n) Gk.: as in **meiostemonous**, less (hence stamens when less in number than the petals or sepals).

MEIOSIS: the nuclear reduction division of sexual reproduction, a mechanism ensuring that the number of chromosomes normal to the species is not doubled at the fusion of nuclei of gametes at fertilization. A double division of a diploid nucleus when, during one of two successive divisions, there is no duplication of chromosomes (i.e. chromatids of homologous chromosomes do not separate), the effect being that the tetrad of daughter nuclei so formed receive each half the content of the parental nucleus (i.e. are reduced to the haploid condition). As a result of crossing-over (q.v.) possible among segments of paired chromosomes, a recombination of genes (alleles) effects a qualitative difference in the genetic constitutions of the four nuclei.

For those plants with a regular heteromorphic alternation of generations, meiosis marks the beginning of the haploid (gametophytic) phase (or haplophase) of the life-cycle, the tetrad of spores formed meiotically from a spore mother-cell being the first cells of the haploid generation. Since further nuclear division are without reduction (i.e. are mitotic), the haploid condition is maintained up to fusion of nuclei contributed by gametes at fertilization. The resultant zygote of this fusion is the first cell of the restored diploid condition, hence the beginning of the spore-producing generation (sporophyte or diplophase).

MEIOSPORE: a haploid cell resultant from meiosis which undergoes mitotic divisions to form a gametophyte.

MEIOTIC: relative to meiosis.

mel, mellis L.: as in **melianthus**, **melleus**, **meliiodora**, honey.

mela(s), melani(s) Gk.: as in **melanoxyton**, black.

MELITTOPHILY: pollination by honeybees.

mel(um) Gk., L.: as in **melophthora**, the apple (**Pryus malus**) hence apple-devouring or destroying.

MEMBRANOUS: of texture when thin-layered and pliable, transparent or translucent, usually without colour.

MENDELISM: of inheritance, a concept embodying the principles of segregation and recombination, based on an interpretation of Gregor Mendel's work (1865).

-mene: as in **thryptomene**, **trachymene**, a membrane. From Gk. **hymen**.

MERICARP: of a schizocarpic fruit, the carpel separated as a one-seeded, usually indehiscent part.

meri(s), mero(s) Gk.: as in **isomeric**, **meristic**, **pentamerous**, a part.

MERISTIC: divided into parts; different in number of parts.

MERISTEM: a group of cells within which active division occurs to form new cells. **Meristematic**: relative to a meristem, e.g. the meristematic tissues of vascular plants are the **apical meristem** when new cells initiate the elongation of a shoot, **lateral meristem** when new cells initiate thickening around an axis (see cambium), **diffuse meristem** when growth is of limited duration, as in the forming of an organ, the meristem unlocalised so that cell-division occurs throughout. See also intercalary.

mer(us) L.: as in **meruleus**, pure.

mesembri(a) Gk.: as in **mesembryanthemum**, mid-day.

MESID: of the moisture conditions typifying a mesophyte, i.e. regular availability of moisture. Neither xeric nor hydric.

MESOCARP: the mid-layer of a pericarp, i.e. between the exocarp and endocarp.

MESOPHYLLIC: with the nature of a mesophyte.

MESOPHYLL: the thin-walled parenchyma of a leaf-lamina between the upper and lower epidermis, made up of layers of **palisade** parenchyma and **spongy** parenchyma. A photosynthetic tissue, the elongated cells of the palisade layer contain in number of the chloroplasts, the spongy layers, with fewer chloroplasts, have larger intercellular spaces and, in association with the stomata, are concerned with the gaseous exchange between leaf and atmosphere.

MESOPHYTE: a plant with optimum growth within the mean of temperature and moisture gradients, i.e. mid-way between the conditions required of a hydrophyte and a xerophyte.

mes(os) Gk.: middle.

MESOTHERMIC: with optimum growth at moderate temperatures.

meta Gk.: as in **metaxylem**, after; in **metamorphic**, a change.

METABOLISM: the total of living processes involving synthesis (anabolism or assimilation) and breakdown (catabolism or dissimulation) of organic matter for the conversion, freeing, and utilization of energy.

METABOLITE: a substance concerned with metabolism; a product of biosynthesis.

METAMORPHIC: of rocks when derived by changes in the properties of pre-existing rocks through forces (e.g. heat and pressure) within the earth's crust.

METAMORPHOSIS: of plants, a change from the normal in form or structure, as of stamens when converted to petals.

METAXYLEM: primary xylem developed after protoxylem but before secondary xylem.

metr(a) Gk.: as in **metrosideros**, heart-wood (hence iron-hard heartwood).

METRE: (abbreviated m) the standard unit of length in the metric system equivalent to 1.0936 yards, 3.2808 feet (1 ft. = 0.3048 m), or approximately 39.37 inches.

METRIC: of a system of measurements where the standard units are the metre, kilogram, and second, other units being decimal subdivisions or multiples, prefixed accordingly, e.g. for a metre, milli- (one thousandth), centi- (one hundredth), deci- (one tenth), deca- (ten), hecto- (one hundred), kilo- (one thousand).

METRIC TON: (tonne) 1,000 kilograms or 2,204.6 lbs.

metr(on) Gk. a measure hence in **thermometer**, an instrument for measuring, **thermometric**, relative to a measure of, **thermometrics**, **thermometry**, the measurement of . . . temperature.

micace(us) L.: glittering.

MICROBIOTA: the flora and fauna of microscopic organisms (microbes).

MICROCLIMATE: the strictly local combinations of atmospheric conditions influencing directly the individual or limited group of individuals.

MICROPHYLL: see under lycopsid.

MICROPYLE: of the integument/s of an ovule, a small pore through which may enter the tube of a germinated pollen-grain for penetration of the nucellus. (in certain gymnosperms, a well-developed tube).

micro(s) Gk.: as in **micranthus**, **microphyllous**, small. In measurement of dimensions, the one-thousandth part when milligram (mass), millimetre (length), and millilitre (volume) are the units. Symbols are ug (microgram), u (micron), ul (microlitre).

MICROSCOPIC: below the limits of sight unaided by the means of magnification provided by a microscope. See also light microscope.

MICROSPORANGIUM: see under sporangium.

MICROSPORE: the smaller of dimorphic spores. The spore of heterosporous plants which develops to the male gametophyte (not necessarily the smaller).

MICROSPOROPHYLL: see under sporophyll.

MICROTOME: an instrument designed for the cutting of an object to slices of such thinness that light may be transmitted for the perception of microscopic detail through means of a microscope.

MICRURGY: micro-surgery, i.e. dissection within microscopic limits, as by a micromanipulator used for the physical dissection of cellular contents.

MID-RIB: of a venation, the major vein when central, prominent, and extending from base to apex to the lamina to form the confluence of other veins.

MILDEW: a disease of organisms, or a contamination of organic material from bacterial or fungal infection, when evidenced by a powdery, felt-like covering or a stain.

mill(e) L.: as in **millennium**, a thousand. **millesim(us)**: the thousandth. In measurement of dimensions, the one-thousandth part when gram, metre, litre, second are the units. Symbols are **mgm** (milligram), **mm** (millimetre), **ml** (millilitre), **m-sec.** (millisecond). A millimicron (μ) is one-thousandth of a micron, or 10 Angstroms.

MILLI-EQUIVALENT: the chemical equivalent, or combining weight of an element or radical expressed in milligrams. As a percentage (m.e%) used to indicate the ions available to a plant from 100 grams of oven-dry soil.

mim(ikos) Gk.: as in **mimosa**, imitating (hence imitating the movement characteristic of animals through a response to atmospheric conditions).

MINERAL NUTRIENT: a soil-derived chemical element in ionic form essential for plant growth. Based on the amount required for nutrition, either a **major element** (macronutrient) or a **minor element** (micronutrient, oligo-element, trace element) according to the needs of a particular plant.

The following have been found essential to some plant, although not necessarily universally required: nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), sulphur (S) - these are regarded for a majority of at least higher plants as the major elements. Required in less amount are: iron (Fe), chlorine (Cl), sodium (Na), cobalt (Co), vanadium (V). In addition, such elements as aluminium (Al), silicon (Si), selenium (Se), iodine (I), nickel (Ni), chromium (Cr), have been detected within some plants but the value as a nutrient has not been determined.

miniat(us) L.: with the colour of cinnabar (L. **minium**).

minim(us) L.: minimal, smallest (the superlative of **parv(us)**).

mirabilis L.: wonderful, unusual.

mitis L.: soft, mild.

mito(s) Gk.: as in **mitosis**, a thread.

MITOCHONDRION: (plural mitochondria) an organelle of cytoplasm which functions as a site for the activation of many of the reactions concerned in respiration. May be isolated by differential

centrifugation, is optically definable as a rod-shaped, filamentous, or spherical structure (length by breadth 0.5 to 10 by 0.5 to 1.0 microns). It is self-replacing, chemically of lipids or proteins as the major fractions with some nucleic acid, and forms a multi-layered lipoprotein system of external and internal membranes.

MITOSIS: the division of a nucleus to two parts which, by eventual re-organisation of nuclear membranes, become daughter nuclei with the same content of chromosomes and (normally) arrangement of genes as the parent. The karyokinesis of somatic cell division. cf. meiosis. **Mitotic:** relative to a mitosis.

MITOSPORE: a spore (especially of thallophytes) formed directly from a mitosis, hence asexual and either diploid or haploid. When motile (i.e. flagellate), a **zoospore**.

MITOTIC APPARATUS: the ultra-structure within a nucleus formed at a mitosis by protein fibres which are orientated between two poles, so forming a spindle-shaped figure (the spindle) widest at the centre (the equatorial plate). Other fibres connecting with centromeres orientate chromosomes in relation to the equatorial plate.

mixis Gk.: as in **apomixis**, a mixing (hence away from, **apo-** fertilization, **-mixis**).

mixt(us) L.: mixed.

MOLAL: of a solution, relative to a weight for weight relationship existing when for a thousand grams (1,000 g) of solution, the weight of the solute (in g's) is equivalent to its gram molecular weight or a multiple thereof.

MOLAR: of a solution, relative to a weight per volume relationship existing when for a thousand millimetres (1 litre) of solution, the weight (in g's) of the solute is equivalent to its gram molecular weight or a multiple thereof.

MOLE: gram molecule, i.e. the amount (of a pure substance) equivalent to one gram molecular weight of the substance.

MOLECULAR: relative to a molecule (or molecules), the smallest particle of a chemical substance able to occur in the free state, formed by the bondage of two or more atoms of different elements (e.g. H₂O) or of the one element (e.g. O₂).

MOLECULAR WEIGHT: of a substance, the sum of the atomic weights (q.v.) of its component atoms. When expressed in grams, **gram molecular weight**.

molle, mollis L.: soft, pliant. **mollissim(us)**, the superlative degree.

mono(s) Gk.: as in **monandrous**, one, single. In **nitrosomonas**, a unit or monad.

MONADELPHOUS: of stamens when grouped or united in a single bundle.

MONILIFORM: of a cylindrical structure (e.g. a pod) when constricted at regular intervals along its length (to appear like a chain of beads).

MONOCHASium: a dichasium (q.v.) when appearing as a solitary-flowered inflorescence by loss through morphologic reduction of the lateral flowers.

MONOCHLAMYDEOUS: of a flower when its perianth is of a single whorl, i.e. without petals (the sepals sometimes petal-like).

MONOCHROMATIC: in general, with a single colour. Of light when modified so that it is of a single wavelength.

MONOCLINOUS: bisexual.

MONOCOTYLEDON: (abbreviated in this work to monocot) an angiosperm with which is associated most of the following characters: an embryo with a single cotyledon which, on germination, usually remains below ground-level to function for storage (i.e. hypogeal), a vascular system of scattered bundles, an absence of a cambium, a predominance of thickened basal stems (rhizomes, corms, bulbs), a fibrous root-system, linear leaves with parallel venation, floral whorls trimerous, petals and sepals undifferentiated.

A member of a class **Monocotyledonae** or some authors, or a sub-class **Monocotyledonidae** of others, Hutchinson (1959) assigning 70 families arranged in 28 orders.

MONOECIOUS: of a plant when bearing unisexual reproductive structure of both sexes. **Monoecism:** the condition. See also andromonoecious, gynomonoecious.

MONOGENERIC: of a family when a single genus is ascribed to it, e.g. **Cephalotaceae** with **Cephalotus** its sole genus.

MONOHYBRID: of a hybrid when heterozygous for a single pair of factors.

MONOPHYLETIC: derived from a single ancestral stock. cf. polyphyletic.

MONOPODIUM: a single axis from which arise all lateral branches.

MONOSPECIFIC: of a genus when a single species is ascribed to it.

MONOSTICHOUS: arranged in a single row or series, or on one side of an axis.

MONOTYPIC: represented by a single member, as a monogeneric family, or monospecific genus.

MONSOONAL: relative to the monsoon, a wind which blows persistently and at regular intervals during definite seasons of the year, due primarily to the seasonal difference of temperature between land and sea. Often used simply to denote the rains which are a feature of the monsoon.

MONTANE: of mountainous regions.

montan(us) L.: dwelling on, or relative to, mountains (**mons, montis**).

MONTICOLOUS: dwelling in mountainous regions.

morph(e) Gk.: as in **morphogenesis**, form, shape.

MORPHOGENETIC: relative to the correlation of morphology with its origin and development or to the morphological features concerned in biological organisation, i.e. relative to morphogenesis.

MORPHOLOGICAL: relative to the external structural features of an organism, especially from the aspect of shape and degree of differentiation.

MOSCHATE: of, or resembling, the odour of musk **Mimulus moschatus**.

MOSS: see under bryophyte.

MOULD: a fungus, usually saprophytic, developing a conspicuous mycelium. Also mold.

MUCID: mouldy. i.e. attacked by, or resembling an attack by, a mould.

MUCILAGE: see under gum.

mucos(us) L.: slimy or mucilage-like (mucilaginous).

MUCRO: a short, hard or flexible point terminating a structure, especially a lamina. From L. **mucro**, a point.

MUCRONATE: equipped with a mucro, as certain leaves.

MUCRONULATE: the diminutive form of mucronate, i.e. with less conspicuous mucro.

MULCH: a layer of a material which, as a covering, may act as a barrier to excessive heat, desiccation, or moisture loss.

MULGA SCRUB: a community of wide occurrence in the arid parts of Australia in which the shrub *Mulga Acacia aneura* usually is a dominant. It is a community of the summer-rainfall zone, confined to regions where the rainfall rarely exceeds ten inches. Other acacias with similar rigid and needle-like phyllodes (e.g. *A. tetragonophylla*, *A. burkittii*) may be locally dominant while other shrubs may be present, e.g. *Eremophila* and *Cassia* spp. In the west, the tree *Brachychiton gregorii* (Kurrajong) also may be in evidence. Most of the members develop seeds of considerable longevity. Of the lower stratum, an ephemeral flora is conspicuous whenever sufficient rainfall is received for its response, while a well-developed herbaceous stratum, chiefly as such grasses as *Eragrostis* spp., usually is present. In the west also known as Mulga Bush.

mult(us) L.: as in **multifid**, many (hence divided into a number of segments or lobes).

MULTIPLE ALLELES: of alleles when there are more than two which may occupy the same locus of a chromosome. Also multialleles.

MULTIPLE CROSS: a hybrid formed by the crossing of more than two parental lines of different origin.

MULTIPLE FACTORS: of a chromosome, genes several in number but with a common effect for a particular character.

MULTIPLE FRUIT: see under fruit.

MULTIPLICATE: with many folds.

MULTISERiate: occurring in several series as, e.g. of cells when formed in several rows.

murale, muralis L.: growing on, or relative to, walls.

MURICATE: of a surface when roughened by short and hard points.

muris L.: of the mouse (**mus**).

musca L.: as in **muscaria**, a fly (the insect of **Diptera**).

muscor(um) L.: of mosses.

muscos(us) L.: covered by moss.

musc(us) L.: as in **muscoid**, a moss.

mut(o) L.: as in **mutate**, to change.

MUTABLE: variable in form or colour.

MUTAGENIC: inducing a mutation, as by, e.g. an irradiation.

MUTATION: a change within a genetic system (either by gene or chromosome) which produces in the mutant (or variant) a slight or profound effect. The effect may be of benefit, the mutation continued as a hereditary variation.

Mutation of a gene may occur from some chemical change, the substituted gene being reduplicated, and, of chromosomes, the change may occur by multiplication of the set (polyploidy), by addition or

less within the set (aneuploidy), by structural reconstitution (see inversion, translocation), by chemical alteration, or by breakdown of the duplicating process during cell-division. Both reproductive and vegetative (somatic) cell may be the origin of the mutation: when a somatic mutation, the effect is localised as in bud-sports, chimaeras, variegation, fasciation, etc.

In nature, mutation usually is at random but, by various artificial means (e.g. irradiations, reactive chemical substances), may be induced under controlled conditions.

MUTICOUS: blunt; obtuse.

MUTUALISM: see under symbiosis.

myce(s) Gk.: as in **mycetoid**, **mycosis**, a fungus. In **actinomyces**, **streptomyces**, etc. and the antibiotics **aureomycin**, **neomycin**, **streptomycin**, etc. extracted (at least originally) from culture filtrates of **Streptomyces** spp., the suffix (or form) implies a fungus-like bacterium. **-mycetes** (class)m **-mycetidae** (sub-class) are the suffixes recommended in the nomenclature of fungi.

MYCELIUM: the vegetative structure of a fungus composed of a series of filamentous hyphae.

MYCETOGENETIC, MYCETOGENIC: produced by a fungus.

MYCORRHIZA: a root modified by its association with a soil-inhabiting evidently symbiotic fungus (a basidiomycete or phycomycete). The association provides a nutrient-exchange system essential in the establishment of certain plants (e.g. some orchids, plants of heath communities, pines, eucalypts, etc.).

When the fungus forms a dense mantle of mycelium over the surface of the root with some hyphae forcing through the epidermis to the cortex, the mycorrhiza is termed **ectotrophic**: when invading throughout the parenchyma, it is termed **endotrophic**. See also under Fern.

MYCORRHIZAL, MYCORRHIZIC: relative to a mycorrhiza.

MYCOSIS: a disease caused by a fungus, e.g. dermatomycosis, a disease of the skin from a fungal pathogen, as ringworm caused by species of **Microsporon**, **Trichophyton**, **Epidermophyton**.

-mycota, -mycotina: suffixes recommended for the nomenclature of division and sub-divisions respectively of fungi.

MYCOTROPHIC: of a plant when requiring mycorrhizal roots for its development.

my(o) Gk.: as in **myoporum**, to close (hence with closed pores, i.e. in the genus referring to the punctate nature of the leaves).

myos Gk.: as in **myosotis**, a mouse (hence resembling the ear of a mouse).

myrio(s) Gk.: as in **myriocephala**, innumerable; in a myriad.

myrme(x) Gk.: as in **myrmecophilous**, an ant (hence pollinating through the agency of ants).

myrti-: as in **myrtifolia**, of the myrtle **Myrtus** (from **myr(on)** Gk.: perfume).

myx(a) Gk.: as in **myxomycete**, slime; mucus (hence 'slime fungus').

NACREOUS: with the texture or lustre of mother-of-pearl. (nacre).

NACRINE: with the colour of mother-of-pearl.

NADP: nicotinamide adenine dinucleotide diphosphate. Its reduced form, NADPH, is the reducing agent of carbon dioxide at photosynthesis.

nan(us) L.: dwarf. The prefix **nano-**, as in **nanometre**, indicates the billionth part, i.e. 1×10^9 , hence 1 nanometre equal 10 Angstrom units.

nape(us) L.: of a forest.

nap(us) L.: a turnip. Also **rap(um)**.

narc(e) Gk.: as in **narcotic**, sleep; loss of feeling.

NASCENT: becoming formed. From L.: **nascor**, to be born; to arise from.

NASTIC: see under tropism.

nas(us) L.: as in **nasturtium**, the nose (hence nas(us), tort(um), to twist, i.e. pungent).

natans L.: swimming, floating. Hence **natant**, floating.

NATIVE: originating in the region where found.

NATURAL: of relationship among taxa, connected through similarities based either on observable or deducible evidence.

NATURAL SELECTION: of evolution, a concept of a selective mechanism favouring, among the vast number of randomly-acting gene combinations transmissible to successive generations, those combinations of most benefit to adaptation.

NATURALISATION: the process of adapting to a new environment, i.e. successfully competing with indigens without special aid or protection.

nau(s) Gk.: as in **nauclea**, a ship (hence **nau(s)**, **clei(o)**, to close, in reference to the hull-shaped fruit).

NAVICULAR: boat-like in shape or form. From **navis** L.: a ship.

NECROGENOUS: developing in dead tissue.

NECROPHYTIC: saprophytic; living on the remains of dead plants.

NECROTIC: of plant tissue when disease causes death of its component cells, often with an accompanying darkening of the tissue. **Necrosis**, the condition.

NECTARY: a gland or group of cells secreting a nectar, a sugary substance serving as an attractant to insects concerned in pollination. **Nectariferous**: secreting a nectar.

neglect(us) L.: overlooked.

NEKTON: the organic life at various depths of the ocean or lake with the ability to move independently of the currents, thus distinct from the drifting plankton. From Gk. **nektos**, swimming.

nema Gk.: as in **nematophylla**, **nematoid**, a thread.

nemoralis L.: of woods or groves; sylvan (nemorose).

nemoros(us) L.: woody; heavily foliated.

nem(us) L.: a grove; a forest.

neo(s) Gk.: as in **neolithic**, new.

NEOLITHIC: relative to the New Stone Age or to the communities of this age (c. 7,000 B.C. or almost 10,000 years ago) practised in the use of flint and stone for fanning, especially of the Middle East.

NEOPLASM: newly-formed tissue. Of plants especially a gall or tumour.

neopho(s) Gk.: as in nepheline, a cloud.

nephro(s) Gk.: as in **nephroid**, a kidney.

nerii: as in **nerifolia**, of the oleander, **Nerium**. From Gk. **neros**, humid.

NERVATION: see venation.

nervos(us) L.: prominently veined (of plants).

neso(s) Gk.: as in **nesophila**, an island.

netr(um) Gk.: a spindle.

NEUTER: with no part functionally fertile, as of sterile flowers.

NEW WORLD: of phytogeography, that part of the world approximately between longitudes 20°W to 180°, i.e. the western hemisphere which includes the Americas and proximal islands. cf. Old World.

NICHE: the microenvironment of an organism.

nid(us) L.: a nest, **nidul(us)**: the diminutive.

niger, nigra, nigrum L.: black.

NIGRESCENT: becoming black; almost black. Also nigrant.

nipho(s) Gk.: as in **niphophila**, snow.

nitens L.: shining.

NITID, NITDOUS: lustrous; shining.

nitrari-: as in **nitrarifolia**, of the Nitre Bush **Nitraria**.

NITRATE: of plant nutrition, the soil-derived salt providing the chief source of nitrogen, a normally chemically inert element. In nature, synthesised from free (atmospheric) nitrogen through the processes of fixation and nitrification.

NITRIFICATION: of soil, the conversion of nitrogenous compounds (either organic or ammonium) to nitrates through a succession of micro-organisms influenced by the physical nature of the soil. e.g. the aerobic bacterium of **Nitrosomonas** frees nitrous acid from ammonium compounds, a second bacterium oxidises nitrous acid while the soil reaction changes the product to a nitrate.

Denitrification: the releasing of nitrogen from a nitrogenous compound by the action of soil micro-flora, the element therefore unavailable to higher plants.

NITROGEN CYCLE: the cyclical conversions of nitrogen from organic to inorganic compounds, i.e. by the release to the soil of organic nitrogen (as amino compounds) through decay, putrefaction and excretion which, directly or indirectly, is the biosynthate derived from inorganic nitrogen through initially the processes of ammonification and nitrification.

NITROGEN FIXATION: the synthesis of 'fixing' of free nitrogen to nitrogenous compounds, naturally by such soil-dwelling bacteria as the aerobic **Azobacter** and anaerobic **Clostridium** and such blue-green algae as **Nostoc** and **Anabaena**, or through the symbiosis between the roots of legumes and bacteria of **Rhizobium**. To a lesser degree, by the conversion of gaseous nitrogen to nitrous oxides through the action of atmospheric lightning or ultra-violet radiation, and ultimate reception by the soil through the agency of rain.

NITROGENOUS: relative to the chemical compounds of nitrogen.

nitros(us) L.: as in **nitrous**, **nitrosomonas**, of nitrogen.

niv(is) L.: as in **nivalis**, **niveus**, snow (hence of snow, or snow-white).

nobile, nobilis L.: noticeable; well-known.

nocte L.: night.

nocturn(us) L.: by night; nightly.

NODE: of a stem, that part from which arises a leaf.

nodos(us) L.: with knob or knob-like swelling (nodose).

NODULE: of a root, a swelling caused by excessive development of tissue, e.g. the nodule of a legume when invaded by a nitrogen-fixing bacterium, or of certain other plants (e.g. **Casuarina**) when caused by a mycorrhizal association or a factor not yet determined but possibly concerned in nitrogen-fixation.

nomen L.: a name.

NOMENCLATURE: the naming of groups of organisms (taxa) in conformity with an international code designed for precision and universal comprehension. When the taxon is a species, its naming conforms to a **binomial**, a qualifying name (specific epithet) added to a generic name. When a sub-species or variety, a further qualifying name forms a **trinomial**. For uniformity, when a sub-species or variety is formed, the residue of the parent species also becomes a sub-species or variety and takes again the name of the species, e.g. **Leptospermum lanigerum** var. **macrocarpum**, **L. lanigerum** var. **lanigerum**. While Latin is the basic language used, a derivation from the Greek (latinised Greek) also is in use and, with an appropriate latinised ending, an infinite variety of other languages may be used, e.g. **wooroonooran**, **jibberdingensis**, **Geleznowis**, **Scheuchzeriaceae**, etc.

For a family or taxon of lower rank, the code accepts one name only and this must be the earliest name conforming to the rules of priority, i.e. the earliest legitimate (validly published) name at the same level. A validly published name implies the provision of a published description and nomination of a specimen as the nomenclatural 'type' or, in certain cases, a specimen or figure of a specimen bearing the name without doubt as to its identity. The rules of priority are retrospect to a definite publishing date, in the case of vascular plants and, with a few exceptions, algae, 1st May, 1753 (Linnaeus, **Species plantarum** ed. 1). For certain genera and levels up to family where long usage favours a retention, a name (**nomina conservanda**) not the earliest may be approved. From the beginning of 1935, a name is accepted as validly published only when a diagnosis (in Latin) is included.

For hybrids between two species or two genera, designation may be made by either a formula or (if desirable) a name. The formula takes the form of a citation of the names of both parents separated by an X (e.g. **Eucalyptus camfieldii X haemastoma**); the name is formed by qualification with an X before the 'specific' epithet (e.g. **Eucalyptus X pygmaea**) in the case of a cross (e.g. **X Solidago**). See also author citation, typification, epithet.

nom(os) Gk.: as in **agronomy**, **taxonomy**, a system.

non(us) L.: the ninth.

norm(a) L.: as in **normalis**, a pattern; a rule (hence of the normal form).

NORMALITY: of an aqueous solution of an acid or base, the concentration expressed in grams per litre of hydrogen ions contained or (for a base) the hydroxyl ions contained which would be reactive with hydrogens ions. Numerically it is expressed as a factor of a **normal solution** (1N) which, for one

litre, contains one gram of ionizable hydrogen or hydroxyl. In terms of solute present, a litre of 1N solution contains the gram molecular weight of the solute divided by the number of hydrogen or hydroxyl ions contained by its molecule, e.g. for 1N H₂SO₄ solution, $2(1) + 32 + 4(16) / 2 = 49$ H₂SO₄ are contained. For a deci-normal (N/10) solution, 4.9 g, etc.

NOTATE: marked by lines; spotted.

notho(s) Gk.: as in **nothofagus**, **false** (hence like a beech but not a true beech).

not(os) Gk.: as in **notelaea**, south (hence **not(os)**, **elaia**, an olive).

noto(s) Gk.: an in **notoceras**, the back.

novell(us) L.: the diminutive of **nov(us)**, new.

nubigena L.: of a cloud, or born of clouds.

nubil(us) L.: cloudy; blue with a tinge of grey.

NUCELLUS: of an ovule, a central group of sporogenous cells, usually enclosed by one or two integuments.

NUCLEAR: relative to a nucleus, or to the material contained by a nucleus. From L. **nucleus**, a kernel or stone of fruit.

NUCLEIC ACID: a highly complex polymer occurring (as a nucleo-protein) in both nucleus and cytoplasm, composed essentially of unbranched chains of nucleotides (about ten thousand nucleotides to each chain), hence chemically a **polynucleotide**. The nucleotide consists of a pentose sugar (ribose or deoxyribose) to which is attached a phosphate group (linked with the sugar and by repetition forming the polynucleotide) and a nitrogenous side-group, a pyrimidine base (cytosine, thymine, uracil) or a purine base (adenine, guanine).

When the sugar is deoxyribose (which has one of the -OH groups of ribose substituted by an -H group), the nucleic acid is known as deoxyribose nucleic acid (or sometimes deoxyribose nucleic acid), DNA. The model by Watson and Crick (1953) of the structure of DNA is a two-strand helix, i.e. two helical chains coiled around the same axis, each chain carrying at random along its length four different nucleotides. Each chain is connected to the other by a special type of bonding (hydrogen bond) of pairs of bases, either adenine or thymine together, or guanine and cytosine together. This selective grouping of bases ensures that the sequence of bases on one chain determines the sequence on the other, thus, when uncoiling and separation of a helix occurs (as at nuclear division) a new chain built on one of the original chains has the same sequences of bases. Since DNA is confined almost exclusively to chromosomes, the view is acceptable that it is the coding system created by the positioning of the nucleotides which provides a template upon which the synthesis, e.g. of protein, is based. DNA is considered both the carrier of genetic information and the template for synthesis of RNA.

RNA differs from DNA in its ribose sugar (hence ribose nucleic acid) and substitution of thymine by uracil. It occurs both in nucleus and cytoplasm, and is of at least three forms. According to function, it is named messenger RNA (mRNA), transfer RNA (tRNA), and ribosomal RNA (rRNA). In the synthesis of a protein, the function of these appears to concern (1) the 'acceptance' by mRNA of information from DNA in determining the course from the 64 possible combinations supplied by a 'triplet' of three adjacent nucleotides required for synthesis of a single amino acid (2) transfer by tRNA of the amino acid to a site, the ribosome, found in both nucleus and cytoplasm and where the concentration of RNA is greatest (3) direction of protein synthesis, i.e. the coding by rRNA of the amino acids to form a specific protein.

NUCLEUS: of a cell (other than that of a procaryote), a major organelle limited from the cytoplasm by a double-layered membrane (nuclear membrane) which temporarily disappears at a cell-division. Enclosed by the nuclear membrane is a structureless **nucleoplasm** within which are located granular RNA- containing **nucleoli**, often ribosomes, and a DNA-containing **chromatin** which at a

nuclear division resolves to chromosomes by a process of spiralisation. See also chromosome, chromatid, chromoema, nucleic acid. (plural nuclei).

NUCLEOLUS: (plural nucleoli) an inclusion of a nucleus which is reformed after, but appears absent, during cell-division and is believed to be the site for synthesis of ribosomal RNA (rRNA).

nud(us) L.: without a covering.

NULLAGINE: relative to a series of late Pre-Cambrian rocks covering parts of the archaean rocks of the Australian Shield. The series are in horizontal layers and, as such, form uniform landscapes and soils over large areas. The series occur in plateaus of Arnhem Land, Hamersley Ranges, the Kimberley and Pilbara region of Northern Territory and tropical Western Australia where their derived soils support in the virgin state a type of steppe and impoverished savannah.

NULLIPORE: a coral-like encrustation representing the remains of a calcareous alga (e.g., a species of **Corallina** or **Lithothamnion**) with the property of building reefs. The name means literally 'without a pore' as a feature distinct from the calcified remains of calcium-secreting coelenterates. Other calcareous algae (e.g. **Chara**) form fresh-water limestones.

NUMERICAL TAXONOMY: an approach to classification and discrimination of species through biometric techniques, e.g. the application of statistical analysis in assessing variation from a set of standards (or operational taxonomic units) established from data covering as many characters (at least fifty) as possible.

nummul(us) L.: as in **nummularius**, small money, coinage (hence appearing as a series of discs).

NUT: in a strict sense, an indehiscent, 1-locular, 1 or 2-seeded fruit with the three layers of the pericarp hard-textured and not distinct from one another but usually free from the seed. Sometimes as in the hazel-nut (of **Corylus**) and acorn of oak (**Quercus**), partly enclosed by a cupule.

NUT-LIKE: resembling a true nut but differing in an essential feature, e.g. the coconut of **Cocos** which has a pericarp of three distinct layers.

NUTANT: drooping; bending downwardly.

NUTATION: see circumnutation.

nut(o) L.: as in **nutans**, to nod; to sway.

NUTRITION: of plants, the supply and utilization of nutrients (in solute form) required for the synthesis of higher compounds on which growth and development are dependent - this strictly is mineral nutrition. In a broader sense, the supply of raw materials for conversion to higher compounds of increased energy values.

-nych(a): as in **macronychia**, see **onych-**.

nycti(os) Gk.: as in **nyctanthous**, of night (hence flowering at night).

-o: as in **bacteri-o-logy**, **kary-o-gamy**, **lagen-o-phora**, a connecting vowel forming a compound word of Greek or mixed origin. See also **o(e)ides**, e.g. as in **gramin-o-id**, **myrt-o-ides**.

ob- L.: as in **obconical**, **oblanceolate**, **obovoid**, reversely (hence inverted; turned around. As in **obdiplostemonous**, against; towards.

OBDIPLOSTEMONOUS: of stamens when in two whorls, the outer opposite the petals.

OBLIGATE: limited to a particular mode; not facultative.

OBLIQUE: slant-wise, i.e. not at right-angles to a structure, or not in symmetry, as a lamina when there is greater development on one side of the petiole or mid-rib.

obes(us) L.: inflated; swollen.

OBSOLETE: imperfectly developed; rudimentary; reduced to such extent that it is not apparent.

OBTUSE: of an apex when not forming an acute angle.

OBVALLATE: walled around.

OBVOLUTE: of a conduplicate leaf when one half receives in its fold the half of another folded in the same way.

OCCIDENTAL: western.

OCCLUSION: of a woody stem or trunk, the callusing-over of a wounded surface.

ochr(os) Gk.: as in **ochrophloia**, yellowish; ochre-coloured; ochraceous.

octo L., Gk.: as in **octopetalous**, eight.

-ode, -odes: as in **phyllode**, **staminode**, **gnaphalodes**, **actinodium**, like. For derivation see **o(e)ides**.

odo(us) Gk.: as in **triodia**, **odontoid**, a tooth.

odorat(us) L.: sweet-smelling; fragrant.

-oecious, -oecium: as in **dioecious**, **androecium**, a dwelling or house. From Gk. **oikos**, a house.

-o(e)ides Gk.: as in **graminoid**, **lipoid**, like. When a suffix of the names of taxa, e.g. **myrtoides**, **hakeoides**, should be considered as, and pronounced **myrto-id-es**, **hake-e-o-ides** since -oi- is not a diphthong and the rule with the pronunciation of Latin or latinised names is that each vowel (unless a diphthong) is stressed separately, i.e. the name is derived from, e.g. **myrto-** and **-(o)ides**.

When a suffix to the name of an included genus, **-ideae** indicates the name of a sub-family, e.g. **Myrtoideae**, a sub-family of **Myrtaceae** with fleshy fruits.

oenos: as in **oenology**, wine. From Gk. **oinos**. The **L. oenothera** is an allusion to a plant with a juice producing a soporific when concocted with wine.

officin(a) L.: as in **officinal**, **officinalis**, a laboratory (hence for pharmaceutical preparation).

OFFSHORE: of winds when blowing from inland towards the shore. cf. onshore.

OLD WORLD: in the phytogeographic sense, the eastern hemisphere, i.e. from longitude 20°E to longitude 180° hence including Europe, Africa, Asia and Australasia. cf. New World.

OLEAGINOUS: secreting an oil.

olens L.: as in **suaveolens**, odoriferous.

OLERACEOUS: of a plant when providing a food for human consumption.

oleos(us) L.: oily; bearing an oil.

ole(um) L.: as in **oleiferous**, an oil.

olig(is) Gk.: as in **oligospermous**, few.

OLIGOTHERMIC: tolerating relatively low temperatures.

OLIGOTROPHIC: of a growth-promoting substance (a nutrient) when below optimum in nutritive value.

(h)omal(os) Gk.: as in **omalanthus**, smooth.
olitori(us) L.: of culinary herbs.

ONSHORE: of wind when blowing from shore to inland. cf. offshore.

ONTOGENOUS: relative to the origin and developmental cycle of an organ or organism. Relative to ontogenesis. From Gk. **ont-**, existing.

onych- Gk.: as in **onychosepalum**, **macronychia**, of a claw (Gk. **onyx**).

oo(n) Gk.: as in **oogamous**, an egg.

OOGAMOUS: fertilizing through the fusion of an egg-cell with a male gamete.

opac(us) L.: shaded; dark.

OPERCULUM: of a bud or fruit, a cap-like covering which sheds transversely. Of a moss, a lid-like covering of a sporangium which splits transversely. **Operculate**: possessing an operculum.

ophi(s), ophidi(on) Gk.: as in **ophioglossum**, a snake (hence 'adder's tongue').

-opia Gk.: as in **teloepa**, of sight (hence seen at a distance).

OPPOSITE: of structures (e.g. leaves) in pairs when arising from the same region of an axis (e.g. a node) at the same level but on different sides, or of structures (e.g. stamens, petals) when facing one another in pairs. Also **opposed**, as in leaf-opposed, i.e. of a flower when opposite a leaf.

ops(is), optic(os) Gk.: as in **euryps**, an eye.

-opsis: as in **lilaeopsis**, likened to.

orari(us) L.: of the coast or border.

orbi(s) L.: an orb; a sphere.

ORBICULAR: of a lamina when almost circular in shape. Also orbiculate.

orchi(s), orchid(ion) Gk.: as in **orchid**, a testicle (so named from a resemblance of the thick and fleshy root).

ORDER: as a category, a level below a class but above family. As a taxon, a group of related families or a single family when no affinity with other families at the same level is shown, e.g. **Casuarinales** with a single family **Casuarinaceae**. While the code specifies no rules for the naming of an order, the suffix **-ales** is a prescribed and a recommendation made that the name be compounded from a name of one of its families. For a sub-order, the prescribed suffix is **-ineae**. The name of the order (and sub-order) is used as a noun in plural number.

ORDINAL: relative to an order.

oreo(dont) Gk.: as in **orgadophila**, an open woodland.

ORGAN: an essential structural part of a cell which operates as a more or less autonomous system with a specific function when primary is self-reproducing and is limited within the protoplast by a usually complex membrane. The primary organelles include nucleus, nucleolus, ribosome, mitochondrion, chloroplast.

ORGANIC: relative to an organ or organism. Of a chemical compound when containing the element carbon but usually when hydrogen is present also, this and other elements being linked with the

carbon atom by a co-valent bond distinct from the ionic bond typical of inorganic compounds. So called because of its basic synthesis by plants and animals but now extended to chemo-synthesised compounds.

ORGANIC ACID: an organic compound when containing an acidic group, typically a carboxyl -COOH. Ionization from this group usually is relatively weak. See fatty acid, amino acid, nucleic acid.

ORGANIC EVOLUTION: the progressive development of organisms and their populations through a succession of generations, influenced by, and the resultant of, the interacting forces of heredity and environment.

ORGANISM: the biologically organised, self-regulating unit actively functioning in the generation and utilization of energy for its own complexity. **Organismal:** relative to an organism.

organo(n) Gk.: a tool; an instrument.

ORIENTAL: eastern. From L. **orientes**, the east.

ORIENTATION: an adjustment in position in response to a stimulus.

orni(s) Gk.: as in **ornithophilous**, a bird (hence pollinating through the agency of birds).

orobo(s) Gk.: as in **orobanche**, a vetch (of **Vicia**). (Hence **orobo(s)**, **ancho**, to strangle).

OROGENESIS: the process of mountain-building through lateral compression of the earth's crust.

OROGENETIC: relative to the geological periods during which time mountains were raised.

OROGRAPHIC: relative to the elevations or high relief of the earth's surface.

oro(s) Gk.: a mountain.

ortho(s) Gk.: as in **orthotropic**, straight (hence orientating in a straight line as a response to a stimulus).

ORTHOTROPIC: of a part (e.g. a shoot) when developing in the line with the normal polarity of the organism, e.g. the leading shoot of an erect plant. cf. plagiotropic.

orthro(s) Gk.: as in **orthrosanthus**, morning (hence flowering in the morning).

orya Gk.: rice (**Oryza sativa**).

osme Gk.: as in **diosma**, odour, scent (hence **dios**, divine; **osme**).

osmos Gk.: as in **osmosis**, a pressure; a thrust.

OSMOSIS: the diffusion of water or other solvent through a membrane selectively permeable to it, from a region of low concentration of solute to one of higher concentration. See also permeable membrane, plasmolysis, turgor pressure.

OSMOTIC: relative to an osmosis.

OSMOTIC CONCENTRATION: the concentration, usually expressed in molar units, of a solution capable of exerting osmotic pressure, such concentration varying directly with the pressure.

OSMOTIC PRESSURE: of an osmotic system, the pressure (usually expressed in atmospheres) exerted at the membrane on the side of water intake, due to an increase in volume. When the membrane is the cell-wall of a plant, this pressure is known as turgor pressure. See also vacuole.

osse(us) L.: of, or like, bone; osseous.

osteo(n) Gk.: as in **osteospermum**, a bone.

OSTIOLE: in general, a small opening or aperture.

ostrea L.: an oyster.

-os(us) L.: as in **speciosus, venosa, tomentosum, tomentose, venous**, fully.

ot(o)us, ous Gk.: as in **aotus**, an ear (hence not eared).

OUNCE: a unit of mass in the British system equivalent to 28.35 grams.

OUTCROP: of a bed of rock, an extrusion to or above the surface of land.

OVARY: the basal, ovule-bearing part of a carpel, compound when two or more carpels are united.

OVATE: of a lamina when elliptical in broad outline but with the basal half broader than above.

ovill(us) L.: of sheep.

OVOID: of an ellipsoid shape when the basal part is broadest.

OVULATE: relative to an ovule; bearing an ovule.

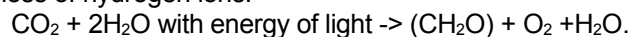
OVULE: the structure of a seed-bearing plant within which ensues the reproductive cycle of the female, i.e. formation of megaspores, egg-cell, zygote, embryo. Its reproductive cells are located in a **nucellus**, the tip of the nucellus is exposed by a **micropyle** but a major part is enclosed by one or two integuments which merge at the base to a **chalaza**. The ovule of an angiosperm is formed from, and retained by, the ovary of a carpel, attached to the wall of the ovary either directly or supported by a **funicle**. Of conifers, the ovule is developed on the upper surface of a scale (ovuliferous scale), the nucellus, and enclosed by a single integument.

Within reproductive cells (archesporium) of the ovule, megaspore mother cells by meiotic divisions form megaspores in tetrads, only one of which survives to become the mother cell for the embryo-sac of angiosperms, but in gymnosperms the gametophyte is represented by a definite archegonium (usually two or more being formed) similar to that of the pteridophyte and containing the egg-cell, and a multicellular prothallus concerned with food-storage for the ultimate embryo. Those embryo-sac possible represents two archegonia without prothallial cells, within it are developed eight nuclei, three of which are persistent, one the egg-cell, the other polar nuclei. At fertilization, the egg-cell fuses with a male nucleus to form a zygote, the polar nuclei fuse with a second male nucleus to originate an endosperm. See also placentation.

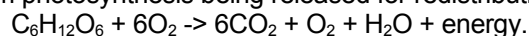
ovum L.: (plural ova) an egg.

OXIDATION-REDUCTION: the loss or gain of electron by atoms of substances (electrolytes) ionizing in solution, oxidation by loss of electrons, reduction by gain of electrons. The substance losing (or donating) electrons (being oxidised) is the reducing agent since it is responsible for the reduction (gain in electrons) of another substance. Conversely, the substance gaining (accepting) electrons (being reduced) is the oxidising agent. The terms oxidant and reductant are also in use, the oxidant being the reducing agent, the reductant the oxidising agent.

The principle may be illustrated by the overall mechanism of photosynthesis which, in its simplest sense, may be regarded as a reduction-oxidation system (redox system) where carbon dioxide is reduced by the acceptance of hydrogen ions from a hydrogen carrier (e.g. water) to form a carbohydrate of the form CH_2O : If water is the hydrogen carrier, it is oxidised to molecular or free oxygen by loss of hydrogen ions.



In respiration, a simple sugar forms carbon dioxide and water by loss of hydrogen ions, the bound energy from photosynthesis being released for redistribution.



oxy(s) Gk.: as in **oxycedrus**, **oxalis**, sharp (in form or taste).

OXYPHILOUS: selective to acidic soils or substrates. Calcifugic.

OXYPHYTE, OXYLOPHTYE: a plant adapted to acidic soils or substrates.

ozo(s) Gk.: as in **ozothamnoides**, a twig or branch (hence like ozothamnus, a twiggy shrub of the genus **Helichrysum**).

P¹: first parental generation (see F¹). p,m,,: **plus minusve** (more or less). pp.: **pro parte** (in part, partly). p.p.m.: parts per million. praec.: **praecedens** (preceding), **praecepa** (especially).

pachy(s) Gk.: as in **pachyphylla**, thick.

palai(os) Gk.: as in **palaeozoic**, ancient (hence the era of ancient life).

PALAEOECOLOGY: the study of the relationships of ancient organisms with their environments.

PALAEOTROPICAL ELEMENT: of phytogeography, that part of a flora originating from lands including tropical Africa, Indo-Malaysia, Polynesia. For the Australian flora, the Malaysian element (q.v.).

PALATE: of a labiate corolla, a projected of the lower lip which closes the throat of the corolla.

PALEA: in general, a bract or bracteole when of thin and stiff texture, usually narrow and pale-coloured, especially when subtending a floret, e.g. of **Compositae**. Of grass, the upper scale of a floret partially enclosed by the complementary lemma.

PALISADE: in general, a layer of elongated cells. Of parenchyma, see under mesophyll.

pallens, pallid(us) L.: pale-coloured.

PALMATE: of a palmately-veined leaf when lobed, the lobes having the radiating major veins as mid-ribs. According to the degree of division to lobes, the leaf is **palmatifid** when the division is less than half-way to the base, **palmatipartite** when from half-way to three-quarters, and **palmatisect** when more than three-quarters. From L. **palma**: a hand, or its palm.

PALMATELY-VEINED: of venation when several common-order veins radiate from the base of the lamina.

pal(us) L.: as in **paludose**, **palustris**, **palustrine**, a marsh.

PALYNOLOGY: the study of pollen grains and other spores.

pan Gk.: as in **pantropic**, **pantropical**, all (hence widely spreading).

pandan(g) Malay: as in **pandanus**, conspicuous.

PANDURIFORM: of a lamina when resembling in outline a violin. Fiddle-shaped. From Gk. **pandoura**, a lute.

PANICLE: in general, an inflorescence when branched, often in large loose clusters. In a restricted sense, a branched raceme (as in the grasses). **Paniculate**: of flowers when forming a panicle.

PANNOSE: with the texture of cloth or felt. From L. **pannus**, cloth.

PANTROPIC: widely distributed, without pronounced selectivity for sites: turning to any direction, as a non-specific pathogen.

PANTROPICAL: widely spread throughout the tropics.

PAPILIONACEOUS: of a flower when its corolla is of five petals, one (the **standard**) uppermost and usually larger than the others, two lateral and forming **wings**, and two lowermost more or less united and forming a boat-like contour, the **keel**. Literally, 'butterfly-like' from a resemblance to the insect, the flower characteristic of the family of legumes, the **Papilionaceae**. From L. **papilio**, a butterfly.

PAPILLATE: of a surface when bearing minute rounded protuberances, papillae.

PAPPOUS: of a calyx when its limb is in the form of bristles, hairs, or feathery processes. Also pappose.

PAPPIFEROUS: bearing a pappus.

PAPPUS: in general, a tuft of bristles, hairs or feathery processes. Of the fruit of **Compositae** when formed from a pappous calyx. From L. **pappus**, down.

PAPYRACEOUS: of a paper-like texture.

para Gk.: as in **paratyphoid**, resembling: in **paraxial**, beside.

PARAMETER: a measure or quantity fixed for a particular case but potentially variable in other cases.

paradox(os) Gk.: with a feature unique among its allies.

PARAPHYSIS: (plural paraphyses) of sporangia (e.g. of mosses, certain ferns, algae, and the hymenium of certain fungi), a sterile hair-like structure.

PARASITE: an organism dependent on another organism (the host) for its nutritional needs, the association either obligate or facultative, the effect often being lethal to the host, i.e. pathogenic.

When parasitic for part only of its nutritional needs, the parasite is termed a **partial parasite**, e.g. the root-parasitising sandalwoods (**Santalum** spp.), Ballarts (**Exocarpus**), quandongs (**Fusanus**) the Christmas Tree of Western Australia **Nuytsia floribunda**, and the branching-parasitising mistletoes (e.g. **Amyema**, **Dendrophthoe**, **Muellerana** spp.) are photosynthetic. Others develop from normally-germinated seeds but become partially parasitic once a secure hold is made of the branches of the host, e.g. the mallee vines of **Cassytha** which may destroy acres of mallee. A few flowering plants are poorly photosynthetic and approach a true parasitic condition, e.g. Broom Rape **Orobanche cernua** var. **australiana**, a root-parasitising herb. See also bacterium, fungus.

A **hyperparasite** is a parasite of a parasite, e.g. **Notothixos** may parasitise mistletoe or mistletoe may parasitise other mistletoe. From L. **parasitus**.

PARENCHYMA: tissue forming the ground (fundamental) structure of a plant, the cells actively-functioning, usually thin-walled and polyhedral in shape. **Parenchymatous:** relative to, or composed of, parenchyma.

PARIETAL: relative to the wall of a structure. From L. **paries**, a wall.

PARIPINNATE: of a pinnate leaf when there is not terminal leaflet of the rachis, i.e. ends in a leaflet-pair. Abruptly pinnate cf. imparipinnate.

paro L.: as in **paronchychia**, to make equal (hence equally clawed).

PARTHENOCARPIC: of fruit when developed without prior fertilization hence without seed. Rather rare in nature, but fairly frequent from horticultural strains of normally seed-forming plants (e.g. the seedless bananas and grapes). **Parthenocarp** may be induced by substitution of the auxin normally provided by the stimulus of fertilization with a synthetic one (e.g. NAA), fertilization being avoided.

PARTHENOGENETIC: of reproduction when from the development of the female gamete without fusion with the male. Of apomixis when an egg-cell divides to form an embryo without fertilization or with partial fertilization (e.g. fusion of male and female nuclei to initiate for endosperm).

partheno(s) Gk.: a virgin

PARTICULATE INHERITANCE: a modern concept that the development of characters inherited is controlled by particles (genes) which retain their identity from generation to generation and is not, as previously believed, determined by the blending in progeny of factors inherited from the parents.

PARTS PER MILLION: (ppm) of the concentration of a solution, the number of parts of solute present in one million parts of the solution. One ppm is equivalent to one microgram (1 ug) per millilitre (1 ml) or one milligram (1 mg) per litre (l).

pascu(us) L.: suited for pasture.

PASSAGE CELL: of a secondary-thickened endodermis of a root, one of the cells opposite the xylem allowing water-movement by reduction of the thickening to a casparian strip (q.v.).

passio Gk.: as in **passiflora**, passion.

pastoralis, pastoris L.: rural (pastoral) or, as in **bursa-pastoris**, a shepherd (hence 'shepherd's purse' in allusion to the fruit).

PASTURE: a cover of plants, usually dependent for maintenance on rainfall, either natural grassland (e.g. of **Poa**, **Panicum**, **Festuca**) or sown crop of grasses (e.g. wimmera rye) or legumes (e.g. clovers, lucerne), available for the subsistence of grazing sheep or cattle.

PATENT: spreading widely; open (e.g. of habit). From L. **patens**, open.

PATHOGENICITY: the potential of a disease-producing organism (a pathogen) to produce a disease (i.e. become pathogenic).

patho(s) Gk.: suffering.

PATULOUS: spearing outwardly; divergent.

pauci L.: as in **pauciflora**, few.

pauper L.: as in **papueriflora**, poor.

PEATY: of soils when containing over twenty percent unconsolidated organic matter which has accumulated under conditions favouring excessive moisture, the material contained able to support combustion.

pecoris L.: of cattle.

PECTIC SUBSTANCE: a derivative of a polysaccharide occurring generally as the cementing substance of cell walls both primary and secondary, particularly the walls of fleshy fruits and the albedo of citrus fruits but also as the external layer of root hairs. The basic substance is water-soluble **protopectin** which may be hydrolysed to **pectinic acids** consisting of colloidal polygalacturonic acid with an esterified methoxyl. When the methoxyl (i.e. a CH₂O group) is absent or virtually so, the substance is a **pectic acid**; both pectinic and pectic acids are water-soluble and salt-forming.

When a pectinic acid forms a gel with sugar and acid, it is termed a **pectin**, commercially extracted from fruit and vegetable wastes. A pectin has wide use as a gelling agent in the preparation of jellies, jams, preserves, and as a stabiliser for ice-cream and various confections. In fruit juices extracted from fresh fruits, the colloids formed by pectic substances produce an often undesired turbidity. Use is made of pectolytic enzymes (commercially obtained from filtrates of such fungi as **Aspergillus** and **Penicillium** spp.) to break down the pectic substances and their colloides to produce a flocculent precipitate which may be filtered off to leave a clear solution.

PECTINATE: of a lamina when segmented to evenly-spaced narrow parts, the whole resembling a comb. From L. **pecten**, a comb.

PEDALFERIC: of soil when free from calcium carbonate, the name derived from a frequent association of aluminium and iron.

PEDATE: of a palmately-divided leaf when the primary lobes are again divided, the leaf resembling a foot or claw. From L. **pes**, a foot.

PEDICEL: the stalk of an individual flower of a branched inflorescence normally arising from the axil of a bract, often bearing one or more bracteoles. cf. peduncle.

Of a sporangium, a supporting stalk. **Pedicellate:** supported by a pedicel.

pedicul(us) L.: a small foot.

pedo(n) Gk.: as in **pedology**, soil.

PEDOCALCIC: of a soil (then a pedocal) when containing calcium carbonate.

PEDOGENIC: relative to the process of soil-formation.

PEDUNCLE: of an unbranched inflorescence, the stalk of a flower when this is the sole member, or the rhachis of flowers when several and sessile. Of a branched inflorescence, the main axis or, of a compoundly branched inflorescence, the complete axes apart from the pedicels of individual flowers.
Pedunculate: supported by a peduncle.

PELAGIC: of the open waters of the sea. From Gk. **pelagos**, the sea.

pelarg(os) Gk.: as in **pelargonium**, a stork (hence fruit resembling a stork's head and beak).

PELLICLE: a protective skin- or film-like covering, e.g. as formed by bacteria and certain fungi. From the diminutive of L. **pellis**, a skin.

PELLUCID: transparent; clear.

PELORIA: of a flower, a departure from normal in some structural feature. Of an asymmetric floral part, a return to symmetry, e.g. a normally labiate corolla converted to an actinomorphic one.

pel(os) Gk.: as in **pelonema**, dark coloured.

PELTATE: shield-like, as a lamina when its petiole arises from within (inner to) the margin, or a stigma when capitate and laterally flattened at the top, or an epidermal hair when two of its component cells develop on opposite sides of a central cell.

pelt(e) Gk.: as in **diplopeltis**, a shield.

p(a)ene L.: as in **peneplain**, almost.

PENEPLAIN: an almost flat, plain-like surface of land formed by the erosive forces of peneplanation.

PENEPLANATION: the denudation of a surface of land to a low, almost featureless relief, through natural erosive forces during geological time.

PENICILLATE: in the form of a small brush, i.e. tipped with a tuft of hairs. From L. **penicill(um)** L.: a small brush.

PENDULOUS: loosely pendent or hanging.

penn(a) L.: as in **penninervis**, **penniveined**, a feather (hence pinneately-veined).

pent(e) Gk.: as in **pentamerous**, five (hence of five parts).

PENULTIMATE: in order of emphasis, the 'last but one', i.e. the one immediately before the last.

PEPO: an accessory fruit formed from a unicarpellate inferior ovary, many-seeded, and with the outer wall a firm and hard rind formed from both pericarp and floral receptacle. The fruit characteristic of the gourd-family. **Cucurbitaceae**.

PEPPERMINT: of eucalypts, a member of a botanic group (**Piperitales**) mainly from the south-eastern tablelands and coastal slopes and Tasmania (**Eucalyptus coccifera**). Leaves, when crushed, often with a peppermint (piperitone) odour, a few (**E. radiata**, **E. dives**, **E. elata** (syn. **andreana**)) being high yielders of commercially important essential oils, the oil of **E. piperita** being one of the first items of export from the early colony of New South Wales (1788). The peppermint bark is persistent over most of the trunk and branches, greyish and with short interlaced fibres, somewhat resembling the box bark.

PEPTIDE: a substance containing two or more amino acids, joined by linkage (peptide bond) of their acidic (-COOH) and basic (-NH₂) groups. See also protein, a polypeptide.

per L.: as in **per se**, through, by means of (hence by itself).

PERCOLATION: of soil or rock the gravitational movement of water through pores or passages.

peregrin(us) L.: exotic; not native.

PERENNATION: vegetative survival from year to year. Following the much-used scheme of Raunkiaer (1903) classing 'biological types with reference to the adaptation of plants to survive the unfavourable season', a number of groups for flowering plants have been established which are based on perennation of the bud.

Phanerophyte: buds borne on aerial parts. Trees and shrubs, especially developed in tropical climates.

Chamaephyte: buds borne on shoots very close to the ground. Low shrubs, especially of alpine or arctic communities.

Hemicryptophyte: buds borne at or just below ground-surface.

Cryptophyte: buds buried in soil to a depth varying with the species. Perennial herbs with food-storing means (e.g. tubers) of temperate regions. Also geophyte.

Therophyte: bud an embryo protected by a seed-coat, i.e. depending for survival on seed-production. Annuals, especially of desert communities.

PERENNIAL: persisting for three or more years.

PERFOLIATE: of a leaf-blade when its base is continued around the stem, the lobes uniting again on the distal side.

PERFORATION PLATE: of a vessel (of xylem), the part of the wall where perforated, the perforation single or in number. When with a single perforation, the plate is simple; when with many perforations which are elongate and parallel, the plate is scalariform, or when forming a network, reticulate.

pero- Gk.: as in **peripheral**, around,

PERIANTH: the single or double whorl of a leaf- or bract-like parts of a calyx and corolla. Two whorls may be undifferentiated or a single whorl alone may be present. In both cases, the segments usually are termed tepals, or the single whorl may be referred to as a calyx.

PERIBLEM: of the apical meristem of a root, a sheath between the outmost layer, dermatogen, and innermost plerome. See also tunica, corpus.

PERICARP: the matured wall of an ovary which, as a fruit, encloses the seed.

PERICLINICAL: parallel to a circumference.

PERICYCLE: of pteridophytes and roots of seed-plants, a thin-layered cylinder of parenchyma ensheathing vascular tissue and limited by an endodermis, functioning for storage.

PERIDERM: of woody plants, the outermost protective layer of tissue formed by secondary growth and replacing the epidermis. The tissue arises from meristem of a cork cambium (the **phellogen**) and usually is of two layers, an outermost **phellem** or cork or lignin, or both and, on the inner side of the phellogen, a **phelloderm**.

PERIDIUM: of a fungus, the limiting wall of its fruiting-body.

PERIGYNOUS: of the parts of a flower (sepals, petals, stamens) when arising from a receptacle surrounding, but not fused with, the gynaecium.

PERIODICITY: of a plant community, the seasonal climatic aspect determining its structure. See also phenology.

PERIPHERAL: following the circumference; distant from a centre.

PERIPHYSIS: (plural periphyses) an outgrowing lining a pore in the form of fringe of short hair-like structures.

PERISPERM: of a seed, a nutritive tissue accessory to endosperm.

PERISTOME: a lining or edging to a pore or opening.

PERMAFROST: permanently frozen subsoil.

PERMEABLE MEMBRANE: a barrier allowing diffusion through it to a degree determined by its physical nature. A membrane with selective permeability, e.g. allowing the free passage of water but not solute, is a semipermeable or differentially permeable membrane. Such a membrane when of a cell is highly complex for, in addition to separating the organelles of a protoplast, it maintains them as distinct but interdependent units, e.g. the vacuolar membrane retaining the contents of vacuole, the outer plasma membrane retaining cytoplasm from a well-wall, both the major regulating barriers to the diffusion of solutes within a cell and from cell to cell.

perolens L.: emitting an odour.

PERSISTENT: not deciduous or withering away soon after development.

PERSONATE: of a labiate corolla when the lower lip almost closes the throat by a projective palate.

pes-caprae L.: the foot of a deer.

pestilentis L.: unhealthy; pestilential.

PETAL: the unit of a corolla. **Petaline, petaloid**: of, or like, a petal.

PETALODY: the conversion of other parts (e.g. stamens) to petals.

pertenuis L.: very slender or thin.

PETIOLE: of a leaf, a part forming an attachment (stalk) of the lamina (blade) with the stem where the origin of the leaf is more or less defined as a swelling, the leaf-base. **Petiolate**: borne by a petiole (as opposed to sessile).

PETIOLULE: of a compound leaf, the stalk of an individual leaflet.

pet(o) L.: as in **acropetal**, **centripetal**, to seek.

petr(a) Gk.: as in **petraeus**, rock (hence dwelling among rocks).

PETRIFICATION: the geologic process of preserving organic remains by substitution of the organic matter by a chemical compound resistant to atmospheric conditions over a large scale of time, e.g. wood, subject normally to decay, may have its organic matter replaced by calcium carbonate or silica when exposed to these substances under appropriate conditions for a sufficiently long period of time.

PETROPHYTIC: of a plant adapted to conditions of rock, either as a lithophyte or chasmophyte.

petro(s) Gk.: as in **petrophila**, **petrophyte**, stone; rock.

pH: the hydrogen ion concentration of an electrolyte, expressed numerically in terms of a scale (from zero to 14) representing reciprocal logarithmic values in terms of moles per litre, e.g. the concentration of hydrogen ions in pure water is 10^{-7} moles per litre, its pH then is 7.0. Since water weakly ionises equally to hydrogen and hydroxyl ions (H_2O ionising as $H^+ + OH^-$), a decrease in the pH value, e.g. to pH 6.0 indicates an increase in hydrogen ions, i.e. 10^{-6} moles per litre, hence a degree of acidity of the electrolyte. Conversely, an increase in pH value, e.g. to pH 8.0, or an increase in hydrogen ions to 10^{-8} , indicates an excess of hydroxyl ions and a degree of alkalinity of the electrolyte. See also acidity, alkalinity.

PHAEOPHYTE: a member of a group of plants typically olive or dark-brown in colour, i.e. the brown algae.

PHAGE: an agent causing a lysis of a micro-organism. A bacteriophage.

PHAGOCYTOSIS: a process of surrounding and engulfing cells for nutritional need, e.g. the penetration of a host tissue, its destruction and absorption of the products by the mycelium of a phagotrophic fungus. Phagocytic: living by means of phagocytosis.

PHAGOTROPHIC: of nutrition when based on the cellular content of other organisms. From Gk.: **phago**, to swallow.

phaio(s) Gk.: as in **phaeus**, **phaeophyte**, ducky.

phalain(a) Gk.: as in **phyalanopsis**, a moth (hence resembling a moth).

phalaro(s) Gk.: as in **phalaris**, brilliant.

phanero(s) Gk.: as in **phanerogamous**, macroscopic; visible to the unaided eye (hence from a group of plants, or a plant, which reproduced from macroscopic structure, i.e. the phanerogams of seed plants).

PHARMACEUTICAL: relative to pharmacognosy from the aspect of preparation and utilization of drugs, or to the chemo-synthesis of such drugs. The term drug need not apply specifically to chemotherapeutic agents, e.g. condiments and spices, masticatories (e.g. chewing gum) and fumitories (e.g. tobacco), aromatics and perfumes, dyestuffs, waxes and volatile oils often are included.

PHARMACOGNOSY: the science concerned with crude drugs and raw materials of plant and animal origin in aspects of their history, commerce, cultivation, preparation, chemistry and identification.

PHARMACOLOGY: a phase of medical science concerned with the physiological action of drugs.

PHARMACOPOEIA: a reference book listing the official standards of dosage, formulae, and preparative methods for drugs.

pharmako(n) Gk.: as in **pharmacology**, a drug.

pheballi-: as in **phebalium**, of the myrtle. From Gk.L **phibale**, a myrtle.

PHELLODERM, PHELLOGEN, PHELLEM: see under periderm.

phello(s) Gk.: as in **phellem**, cork.

PHENETIC: of relationship when based on perceptible similarities. From Gk. **phaino**, to appear; to show.

PHENOL: a derivative (when simple) of benzene with at least one hydroxyl (-OH) group attached directly to a carbon atom of the benzene ring, monohydric when with a single hydroxyl group (e.g. the coal tar derivative phenol or carbolic acid C_6H_5OH), polyhydric when there is a repetition of the hydroxyl group (e.g. the trihydric pyrogallol $C_6H_3(OH)_3$), the increase in number of hydroxyl groups giving an increase of solubility in water.

PHENOL-COEFFICIENT: of a germicide, the ratio of the dilution required to destroy a specified bacterium under specified conditions to the dilution of phenol (carbonic acid) destroying the same bacterium under identical conditions. A method of evaluating the efficiency germicides, called after originators (1903), the Rideal-Walker test.

PHENOLOGY: a phase of ecology concerned with the correlation of climatic factors with reproductive and vegetative development.

PHENOTYPE: the observable aspect of an organism representing the variable expression of a relatively unchanging genotype to varying environmental conditions. For a species, different phenotypes may be expressed in different environments, although of the one genotype. Conversely, similar phenotypes may be expressed by different genotypes when in similar environments.

philo(s) Gk.: as in **acidophilous**, **nesophila**, **philydrum** (from **philo**, **hydor**, water), seeking, preferring. In such terms as **anemophilous**, **entomophilous**, indicates a relationship effecting pollination. In **philotheca**, smooth.

phleb-, (from phelps) Gk.: as in **phlebocarya**, a vein.

phlegmato(s) Gk.: as in **phlegmatospermum**, of mucus (hence seeds with mucilage).

PHLOEM: a system of vascular tissue, continuous throughout the plant body, concerned with the translocation of synthesised materials. Composed of sieve tubes (q.v.), supporting and protective fibres and sclereids, and parenchyma functioning for storage and (when secondary) for the initiation of periderm.

Internal phloem: phloem when occurring on the inner side of xylem (i.e. intraxylary) as distinct from external phloem when external to the xylem (i.e. extraxylary).

phloi(os) Gk.: as in **phloic**, inner bark (hence relative to phloem).

phlox Gk.: a flame.

PHOENICEOUS: scarlet-coloured. From Phoenicia, a seaboard region of ancient Syria noted for its dyeing industry.

PHOLADOPHYTE: a plant avoiding direct light by growing in a hollow. From Gk.: **pholas**, lurking.

pholido-: as in **pholidophylla**, of **Pholidia** (**Myoporaceae**).

pholi(s) Gk.: as in **pholidia**, a scale.

phoros(s) Gk.: as in **nematophorus**, **angophora**, **chromatophore**, **cyanophoric**, a bearer; a carrier.

PHOSPHATE: the radical -PO_4 of compounds of phosphorus which, when taken up as a mineral ion by the plant, maintains its identity as such in most of the organic compounds formed. Concerned in most metabolic reactions including respiration, phosphorylation and synthesis of starches, sugars, and proteins, and as a constituent of such vital complexes as nucleoproteins, phospholipids and various enzymes.

PHOSPHATIDE: a phospholipid (q.v.) in which one of the acidic hydrogen groups is linked with a basic nitrogenous radical. Includes cephalin, lecithin.

PHOSPHOLIPID: an ester of glycerol (glyceride) of a fatty acid in which one of the -OH radicals of glycerol is esterified with a phosphate. In plants, occurring in greater or lesser amount in all cells and the membranes of such cells, but particularly in chloroplasts (in grana) and in oil-bearing fruits and seeds. An amphoteric substance soluble in the fat solvents but poorly in acetone.

PHOSPHORESCENCE: of photoluminescence (q.v.) when the light emitted by the activated object persists after the exciting light is removed. From Gk. **phosphoreo**, to bring light.

PHOSPHORYLATION: the combination of inorganic phosphate in an organic bond with an organic acceptor to give a product with increased reactivity, i.e. with higher energy value, e.g. the combination of inorganic phosphate with glucose to form glucose-6-phosphate. The phosphate linked by an organic bond (the phosphoryl group of the phosphorylated compound) may be transferred (transphosphorylated) to other molecules, or split off (dephosphorylated), e.g. through substitution by an organic radical, and converted to inorganic phosphate.

On the basis of the free energy potential (or phosphoryl transfer potential) the phosphate bond may be classed as a high or low energy bond. Its potential usually is expressed in k cal (see calorie) per mole, indicating the amount of biochemical work obtainable from the bond. Thus the high energy bond of ATP (12 k cal) can be compared with the low energy bond of glucose-6-phosphate (2 k cal.).

The energy of metabolic processes, originally derived from the radiant energy of sunlight (see photosynthesis) is liberated at the oxidation of synthesised compounds (i.e. respiration) and is stored in phosphates with high energy bonds (indicated by -P). Chief of these is adenosine triphosphate (ATP) in which three phosphate groups are linked with the sugar ribose in combination with a derivative of the organic base adenine. When hydrolysed, a phosphate group is split off from ATP to form adenosine diphosphate (ADP) with the freeing of about 7 k cal. energy available for biochemical work.

pho(s) Gk.: as in **photic**, light.

PHOT: of light, a unit of luminous intensity, on phot equal to the amount of light received at a distance of one centimetre from a standard candle, or one lumen (q.v.) per square centimetre.

PHOTIC REGION: of oceanography, the later of the ocean where the intensity of sunlight is sufficient of photosynthesis by marine algae.

PHOTOAUTOTROPHIC: of nutrition when by direct synthesis from inorganic sources through utilization of radiant energy from sunlight.

PHOTODYNAMIC: relative to the effect of light (e.g. on plants) when exposed to its stimulus.

PHOTOGENIC: producing light.

PHOTOLUMINESCENCE: the emission of light from an object when exposed to light from an external source and (usually) from a different wave-length. See also fluorescence, phosphorescence.

PHOTOLYTIC: decomposing or reacting through the effect of light.

PHOTOPERIOD: of plant growth, the unbroken length of the daily exposure to light, in contrast to the length of the period of darkness (nyctoperoid).

PHOTOPERIODISM: the response (both vegetative and reproductive) of plants to be photoperiod. On the basis of the influence of photoperiod on flower-production distinctions are made although equally important are the prevailing temperature, the physiological age of the plant, and the concentration and distribution of phytochrome (q.v.).

Long-day: flowering only when the photoperiod exceeds a level critical to the species (summer-flowering plants).

Short-day: flowering under relatively short photoperiod and longer nyctoperiod (winter or early spring-flowering plants).

Day-neutral: the photoperiod not critical to flowering.

PHOTOPERIODIC INDUCTION: the manipulation of the photoperiod in order to promote flowering.

PHOTOSENSITIZER: an agent which, through an ability to absorb and utilise radiant energy, is capable of initiating a series of chemical reactions, e.g. chlorophyll, carotenoids.

Certain photosensitizing occurring in plants may have an effect of unpigmented skins of animals when eaten by them, the photodynamic reaction creating a rash or swelling of the skin.

PHOTOSENSITIZATION: in general, the photochemical process induced by a photosensitizer.

PHOTOSYNTHATE: a product of photosynthesis.

PHOTOSYNTHESIS: biosynthesis through photochemical means. A process directly or indirectly fundamental to the nutritional maintenance of all living organisms but limited to those with the essential means for absorbing and converting radiant energy to chemical energy.

The chlorophylls contained by chloroplasts and chromatophores provide the immediate means while secondary are the accessory carotenoid and phycobilin pigments which absorb light of different wave-length. Except for bacterial photosynthesis, the raw materials are carbon dioxide and water, products released to the atmosphere from respiration of organisms. Oxygen is a side-product of photosynthesis by green plants, hence the re-cycling of these gases maintains a relative constant of carbon dioxide and oxygen in the atmosphere.

The process operates under conditions of from low light intensity (as by seaweeds at the lower depths of the photic region where the intensity is about equal to moonlight) to high intensity (as by terrestrial plants from the arid desert in full sunlight), but of the total available light, a very small fraction (estimated at about one-thousandth part) is used hence in terms of the available potential for energy conversion, a relatively inefficient process. The world output of organic matter from the process is believed at about 14×10^{11} tons per year, a large proportion of this contributed by the pelagic plankton.

The primary end-product of photosynthesis when carbon dioxide and water are the raw materials is the carbohydrate **glucose**, its synthesis involving the 'splitting' of water to hydrogen ions (for the ultimate reduction of carbon dioxide) and hydroxyl ions (for the eventual evolution of free, or molecular, oxygen). The chemical reactions are numerous and complex, each requiring a specific group of enzymes. Much of the biochemical detail has been elucidated at least for the plant where isotopic and other techniques have been applied (viz. such unicellular algae as **Chlorella**). In general, recent concepts are based on the observations of Robert Hill (1939) and D. Arnon (1954), Hill noting that isolated chloroplasts from minced leaves evolved oxygen when illuminated, in water, with suitable hydrogen acceptors (e.g. ferric ions). Arnon noted that chloroplasts under similar conditions also brought about the phosphorylation of ATP from ADP (see phosphorylation) and phosphate. As early as 1904 Blackman proposed that photosynthesis occurred in two phases, a series of reactions occurring in light (i.e. photochemical) and a subsequent series when light was not involved (i.e. thermochemical, or dark reactions). Quantitative comparative studies, e.g. by a flashing light of high intensity but short duration compared with a non-flashing or continuous light giving greater production of photosynthate, have substantiated this proposal and the light (photochemical) reactions have been termed the **Hill reaction**, the dark (thermochemical) the **Blackman reaction**.

The Hill reaction concerns the 'acceptance' conversion and cycling of light energy to chemical energy, the synthesis of ATP and co-enzyme NADPH and the evolution of free oxygen. ATP and the co-enzyme appear essential for the assimilation of carbon dioxide, their synthesis termed **photophosphorylation**, cyclic when ATP is the product, non-cyclic when the co-enzyme is formed by the reduction of its nucleotide. The primary reaction and the mechanism dissociating oxygen are yet to be resolved, one concept (**photolysis**) being that the energy of light directly dissociated water to reducing H^+ and oxidising OH^- ions, another that the excitation of chlorophyll by light effects a flow of energy-carrying electrons which, directed through cytochromes, have cyclic pathway in the generation of ATP back to chlorophyll, and a replacement from OH^- (contributed by the ionization of water) when oxygen is released and the H^+ used in the reduction of the nucleotide.

The dark or Blackman reaction concerning the reduction of carbon dioxide is even more complex. In general, it follows the pathway-formation of an intermediate of glycolysis (see respiration), phosphoglyceric acid, by the combining of carbon dioxide with a phosphorylated pentose sugar-conversion of this intermediate to a triose sugar phosphate 3-phosphoglyceraldehyde, through reduction by H^+ and energy supplied by ATP and the reduction nucleotide- derivation from this phosphate of glucose and other sugars. For the reduction of each molecule of CO_2 , 3 molecules of ATP and 2 molecules of NADPH are required.

Its course was defined in 1961 by M. Calvin hence it is known as the Calvin cycle.

Compensation point is the point when the rate of biosynthesis equals the rate of break-down of the products by respiration, above this point the gaseous exchange characterising photosynthesis ensues, carbohydrate being formed when the ratio (**photosynthetic coefficient**) of the volume of oxygen released and the volume of carbon dioxide absorbed is unity. The process is 'saturated' in respect to a factor when an increase effecting a decrease in an inhibiting or depressing factor (dependent on the optimum requirement of the plant) no longer effects an increase in the photosynthetic rate, e.g. a factor of light may be limiting at a low concentration but when brought to optimum level, other factors (e.g. concentration of carbon dioxide) may become limiting, photosynthesis thus being 'saturated' in respect to light.

Single, or interacting factors which may become limiting to the photosynthetic rate include (under conditions appropriate for the plant) - nature, intensity and duration of light, the concentration of carbon dioxide available (0.03 percent normally present in the atmosphere, compared with 0.01 percent at compensation point, an increase may increase the rate assuming photosynthesis is saturated in respect to light, but up to a point when its concentration may become toxic to the plant), the amount of water in the photosynthetic region (wilting decreases the rate), temperature (usually higher in the photosynthetic region than the ambient air, the process rarely proceeding below $-5^{\circ}C$, but increasing up to about $37^{\circ}C$), the accumulation of photosynthate by non-translocation (an inhibiting effect which may occur when there is a severe reduction in water availability), the percentage of pigment not utilizing light but losing energy as heat. See also light, bacterium, chlorophyll.

PHOTOSYNTHETIC: relative to photosynthesis, or of the organism, tissue or cell concerned with the process.

PHOTOTAXIS: the movement (**in toto**) of an organism responsive to the stimulus of light, e.g. by certain motile unicellular algae. **Photoactic:** relative to a phototaxis.

PHOTOTROPISM: a response in growth effected by light, positive when growth is directed towards the stimulus.

PHOTOTROPHY: the reversible change in colour of a chemical substance when exposed to light.

phragm(a) Gk.: as in **phragmites**, a hedge.

phyc(os) Gk.: as in **phycology**, an alga; a seaweed. Suffices recommended for the naming of categories of algae are **-phyceae** (class) and **-phycidae** (sub-class).

phyl(e) Gk.: as in **phylogeny**, **phylum**, a tribe or race.

phylici-: Gk.: as in **phylicoides**, of **Phylica (Phamnaceae)**, the name derived from Gk.: **Phylicos**, leafy.

PHYLLARIES: of the involucre of certain capitula of **Compositae**, the constituent bracts when in two or more overlapping rows.

PHYLLOCLADE: see cladode.

PHYLLODE: a petiole when lamina-like and functioning as an entire leaf, a feature of many acacias. Also phyllodium. **Phyllodinous**: bearing, or relative to, phyllodes.

PHYLLODY: the abnormal conversion of flowers to vegetative shoots, or of petals and sepals to leaf-like structures.

phyll(on) Gk.: as in **phyllanthus**, **brachyphyllus**, **phyllodes**, **mesophyll**, **epiphyllous**, a leaf.

PHYLLOTAXY: the arrangement of leaves and floral parts on their axes, in general either spiral (alternating) or cyclic (whorled).

PHYLOGENY; the origin and evolutionary development of taxonomic groups.

PHYLUM: (plural phyla) the major category (i.e. highest level) of classification formerly used for both plant and animal kingdoms uniting related classes. For the plant kingdom, the category now is division (q.v.).

phymat(os)Gk.: as in **phymatocarpus**, long.

physa Gk.: as in **physarum**, a bubble, a bladder.

physic(os) Gk.: as in **physical**, of nature; natural.

PHYSIOGNOMY: of vegetation, the general appearance without reference to composition, e.g. the mallee, mulga, woodland, sclerophyll forest, heath, rainforest communities present landscapes familiar to this continent. From Gk. **physis**, **gnomon**, judge).

PHYSIOGRAPHY: in one sense, description of the physical features of a landscape or geographic region. Usually identified with physical geography.

PHYSIOLOGY: the science concerning the function of growth and development.

PHYSIOLOGICAL ECOLOGY: a phase of ecology concerning the tolerance of organisms to their environments, e.g. in aspects of their physiological responses to drought and to soil groups.

physis Gk.: as in **physiognomic**, **physiology**, an inherent or inbred character; nature.

PHYTOCHROME: a blue-green pigment (part of which is a protein) synthesised by plants in extremely low concentration, with maximum absorption of light in the red region of the spectrum.

Phytochrome systems have been shown to be vitally concerned in the photoperiodic response, e.g. of flower-production and the germination of light-dependent seeds. Red light (at 6,600 Å) is most effective but the response may be reversed if followed immediately by exposure to far-red light (at 7,300 Å), and re-activated by re-exposure to red light. It is believed that phytochrome exists in two interconvertible forms, Pr (or P₆₆) and Pfr (or P₇₀₀). When absorbing red light to give a positive photoactive response, Pr is converted to Pfr, but then far-red light is absorbed to give an inhibition, Pfr reverts to Pr. The photoactive response is resumed on re-exposure to red light by conversion of Pr back to Pfr. The final effect in the series of fluctuations normally operative is dependent on the final absorption of the sequence.

phyt(on) Gk.: as in **phytology**, **pteridophyte**, **xerophyte**, a plant. **-phyta** (division) and **-phytina** (sub-division) are the suffixes recommended for the naming of the major categories of the plant kingdom except for fungi where **-mycota** and **mycotina** apply.

PHYTOGEOGRAPHY: the study of the geographic relationships concerned in the adaptation of plants, and the causes for their evolution, perpetuation, and migration.

PHYTOHORMONE (Plant Growth Substance): an organic biocatalyst synthesised by the plant with an effect, in relatively low concentration, singly or in interaction with other phytohormones, of accelerating or retarding the processes concerned in growth and development.

Since F. Went's first proof, in 1928, of the existence and significance of such a substance, much of the biochemical detail concerning structure of the molecule has been derived, leading to the development of a number of synthetic substances with similar effect. Relatively little is known, however, of the actual synthesis and mode of operation within the plant.

The role of phytohormones is seen as a regulation involving both promoting and inhibiting influences, e.g. promoting cambial division while inhibiting development of axillary buds. When in higher than optimum concentration (as evidence by synthetic substances), an inhibiting or toxic effect may be produced. The probability has been demonstrated that the physiology of the plant is influenced by an interaction of growth-promoting substance and other catalyst (e.g. an enzyme or mineral ion), a hormone of a different kind, or an environmental fact (e.g. light). It has been demonstrated, e.g. that the gas ethylene C_2H_4 , produced in minute amounts as a metabolite, in conjunction with oxygen is concerned in the processes leading to the ripening of fruit.

Substances with a definite inhibiting influence have been isolated, e.g. avscisic acid or dormin shown to inhibit the synthesis of nucleic acid. This hormone was first extracted from cotton bolls where believed responsible for premature abscission, and from maple leaves where believed responsible for winter dormancy of buds.

The known growth-promoting phytohormones may be referred to the chemically distinct groups of **auxins**, **gibberellins**, and **cytokinins**, one member of a group having a similar or opposite effect for a specific process to a member of another group, or the two members may be co-operative (synergic), e.g. gibberellin and auxin promote stem elongation (the former with a much stronger effect), and both promote production of parthenocarpic fruit. An auxin inhibits lateral bud development (see apical dominance) while a cytokinin promotes lateral bud development. Cytokinin has been shown to effect formation of callus tissue only in the presence of an auxin. In cereal seed at least, gibberellin has been shown to be formed in the embryo where, under the stimulus of water-intake, it initiated synthesis of enzymes hydrolysing starch and other storage products to soluble form. Auxin (typified by IAA, indole acetic acid) promotes the synthesis of nucleic acid and in the orientation of the young shoot (in the ground) to light, its accumulation in greater amount on the lower side of the stem causing a more rapid cell division on that side which results in a geotropic movement of the shoot to the vertical position.

In general, members of each group have similar effects, e.g. the water-soluble, weakly acidic auxins promote cell division within coleoptiles, cambial development, root formation, callusing of tissue, parthenocarpy, and inhibit root, elongation and lateral bud development. The synthetic indole butyric acid (IBA), naphthalene acetic acid (NAA), and 2, 4-dichlorophenoxy acid (2, 4-D), have similar effects. Gibberellins (q.v.) effect stem elongation, parthenocarpy, flowering of long-day plants on short-day photoperiods. Originating with **kinetin**, isolated as a breakdown product (a derivative of adenine) of DNA, the cytokinins also include both naturally-occurring (e.g. zeatin from sweet corn) and synthetic growth-promoters with a general effect on protein synthesis, cell-division, and callusing of tissue. See also vitamin.

PHYTOLITH: a hard or stone-like substance of mineral origin secreted in the cells of certain plants.

PHYTOPATHOLOGY: the science of plant disease.

PHYTOSOCIOLOGY: a phase of ecology considering the relationships among plant communities from the aspect of their structure, development and distribution, and the derivation of methods evaluating their classification, analysis, and description.

PHYTOTRON: an enclosed area, e.g. a cabinet, room, building, within which are facilities for the establishment and control of a constant environment for the growth of plants under experiment conditions.

picr(os)Gk.: as in **picridium**, **picris**, bitter.

pict(us) L.: ornamental.

PIGMENT: see anthocyanin, carotenoid, chlorophyll, plastid, xanthophyll.

pile(us) L.: as in **pileanthus**, **pileiform**, a cap.

pil(i) L.: as in **pilose**, hair.

PILIFEROUS: in general, bearing hair. Of the part of the epidermis of a root when bearing root-hairs.

pilul(a) L.: as in **pilularis**, **piliferous**, a small ball; a pill.

pimele Gk.: as in **pimela**, fat; oil.

PIN and THRUM EYED: of flower of dimorphic sympetalous species (e.g. the Primrose **Oenothera**) when the stigma is either at a level with the corolla throat (pin-eyed), or the style is much shorter and the stigma in consequence is below the level of the throat (thrum-eyed).

pini-: as in **pinifolius**, of pine, **Pinus** (the name originating from the ancient Greek).

pinnat(us) L.: with a feather or wing (**pinna**).

PINNA: (plural pinnae) of a pinnate leaf, a primary leaflet.

PINNATE: of a compound leaf when the leaflets arise along a rachis which may be terminated by a leaflet-pair (the leaf then even- or paripinnate) or a single leaflet (the leaf then odd- or imparipinnate).

A pinnate leaf may again be bipinnate, i.e. bipinnate, the secondary leaflets (**pinnules**) arising along a secondary rachis (**rhachilla**), the primary (compound) leaflets being termed **pinnae**. A tri-pinnate leaf may develop by a further division from the rhachilla' when the division is complete, i.e. tertiary leaflets (also called pinnules) being formed, the leaf is **decompound**. The stalk of individual pinnae and pinnules (when present) is known also as a petiolule.

PINNATELY-VEINED: see under venation.

PINNATIFID: of a leaf approaching the pinnate condition but the divisions from the margins reaching less than half-way to the mid-rib.

PINNATIPARTITE: of leaf approaching the pinnate condition but the divisions from the margins reaching from one-half to three-quarters the depth to the mid-rib.

PINNATISECT: of a leaf approaching the pinnate condition but the divisions from the margins almost or fully reaching the mid-rib without the forming of definite leaflets.

PINNULE: the secondary or tertiary leaflet of a bipinnate or decompound leaf.

pisci(s) L.: as in **piscium**, a fish.

pis(um) L.: as in **pisiform**, a pea.

PISTIL: a unit of a gynaecium either a single carpel when the carpels are free (or the gynaecium unilocular), or a group of carpels when the carpels are united by fusion of the walls.

PISTILLATE: of a flower when the only fertile parts are carpels.

PIT: of a cell-wall, a modification in thickening when a pore-like region is unthickened so that a cavity (pit cavity) is formed. Pits of adjacent cells normally coincide in position so that a **pit-pair** is formed, a single membrane (closing membrane), developed from the middle lamella, separating the two cavities. Over-arching of the thickening may form a rim around the pit-cavity, the pit then a **bordered pit** (e.g. of a tracheid), or the pit may remain simple. Pit-pairs function as intercellular diffusion areas with a direct association with plasmodesmata. Their number to the walls is variable but is often high. See also torus.

pitheco(s) Gk.: as in **pithecolobium**, a monkey.

pitte Gk.: as in **pittosporum**, pitch or tar (hence the seed embedded in a pitch-like, resinous pulp).

PITH: a central cylinder of parenchyma within a shoot.

pityr-: as in **pityrodes**, chaff, bran (from Gk. **pityron**).

PLACENTA: the region of a carpel wall, sometimes projecting, from which arise the ovules.

PLACENTATION: the arrangement of ovules on a carpel wall. Of a single carpel (i.e. the gynaecium is either unilocular or of two or more un-united carpels) placentation is either **sub-marginal** when the ovules are borne in rows close to the suture or the carpel, or **laminar** (diffuse) when there is a wider distribution. When sub-marginal and the ovules are few in number, placentation is **basal** when the ovules are concentrated at the base of the suture, **apical** when concentrated towards the apex. When the carpels are united, placentation may also be laminar but when fundamentally sub-marginal, is **axile** when the carpels are closed and the ovules grouped around a central axis (e.g. a projection of a receptacle) or, when the carpels are united by their margins to form a unilocular ovary, **parietal** when the ovules are borne on the ovary wall typically in longitudinal rows, **free central** when free from the wall but on a central axis, and **basal** when there is no central axis or projection of the placentae. When **apical**, the ovules are few in number and restricted to, or close to, the 'ceiling' of the locule, often pendulous on long funicles.

In relation to the placenta, the orientation of the ovule may be **orthotropous** when the ovule is erect, its micropyle distal and funicle short or absent, **anatropous** when turned over (deflexed) at the chalazal and pressed against or adnate with the funicle, the microphyte (usually) facing the placenta, **campylotropous** when more or less 'n'-shaped, the microphyte facing the placenta to which is attached about mid-way the ovule, **amphitropous** when the first half of the ovule is adnate with the funicle and the micropyle laterally faces the placenta.

plagi(os) Gk.: as in **plagianthus**, **plagiotropic**, oblique; slanting.

PLAGIOTROPIC: responding to the stimulus of the earth's gravitational pull by movement outwardly at an angle from the main axis, e.g. the branches of the Araucarias; the young shoots from lignotubers of mallees.

PLAIN: in general, a land surface of high or low elevation with little or no relief (essentially flat) and near the base-level. The plains of the continent (including the Artesian Basin and the Murray system, where elevations are below a thousand feet) represent a geosyncline.

PLANKTON: the microscopic floating or drifting flora and fauna of the ocean or lake. From Gk.: **planktos**, drifting.

planta L.: as in **plantago**, the sole of the foot.

plasi(s) Gk.: as in **hyperplasia**, a formation.

plasma Gk.: as in **plasmalemma**, **plasmodium**, **protoplasm**, an object or substance formed or moulded.

PLASMAGENE: a gene associated with an organelle of cytoplasm (e.g. a plastid), without fixed position but concerned as a factor of inheritance influencing the replication and nature of the organelle where found.

PLASMALEMMA: the enclosing membrane of cytoplasm.

PLASMODESMA: (plural plasmodesmata) a strand of cytoplasm which passes through a minute pore of the wall of a living cell, usually in number, in series interconnecting in such a way that the protoplast is continuous between two adjacent cells.

PLASMIDIUM: a multinucleate protoplasmic aggregation enclosed by an ultra-thin flexible membrane and with amoeboid movement. See under fungus, bacterium.

PLASMOGAMY: the fusion of the protoplasts of two sexual cells.

PLASMOLYSIS: of a cell, a loss of turgor pressure with contraction of the cytoplasm away from the wall when water is withdrawn from the vacuole by the appreciably lower water content of the environment, i.e. the environment (e.g. an adjacent cell) is hypertonic to the cell plasmolysed. The reverse **deplasmolysis** is attained for the plasmolysed cell when the concentration of solute become lower in the environment, i.e. the environment becomes hypotonic to the cell. The reciprocation is a regular event in tissues subject to periodic water stresses.

PLASTIC: of a substance which, under pressure or heat, is irreversibly stretched. cf. elastic.

PLASTID: an organelle, various in shape, form, and function, concerned with storage and control of diffusion rates and various metabolic processes. According to the nature of the pigment contained, generally either a colourless **leucoplast** (e.g. containing grains of starch) or a coloured **chromatoplast** (e.g. of carotenoid substances). A **chloroplast** is a special type of chromatoplast.

plast(os) Gk.: as in **plastid**, **chloroplast**, formed; moulded.

platy(s) Gk.: as in **platyphylla**, broad and flat.

PLATEAU: (plural plateaus, plateaux) a land of low or high elevation, essentially flat but intersected by deep valleys to give noticeable relief. Because of this relief, and because it is not near its base-level, it is regarded as a distinctive type of plain. Much of the landscape of the continent has been formed by the uplift of peneplains (mainly Pleistocene) to form plateaus, in the west those of the Western Shield at about twelve hundred feet elevation and in the east a series from two thousand to seven thousand feet above sea-level, the coastal tablelands or 'Great Divide'.

plect(on) Gk.: as in **plectranthus**, a cock's spur.

PLEIOCHASium: a cyme with more than two lateral branches.

PLEICOTYL: of an embryo when with more than two cotyledons.

PLEIOMORPHIC: of more than one form.

plei(on) Gk.: as in **pleiandrous**, **pleochroic**, **pleimorphic**, the comparative of **polys**, many, i.e. more.

pleisto(s): Gk.: as in **pleistocenic**, the superlative of **polys**, many, i.e. most.

PLEISTOCENIC: of the geological period following the Pliocene (most recent of the Tertiary) ending about 11,000 years ago but before the Recent when present-day organisms are most representative.

plen(e) L.: as in **plenus**, **florepleno**, full (**florepleno** usually means double-flowered).

PLEOCHROIC: of various colours, e.g. of a crystal when changing colour according to the direction of observation.

PLEROME: of the apical meristem of a shoot or root, the innermost core from which develop the vascular tissues.

plesio(s) Gk.: as in **plesiomorphous**, near (hence appearing in similar but not identical forms).

pleur(a) Gk.: as in **pleuranthous**, a side; a rib (hence bearing flowers in lateral inflorescences).

PLICATE: folded or plaited longitudinally, in the manner of a closed fan. From L. **plico**, to fold.

-ploid, -ploidy: as in **triploid**, **triploidy**, of the number of chromosomes contained by a complete set relative to the haploid (basic) number.

plum(a) L.: as in **plumate**, a feather.

plumb(um) L.: as in **plumbeus**, the metal lead (hence, e.g. lead-grey in colour).

PLUMOSE: of hairs or segments when feather- or plume-like.

PLUMULE: of an embryo, the leaf-bud (especially of monocots).

plur(es) L.: as in **plurinervis**, several.

PLUTONIC: see under igneous.

pluvia L.: as in **pluvial**, rain.

PLUVIAL: relative to the incidence of rainfall, especially(as in pluvial period) when alternating with a comparatively dry period.

pneuma Gk.: as in **pneumotaxis**, **pneumatophore**, air.

PNEUMATOPHORE: a specialised, stem-like root which projects above a poorly aerated rooting medium (e.g. mud) and, through its constituent tissue aerenchyma, is capable of gaseous exchange with the atmosphere. A feature of certain hydrophytes, as the mangroves **Acidennia marina** and **Bruguiera gymnorhiza**.

PNEUMOTAXIS: a movement (in toto) in response to a gas, e.g. to dissolved carbon dioxide.

-podi, podo- (from Gk. **pous**): as in **monopodium**, **podolepis**, a foot (in plants, a peduncle, stalk or stem).

POD: a general term for a dry, unilocular, dehiscent or indehiscent fruit, usually in reference to a legume, lomentum, silqua, silcule.

podaltri-: as in podalirifolia, of **Podalyria (Papilionaceae)**. A mythical name.

PODZOL: a soil of coarse texture and acidic reaction, with a well-developed profile, the A horizon grey but darkened by some organic matter, the B horizon brown to black from accumulated organic matter and iron (often as hardpan). Occurs along the east, south-east and south-west of the continent where generally of low nutritional status because of intense leaching and development from poor parent material. In the virgin state supports sclerophyll forest and heath. From Russian **pod**, under; **zolit**, to leach.

PODZOLIC: relative to the profile in which eluvial (q.v.) and illuvial (q.v.) horizons are well-developed, and soil reaction is acidic from complete leaching of calcium and magnesium carbonates.
Podzolisation: the process of forming a podzolic soil.

pogo(n) Gk.: as in **pogostoma, leucopogon**, a beard (-like tuft of hairs).

poikilo(s) Gk.: as in **poikilothermous**, varied (hence of the temperature of an organism when varying with its environment. Applied especially to cold-blooded animals).

POLARISED: of light when its rays are redirected (e.g. polariser) from its normal transverse multidirectional vibrations (perpendicular to the line of advance) to a single plane.

POLARITY: of organic form, the differential orientation of parts.

POLE STAGE: the growth stage of an erect tree following the sapling stage (when the lower branches below the crown remain unshed for a considerable time).

polio(s) Gk.: as in **poliomyelitis**, grey (hence a viral infection which may cause inflammation of the grey matter of the spinal cord).

POLLARDING: the technique of inducing a normally tall-growing but sparsely-foliaged tree to produce a number of pollard-shoots (q.v.) for the purpose, e.g. of effecting further growth as a densely-foliaged, bushy crown.

POLLARD SHOOT: a shoot arising from a point close to the region of severance or 'topping' of a main shoot or trunk, the point being several feet above ground-level. cf. coppice shoot.

POLLEN-GRAIN: (collectively pollen) the matured microspore of angiosperms and gymnosperms, formed as one of a tetrad from spore mother cell by meiotic division, and with a chromosome number reduced from the diploid to the haploid. The carrier of genetic information from the male parent, usually short-lived.

The contents of the pollen-grain largely are of proteins and fats, amino acids and vitamins and, in small amounts, nucleic acids and the phytohormones indole acetic acid and gibberellic acid. The phytohormones are believed to induce the production of a hormone within the female structure which stimulates the production of fruit. The typical enclosure is an inner wall (intine) of cellulose with a superficial later of pectin, and an outer wall (extine) usually furrowed (coplate) or pitted, or variously sculptured, composed mainly of sporopollenin, a derivative of a fatty acid with high resistance to water-entry and decay. See also prothallus.

POLLEN TUBE: a projection, developed by the intine of a pollen-grain as a response to its reception by a stigma or nucellus, through which passes the grain's content to form the male gametophyte. Its function is to serve as a carrier of the male gametes to the egg.

POLLINATION: the dispersal of pollen and the reception and the reception by a stigma or nucellus of pollen-grain (one of several thousand) contributed either from the same flower (self-pollination) or from a different source (cross-pollination). See also anemophilous, entomophilous.

POLLINIFEROUS: bearing pollen.

POLLINIUM: (plural pollinia) a waxy aggregate of pollen-grains formed by certain insect-pollinated plants, especially of **Orchidaceae** and **Asclepiadaceae**.

poly(s) Gk.: as in **polycladous, polymeric**, many.

POLYADELPHOUS: of stamens when grouped in three or more bundles.

POLYANDROUS: of a flower when its stamens are in an indefinite number (at least twenty).

POLYCARPELLARY, POLYCARPELLATE: of a gynaecium when composed of more than one carpel.

POLYCARPIC, POLYCARPOUS: developing fruit over several seasons.

POLYCHRONIC: of a taxonomic group when arising from a single ancestral stock at different periods of time.

POLYEMBRYONY: of apomixis, the development of embryos either directly from a nucellus or integument of an ovule (i.e. adventive) or directly from a single proembryo resultant from an ovule of normal fertilization (cleavage polyembryony).

polygali-: as in **polygalifolia**, of **Polygala (Polygalaceae)**. (The name meaning 'much milk').

POLYGAMODIOECIOUS: of a species functionally dioecious but with some members bearing bisexual flowers additional to unisexual ones.

POLYGAMOUS: of a plant when bearing both unisexual and bisexual flowers.

POLYGENETIC: originating from more than one source.

POLYGENIC: of genetic variation when involving the segregation of several genes with small individual effect.

POLYMER: a product of polymerization, i.e. a chemical process involving the repetition of structural units (mers) contributed by monomers (structurally identical or otherwise) to form a macromolecule.

POLYMORPHIC, POLYMORPHOUS: of various within a species when involving the appearance of several distinct forms. Of individuals or their organs when of different form at different periods of life. Of substances when existing in more than one crystalline form.

POLYPETALOUS: of a corolla when the petals are distinct (free) from one another. Also dialypetalous.

POLYPHYLETIC: of a taxonomic group when shown to be of mixed origin, hence not conforming with a common phylogeny.

POLYPLOIDY; the replication of chromosomes to a number greater than that basic to the species. See allopolypoidy, aneuploidy, autopolyploidy.

POLYPLOID SERIES: of a taxonomic group, a series arithmetic progression, the polyploids indicated by a prefix for the multiple, e.g. diploid, triploid, tetraploid, etc. See also allopolyploidy, aneuploidy, autopolloidy, euploidy.

POLYSEPALOUS: of a calyx when divided into distinct sepals.

POLYSTEMENOUS: of a flower when its stamens are more than double the number of petals or sepals.

POLYSACCHARIDE: a carbohydrate formed by polymerization of monosaccharides usually to such a degree that the chemical nature of the sugar is altered. Includes starch, cellulose, hemicellulose, gum, chitin, callose.

POLYSTICHOUS: of units when arranged in several series,

POLYTOPIC: of a taxonomic group when arising from more than one ancestor of the same stock.

poma Gk.: as in **pomax**, a lid; an operculum.

POMA: a fleshy, multi-locular, several-seeded fruit formed from an ovary fused with a floral cup which, when enlarging, become the fleshy tissues. An accessory fruit, chiefly of a section of **Rosaceae** including the apple, pear, loquat, quince, etc.

pom(um) L.: as in **pomiculture**, **pomology**, a fruit.

POMIFEROUS: bearing pomes or pome-like fruits.

POMIFORM: shaped like a pome usually in the sense of an apple.

pompholux Gk.: as in **polypompholyx**, a bubble.

POPULATION: in a general sense, a community or group of individuals sharing some common relationship. In one sense, a community in which there is free breeding and gene-exchange.

popule(us) L.: as in **populifolia**, **populnea**, of the poplar **Populus (Salicaceae)**.

PORE: of wood, a vessel (q.v.) especially in cross-section.

porphyr(os) Gk.: as in **porphyrocephalus**, purple.

PORPHYRIN: of plants, a pigment derived from porphine which, combined with iron or magnesium, is the base for such complexes as chlorophyll, cytochromes and other iron porphyrins functioning as enzymes or respiration.

PORRECT: extending outwardly.

porr(us) L.: as in **porrifolia**, the leek, **Allium porrum**.

port(o) L.: as in **portulaca**, to bear (hence bearing milk, i.e. a latex).

post L.: as in **posterior**, behind; after.

POSTERIOR: of the side facing the axis to which the part of reference is related, e.g. the posterior surface of a petal is the side facing (immediately after) the centre of the flower. cf. anterior.

potamo(s) Gk.: as in **potamogeton**, a river (hence neighbouring a watercourse).

POTAMOUS: living in, or beside, a watercourse.

prae L.: as in **praecox**, before; in front.

praecox L.: premature; precocious, i.e. developing earlier than its kind.

PRAEMORSE: with the apex abruptly shortened and irregular, as though bitten off.

praeter L.: as in **praetervissus**, by; past; except; beyond (hence overlooked; neglected).

praso(n) Gk.: as in **prasophyllum**, the leek **Allium porrum**.

pratensis L.: of meadow or grassland; pratal.

prav(us) L.: crooked; irregular. **pravissimus**: most irregular (in branching).

PRECIPITATION: from a solution, the settling out (as a precipitate) of a solute or substance held in suspension when some physical or chemical change occurs in the solution, e.g. when the solution is an atmosphere saturated with water vapour at a certain temperature and the substance is water vapour condensed to finely dispersed water-droplets suspended as cloud, water will precipitate under certain conditions (yet to be fully determined) when the atmosphere is cooled rapidly below its dew-point (q.v.). The precipitation will be in the nature of drizzle or rain (according to the size of the water-droplets), sleet or snow (when the atmosphere is cooled below freezing-point, sleet when rain is frozen to ice, snow when the water-vapour passes directly into the solid state to coalesce in snowflakes), hail (formed during summer thunder-storms when water-droplets are carried to higher, cold levels of the atmosphere to form ice until reaching the mass required of precipitation), glaze (when rain is frozen at ground level).

PRECURSOR: of a synthesised compound or complex, the substance or element initiating its formation.

premn(on) Gk.: as in **premna**, a tree-stump.

PRICKLE: a sharp-pointed, hardened outgrowth (a multicellular hair) from an epidermis, readily detached by physical contact. cf. spine.

prim(us) L.: as in **primordial**, first; chief.

PRIMAEVAL: of original and ancient character.

PRIMARY GROWTH: growth and when originating from primordia and continuing principally from derivative primary meristem, **protoderm** when the primordial epidermis, **procambium** when the primordial vascular tissue, and **ground meristem** when the primordial ground tissue.

PRIMARY ROOT: a root (taproot) continued in growth and from which lateral roots branch to form a root-system. The root-system of dicots and gymnosperms in contrast with the adventitious root-system typical of monocots where there is a continual replacement of roots, no single root remaining dominant.

PRIMARY TISSUE: the tissue formed by primary growth. For the higher plants, **dermal** when forming the epidermis, **vascular** when functioning for conduction of solutes through its constituent xylem and phloem, **ground** or fundamental when chiefly of parenchyma, collenchyma, or sclerenchyma.

PRIMORDIAL: the first-formed; the original.

PRIMORDIUM: (plural primordia) a cell or tissue in its earliest stages of differentiation. Also primordial meristem.

prion Gk.: as in **prionotes**, a saw (hence toothed like a small hand-saw).

pro Gk.: L.: as in **progeny**, before; in front of; in place of.

PROCARYOTIC: of a cell when its nuclear material (nucleoplasm) is not differentiated to a definite nucleus, the nature of a schizophyte (procaryote) which lacks, in addition, organelles (e.g. plastids, mitochondria, vacuolar systems) bounded by membranes. cf. eucaryotic.

procer(us) L.: lofty; long.

PROCUMBENT: trailing or lying flat on the ground without rooting.

procurrens L.: projecting; extending beyond.

PROEMBRYO: an embryo before differentiation of parts, e.g. before the development of cotyledons and axis.

PROFILE: of soils, a vertical exposure viewed from the surface to the underlying unweathered material.

PROGENY: a descendant brought forth by sexual reproduction.

PROLIFERATION: in general, increasing by active growth. In one sense, excessive development, or production of abnormal parts, e.g. smaller leaves in number replacing a normal leaf.

PROLIFEROUS: reproducing by stolons, offsets, adventitious buds, or other asexual means. In general, increasing by active growth.

PROMERISTEM: the meristem at the tips of roots and shoots, the cells initiating (dividing) for the primary tissues. Apical meristem.

prominens L.: prominent; standing out from its kind.

PROPAGATION: in general, reproduction. Reproduction by vegetative means.

PROPAGULE: a unit of vegetative reproduction, as a leaf or stem cutting.

PROPHYLL: a much-reduced leaf subtending the base of a lateral branch. Of dicots, usually paired but in monocots single. The bracteole is a prophyll limited to an inflorescence.

propinqu(us) L.: similar, closely connected.

PROP-ROOT: an aerial root adventitious from a trunk, usually in a radiating series. When reaching the ground, forms a stalk-like support. Well-shown by the screw pines (**Pandanus** spp.) of the rainforest.

pro(s) Gk.: as in **prosthetic**, in addition; towards.

PROSTHETIC: of a complete enzyme (holo-enzyme), the non-protein part.

prost(heke) Gk.: as in **prosanthera**, an appendage.

PROSTRATE: trailing on the ground.

proter(os) Gk.: as in **proteranthous**, earlier, before (hence flowering before leaves are replenished).

prot(os) Gk.: as in **protista**, **protophyte**, first; first-formed; original.

PROTANDROUS: of a flower when the shedding of pollen by anthers occurs before the stigma becomes receptive, the effect being an avoidance of self-fertilization. Originally proterandrous. cf. protogynous.

PROTEAD: a member, or relative to a member, or the **Proteaceae**, the name derived from L. **proteus**, a self-changing sea-god, hence **protean**, changeable in form.

PROTEIN: a nitrogenous organic compound of high molecular weight, formed (when simple) by linkage, the peptide bond, of amino acids, its nature determined by the sequence of about twenty protein-forming amino acids, the number of combinations (and hence the number of proteins) being innumerable.

The major (or total) constituent of an enzyme, the protein is concerned in all metabolic reactions. It may be linked (conjugate) with a polysaccharide to form a **glycoprotein**, or associated with a lipid as a **lipoprotein**, or a nucleic acid as a **nucleoprotein**. It is certain cases derivable in crystalline form. It may be soluble or sparingly soluble in water (e.g. albumin, globulin), soluble in 70-80 percent alcohol (protamin), or soluble only in acid or alkali (glutelin). Its solubility in water is a factor of the pH of the solution; when soluble form an optically-active, electrolytic (by virtue of its component amino acids), colloidal solution. See also amino acid, enzyme.

PROTEINACEOUS: with the nature of, or compounded of, protein. The word derived from Gk. **proteios**, primary.

PROTEOLYTIC: protein-splitting, as the peptidase and protease groups of enzymes.

PROTHALLUS: of a vascular plant, a gametophyte derived from a spore. Of the homosporous pteridophytes, a typically thalloid structure, free-living and autotrophic, developing both antheridia and archegonia, but of other vascular plant shows a progressive degree of reduction.

The male prothallus of heterosporous plants typically is represented by one or two prothallial cells developed within and retained by the microspore. It takes no further part in growth, the activity leading to the formation of gametes coming from an antheridial cell of the microspore which develops as an antheridium. It is most reduced in angiosperms, being represented by the very small generative cell and the large tube cell contained by the pollen grain.

The female prothallus (except in **Salvinia**) never is entirely free from the megaspore but from it is developed an archegonium (several archegonia in gymnosperms) within which occurs fertilization. Of gymnosperms it is a nutritive tissue wholly enclosed by the ovule and persistent within the seed as an endosperm. Of angiosperms, it is reduced to an embryo sac containing eight nuclei.

PROTISTA: the collective primitive organisms, including the unicellular plants and animals and those 'in-between', and multicellular organisms when of simple organisation. The algae, protozoa, fungi and bacteria.

PROTOCHLOROPHYLL: a precursor of chlorophyll, accumulative only in darkness and converted to chlorophyll on exposure to light.

PROTODERM: the primary meristem initiating cells forming an epidermis.

PROTOGYNOUS: of a flower when the stigma is receptive before maturation of pollen-grain, the effect being an avoidance of self-fertilization. cf. protandrous.

PROTON: a unit of an atom equivalent to the nucleus of a normal hydrogen atom, electrically in balance with an electron but of opposite charge (i.e. is positive) an 1840 times its mass.

PROTONEMA: (plural protonemata) of a moss, a branched filament developed from a germinated spore and becoming the gametophyte.

PROTOPHYTE: a unicellular plant; a primordial plant. A member of a division (**Protophyta**) which includes blue-green algae, bacteria and viruses.

PROTOPLASM: a metabolically-active colloidal system essentially of water (up to 90 percent) within which are dissolved or dispersed proteins, lipids, carbohydrates, nucleic acids, pigments, hormones, vitamins and a great variety of organic and inorganic substances both bicatalytic and apparently functionless, in addition to various structural components as the nucleus, endoplasmic reticulum, plastids, mitochondria, ribosomes, etc., functioning in the generation and utilization of energy for growth, regeneration and reproduction.

PROTOPLAST: a unit of protoplasm limited by a cell wall or membrane, composed of a cytoplasmic matrix and a nucleus. In multicellular organisms, continuous with other protoplasts by cytoplasmic strands which pass (in plants) through minute perforations of the wall. See also cell, cytoplasm, plasmalemma, plasmodesmata.

PROTOSTELE: a fundamental stele composed of a solid core of xylem surrounded by phloem, pericycle and endodermis. The stele of roots where exarch, and the stems or ribosomes or many ferns where mesarch. See also under lycopsid, sphenopsid.

PROTOTYPE: the ancestral form.

PROTOXYLEM: the primary xylem when first-formed from a plerome, maturing to metaxylem.

PROVENANCE: of seed of species, the geographic origin or source.

PROVENTITIOUS: arising from a source accessory to the normal, as buds normally dormant replacing primary buds and developing to epicormic or proventitious shoots.

PROXIMAL: close to the point of reference or axis, not distal.

PRUILOSE: glaucous; with a whitish or bluish sheen.

prunelli-: as in **prunellioides**, of **Prunella (Labiatae)**.

pruriens L.: causing an itching sensation; prurient.

psalio(n) Gk.: as in **psaliola**, a ring.

psamm(os) Gk.: as in **psammophilous**, sand.

psathyr(os) Gk.: fragile.

pseud(es) Gk.: as in **pseudanthus**, **pseudocarp**, false.

PSEUDOBULB: of an orchid, a part of the stem when bulbous (swollen) and storing reserve products. New axillary shoots may arise from scales at its base which may again form a pseudobulb, the repetition forming a chain or series of pseudobulbs.

PSEUDOCARP: a 'false' fruit, i.e. an accessory fruit.

psil(os) Gk.: as in **psilocaulon**, **psilopsid**, bare; smooth.

PSILOPSID: a homosporous pteridophyte, terrestrial but without true roots and leaves, the former represented by hair-like rhizoids arising from a subterranean, dichotomously-branching, mycorrhizal rhizome, the leaves represented by dimorphic lobes. The axis of the shoot is dichotomous, ridged, flattened or thalloid. Sporangia are large and borne on the tips of the larger lobes (considered part of the axis), the spores produced are numerous, simple, in tetrads, on germination developing to small prothalli resembling the rhizome of the sporophyte. The prothallus bears both antheridia and archegonia, the former spherical protuberances within which arise multi-flagellate gametes, the archegonia sunken, with a projecting neck which breaks away at maturity. Among the pteridophytes, the relationship of the psilopsids is with the lycopods, differing from them in the absence of roots and leaves, the position of the sporangia, and the multi-flagellate male gametes. The two genera, **Psilotum** (often xerophytic) and **Tmesipteris** (often epiphytic) occur in Australia, either in crevices of sandstone cliffs, or as epiphytes of rain-forest.

An identical structure has been shown by fossils from the Devonian (e.g. **Rhynia**, **Psilophyton**) and the Silurian (**Baragwanthia**) periods which evidence an aerial photosynthesising system, the stem of **Rhynia**, the lamina of **Baragwanthia**. The latter, although from an earlier period, shows leaf-traces and veins. This resemblance, and the fact that the features are not found in other groups indicate that the fossils (collectively the **Psilophytales**) are linked directly with the psilopsids, hence the extant group may be regarded as the surviving ascendants of the oldest stock of vascular plants. The category of the psilopsid group is generally accepted as a division (**Psilopsida**) composed of a single order (**Psilotales**) with a single family **Psilotaceae**. A second common name for the psilopsid in psilophyte.

psorale(os) Gk.: as in **psoralea**, covered with a scurf; scurfy.

PSYCHROMETRIC: of measurement when based on the degree of coolness, e.g. on the cooling effect of evaporation in determining the moisture content of an atmosphere (see under humidity).

PSYCHROPHILOUS: adapted to cold conditions. From Gk. **psychros**, cold.

ptero-: as in **pteridophyte**, of, or like, a fern. From Gk. **ptēris**, a fern; **idos**, like.

PTERIDOPHYTE: an autotrophic plant predominantly of moist and shaded habitats of warm regions, with an alternation of free-living generations, the sporophyte dominant: a vascular plant (without a cambium except **Isoetes**), usually a perennial or annual herb (sometimes arborescent) with true roots, or (the psilopsid) without true roots or leaves but with aerial stems, in some (e.g. **Azolla**) reduced to a simple, moss-like cluster of leaves and free-floating.

The sporophyte is either homosporous (a majority) or heterosporous. When homosporous, the asexual spores (reduced to the haploid condition by meiosis from spore mother-cells) germinate to form a small, filamentous or thalloid prothallus, independently living for a short or long time, forming both antheridia and archegonia. When heterosporous, the spores developing either male or female gametophytes with rarely an independent existence from the spore. In both cases, the male

gametes and flagellate and require, for fertilization, water in their transport. Fertilization leads to the diploid zygote, embryo and development from this of the sporophyte.

The classification of the pteridophyte is as a member of one of four divisions **Psilophyta** (see psilopsid), **Lepidophyta** (see lycopsid) **Calamophyta** (see sphenopsid) and **Filicophyta** (see fern) but in more conservative systems, a common division **Pteridophyta** is retained for four classes, **Psilopsida**, **Lycopsida**, **Sphenopsida**, **Pteropsida**. Its phyletic relations are believed to be with the cycadophytes (see under cycad) with a possible derivation through the psilophytes. See also agomany, apospory, dictyostele, protostele, siphonostele.

PTERIDOSPERM: a member of the fossil 'seed-fern' flora (united in an order of gymnosperms **Cycadofilicales**), dating from the Carboniferous Periods, with no known existing representation but of some similarity to the fossil order **Bennettiales** which succeeded the pteridosperm in the Mesozoic Era, this order with strong affinity with modern cycads. Its significance is in the fern-like vegetative features (e.g. the frond-like foliage) and reproductive structures developed on vegetative fronds but with definite forming of seed, thus appearing to bridge the gap between the pteridophytes and gymnosperms. Other seed-bearing fern-like groups subsequently have been established from fossils, e.g. the order **Cordaitales**, dominant in the Palaeozoic and generally believed the ancestral line of modern conifers.

pter(on) Gk.: as in **pterospermous**, **tetraptera**, **apterous**, a wing or wing-like structure. **pterygion**, the diminutive.

ptil(on) Gk.: as in **ptilotus**, **coleoptile**, a feather.

ptych(e) Gk.: as in **ptychosema**, a plait or fold.

PTYXIS: the rolling or folding of leaves or floral parts in bud.

pubens L.: of plants, well-developed; luxuriant.

PUBERULENT, **PUBERULOUS**: pubescent, but with the hairs very fine and soft.

PUBESCENT: with a covering of short, stiff, down-like hairs (pubescence). From L. **pubescere**, to become mature.

pugion(is) L.: as in **pugioniform**, a dagger.

puchell(us) L.: the diminutive of **pulcher**, beautiful.

pull(us) L.: dark in colour.

PULSE: in one sense, an edible legume or one of the crops which bear edible legumes, e.g. the crops of beans and peas.

PULVERULENT: powdery; with a powder-like covering. From L. **pulbis**, dust.

pulvin(us) L.: as in **pulvinate**, a cushion.

PULVINUS: (plural pulvini) a leaf-base (q.v.) when forming a well-defined, cushion-like swelling. Sometimes responsive to certain atmospheric stimuli (e.g. light) through changes in turgidity of its constituent cells, the response transmitted to the leaf which has the property of adjusting its position in relation to the stimulus. A feature of some of the **Mimosaceae**, e.g. the 'sensitive' plants of **Mimosa** and certain of the bipinnate acacias. A small pulvinus at the base of a leaflet is known sometimes as a **struma**.

pumil(us) L.: dwarf.

PUNCTATE: with translucent dots or depressions, e.g. of the leaves of **Myrtaceae** and **Rutaceae** where representing oil-secreting glands.

PUNCTATE: the diminutive degree of punctate (from L. **punctum**, a point).

PUNGENT: of an apex when forming a stiff, sharp point.

punice(us) L.: from Gk.: scarlet.

PURE: of a community when consisting of a particular species almost to the total exclusion of other species. See also axenic.

PURE LINE: the progeny and descendants of a self-fertilized homozygous parent, hence the stock of uniform genetic constitution.

PURINE: of a cyclic nitrogenous base when containing a purine ring, purine itself not occurring in the free state but its derivatives are of high importance in metabolic processes, e.g. the purine bases adenine and guanine of nucleic acids. Xanthine, a dioxypurine, is a common constituent of plants, its methylated derivatives occurring in some cases as purine alkaloids, e.g. caffeine, theobromine.

purpur(a) L.: as in **purpurascena**, **purpurea**, purple.

pusill(us) L.: insignificant.

PUTAMEN: the endocarp of a drupe when woody or hardened. The 'stone' of a 'stone-fruit', e.g. of a peach, plum, apricot.

PUTATIVE: believed to be, as species when believed to be the parents of a hybrid.

putealis L.: found near a well or water-hole.

putid(us) L.: rotten; putrid.

PUTREFACTION: the reduction of proteins and other nitrogenous organic compounds by fungi and bacteria.

pycn(os) Gk.: as in **pycnantha**, **pyconophylla**, dense; compact.

pygmae(us) L.: dwarf.

pyle Gk.: as in **micropyle**, an opening.

pyr(os) Gk.: as in **pyracanthus**, **pyrogenic**, fire, heat (hence with flame-coloured spines, and heat-producing respectively).

PYRAMIDAL: of habit when of conical shape.

pyren Gk.: as in **pyrene**, **pyrenocarp**, a fruit-stone or, as in **pyrenoid**, a dense mass.

PYRENE: a drupe when developed from a multicarpellate gynaecium, each carpel forming a hardened or woody endocarp, the individual stone enclosing a seed. Also pyrenocarp.

PYRENOID: of an alga, a region of protein occurring in a chloroplast, of green algae and the **Anthocerotae** (see bryophyte) associated with the formulation of starch.

pyri-: as in **pyrifolia**, **pyriform**, a pear. From L. **pirum**, a pear.

PYRIMIDINE: of a cyclic nitrogenous base when containing a pyrimidine ring, the pyrimidine bases including the constituents of nucleic acids, uracil, thymine, cytosine, and methylcytosine.

py(um) Gk.: as in **pyogenes**, pus (hence pus-producing).

PYXIS: a capsule when dehiscent by a transverse circular slit. Also pyxidium.

QUADRAT: of ecology, a marked area in which sampling of a vegetation is undertaken, the standard being a square metre.

quadrat(us) L.: square.

quadrifarium L.: fourfold; in four parts.

quadrifis(us) L.: split into four parts.

quadrupl(ex) L.: four -fold; quadruple.

quart(us) L.: the fourth; one-fourth.

quasi L.: as if; almost.

quaterni L.: four each; in fours; quaternary.

querci- L.: as in **quercifolia**, of the oak **Quercus (Fagaceae)**.

quies L.: as in **quiescent**, rest; repose (hence becoming dormant).

-quetr(us) L.: as in **triquetrous**, concerned; with acute angles.

quini L.: as in **quinary**, five each; in fives.

QUINCUNCIAL: of five objects (e.g. trees) so placed that four occupy the corners of a square and the fifth is at the centre of the square thus forming a quincunx. The L. **quincunx** means five-twelfths.

quinque L.: as in **quinquefid**, **quinquenervis**, five.

quiquies L.: five times.

quint(us) L.: the fifth. Commonly, as in **quintuple**, misapplied to mean five.

RACE: a category at a level subordinate to a sub-species. A group of individuals maintaining an identity through geographic or ecologic isolation or (especially of micro-organisms) nutritional or physiological isolation.

RACEME: an inflorescence formed by pedicellate flowers arising from along an axis (peduncle) of indefinite length.

RACEMOSE: of branching when formed by the successive (acropetal) development of axillary buds from buds from a primary axis of indefinite length. Branching when indeterminate. Of an inflorescence when a raceme (the fundamental type), spike, catkin, corymb, umbel, head, panicle, thyrse.

racem(us) L.: as in **racemation**, **racemulose**, a cluster, or stalk of a cluster, of grapes (hence a cluster, and in small clusters, respectively).

RACHIAL: of a rachis. from Gk. **rhachis**, a spine. The 'h' is often retained, e.g. as rhachial, rachis, etc.

RACHILLA: a secondary axis of an inflorescence or compound leaf.

RACHIS: a primary axis of an inflorescence or compound leaf.

RADIAL: of a radius, e.g. a radial section is a cutting made in line with a radius of a transverse section. A radial cell system is a system in which the cells are disposed with their long axes transverse (at right-angles) to the shoot. From L. **radius**.

RADIALLY SYMMETRICAL: of structures when radiating from a common centre, members of the same series being alike in shape and size. Actinomorphic or regular.

RADIANT: emitting a radiation. Of a species when dispersed from a geographic centre where originating.

RADIATE: spreading from a common centre. From L. **radius**, a spoke; a ray.

RADIATION: a form of energy (e.g. heat, light, ultra-violet, electric), its traversal of space as an electromagnetic wave of particles (photons) when created by vibration of electrons or vibrations within the atomic nucleus of matter.

radic(is) L.: as in **radicant**, root.

RADICAL: arising from a root or (as in radical leaves) from a region close to the root-shoot junction.

RADICAL: a chemical compound, a group of atoms which, in a series of chemical reactions, maintains its identity (acting as a single atom) and is replaceable by other radicals or atoms of single elements with equivalent valency. When ionizing, is either a basic radical when with a positive charge (e.g. ammonium NH_4^{+}) or an acid radical when with a negative charge (e.g. nitrate NO_3^{-}).

RADICANT: rooting, developing roots from a stem.

RADICATE: rooted, with root-like structures.

radic(is) L.: a root.

RADICLE: a primary root originating as a primordium at the base of a hypocotyl within a seed.

RADICOLOUS: living within or in association with a root, as certain fungi.

radio L.: as in **radiometric**, to radiate (hence relative to measurement of the intensity of a radiation).

RADIOBIOLOGY: the study of the effects of radiation on living organisms. See also isotope.

radix L.: a root.

RADULATE: of a structure when rasp- or scraper-like. In epithets, e.g. **radula**, usually in reference to a leaf or shoot appearing like a flexible file. From L. **rado**, to scrape.

RAINFOREST: a closed community dominated by trees which form a two or more layered dense canopy in which lianes and epiphytes are usually conspicuous, and a lower sparse assemblage of smaller trees, shrubs, herbs including ferns. On latitude classed as tropical, sub-tropical, and temperate rainforest.

ram(us) L.: as in **ramose**, **ramiflorous**, a branch (hence much-branched, and flowering from the branches respectively). The diminutive is **ramul(us)**, as in **ramulose**, twiggy.

RAMULUS: a secondary or tertiary branch.

racens L.: putrid.

RANGE: of physiogeography, a continuous line of mountain or a continuous ridge when in the sense of mountain-range.

ranunculus L.: the diminutive of **rana**, a frog.

RAPACEOUS: turnip-shaped. Derived from the name for turnip, **Brassica rapa**.

RAPHE: a ridge on an ovule persistent in the seed, formed by adnation with a funicle. From Gk. **raphe**, a seam.

RAPHIDE: a needle-like crystal of calcium oxalate occurring in certain cells. From Gk. **raphis**, a needle.

RAY: (vascular ray) of secondary xylem and phloem, a later of parenchyma which, in series, extends from the vascular cambium (where originated) in a direction radial to the vertical or axial system. A vascular ray functioning for the exchange of solutes and gasses throughout the stem, and for storage of synthesised products.

RAY FLORET: of **Compositae**, one of florets of the outermost series of the head, commonly ligulate and distinct from the inner disc florets.

re L.: as in **reaction**, again; against (hence a response when two (or more) elements, chemical substances, organisms and environmental factor/s, ect., combine. **Soil reaction** implies simply the pH of a soil.

REACTION WOOD: of conifers, see compression wood: of angiosperms see tension wood.

RECEPTACLE: of a flower, the tip of the floral stem from which arise the reproductive and sterile units.

RECEPTOR: for a stimulus, a responsive cell or group of cells.

RECESSIVE: of alleles, the factor which is suppressed partially or wholly by the dominant.

RECIPROCAL CROSS: of breeding, a backcross with the parent contributing the gamete opposite in sex to that originally contributed, i.e. the paternal parent of an initial cross become the maternal parent of the back-cross.

RECLINATE: curved or bending from the apex downwardly.

RECOMBINATION: of genetics, the formation of new combinations of genes.

RECONDITE: closed; hidden.

rest(us) L.: as in **rectilinear**, straight; correct (hence occurring in straight lines).

RECTIFICATION: of a liquid mixture, the purification and refinement by continuous distillation, e.g. though a fractionating column.

RECURVED: curved or bending backwardly, or downwardly.

RED-BROWN EARTH: a soil group formed from either sedentary or transported rock, with colour red-brown in the surface layers and red in the upper subsoil, texture with a definite transition from light (usually a loam) to a heavy (usually clay) subsoil, and reaction neutral to acid in the surface layers and neutral to alkaline in the lower where salts have leached. Occurs on the continent mainly in the south where maximum rainfall (12.25 in annual) is in winter, and supports in the virgin state a savannah woodland. With improvement, is potentially valuable wheat and sheep land.

RED GUM: of eucalypts, a tree essentially of open woodland, typically with widely-spreading branches and a short, broad trunk. Its bark is smooth and mottled, often with some retained at the trunk-base and becoming rough. Typically also are the broadly-lanceolate to ovate or orbicular juvenile leaves, lanceolate, often falcate, adult leaves where the venation appears as a closed system removed from the leaf-margin, axillary umbels of pointed (often beak-like) buds, and small hemispherical fruits with strongly exsert valves. Usually a commercial timber tree developing a brown to red-coloured durable wood, as well as a valuable honey, shade and shelter tree.

Forest Red Gum **Eucalyptus tereticornis** traverses some two thousand miles of the eastern coast and appears again in New Guinea. River Red Gum **E. camaldulensis** is the most widespread of all eucalypts although confined to the mainland. Blakely's Red Gum **E. blackelyi** and Hill Red Gum **E. dealbata** are the ubiquitous red gums of the western slopes of New South Wales, the latter sometimes known as Silver Gum because of its ashy-white juvenile leaves (less so with the adult),

buds and smaller branches. Cabbage Gum **E. ampifolia**, closely allied with Forest Red Gum is a tree of the coast and tablelands adapted to swampy conditions. Another close ally of Forest Red Gum is **E. seeana**, a commercial timber tree of the coast and sub-coast of northern New South Wales - it is atypical among red gums in its linear to narrowly lanceolate juvenile leaves.

REDUCTION: of morphology, the loss or suppression of parts as a result of increased specialization. Of chromosome number, the halving as a consequence of meiosis.

REDUNCATE: turned or bending backwardly.

REDUPLICATE: of sepals or petals in bud when the margins of adjacent members are turned outwardly at points of contact.

REFLECTED: of a lamina when folded or turned back on itself.

REFLEXED: abruptly curved or bending backwardly or downwardly.

REFORESTATION: the re-stocking of impoverished or depleted forest.

REFRACTION: of light, the change in direction of its waves when passing at an oblique angle from one substance through another of different optical density, e.g. from air through water, from glass to air, etc. The greater the density of the second substance, the lesser the angle (of refraction) between the normal (a line at right-angles to the surface of the optical medium) and the refracted wave. When the wave is co-incident in direction with the normal ray, there is no refraction.

REFRACTORY: unresponsive. In one sense, e.g. refractory material, not broken-down or damaged by, e.g. heat.

REFRINGENT: breaking apart.

REGENERATION: of an organism, the ability to replace or restore a part lost or removed to produce again a whole individual. The capacity for regeneration varies inversely with the degree of specialization, but for vascular plants the principal natural means are restoration, reconstitution, and reproductive regeneration.

Restoration occurs from the activity of meristem adjacent to a wounded surface, e.g. by the development of root or shoot primordia from a callus, as in root-suckering or coppicing.

Reconstitution occurs by the re-organization either of meristem or mature tissue, e.g. by the rather rare development of meristem below apical meristem to replace the latter when disturbed, or by the re-differentiation of cells close to a wounded surface which reproduce normally for another tissue.

Reproductive regeneration implies the separation of a part and the development from this part, e.g. a stolon, offset, adventitious bud. It is simply vegetative reproductive.

Of a community, the restoration or re-establishment from a disturbed state through the ability of its members to regenerate.

REGIONAL: of a geographic area with a relative uniformity in biologic, climatic, or physiographic features.

REGMA: a schizocarpic fruit splitting into dehiscent one-seeded mericarps. A feature of the **Euphorbiaceae** (e.g. **Ricinus communis**) and the **Geraniaceae**.

REGRESSION: the tendency of the progeny of extreme advanced forms to revert to the condition typical of the species.

REJUVENESCENCE: in general, the renewal or return from an advance or aged state to a youthful or less aged state. Of the evolution of a species, when genetic changes result in a return of characters more typical of the younger or ancestral form. Of land, the development of younger topographic

features from a region previously eroded close to base-level through such events as faulting, warping, or accelerated erosion.

RELIC: a population or taxonomic group now occupying a restricted part of a region where once abundant. Also relict.

REMOTE: of distribution when of isolated or scattered occurrence.

ren L.: as in **reniform**, a kidney.

RENDZINA: a soil group allied with the Black earth (q.v.) but formed from a calcareous parent material.

renasc(or) L.: as in **renascent**, to arise again; to regenerate.

RENIFORM: of a lamina when its base is shallowly and broadly concave and the margin is continued to form a broadly convex apex, thus resembling in shape the traditionally-depicted kidney.

REPAND: of a lamina with a margin unevenly undulate. From L. **repandus**, bent backwards.

REPENT: of a stem when prostrate and rooting. From L. **repens**, creeping.

REPLICATE: of a structure when doubled over on itself. As a noun, a duplication.

REPLUM: a dissepiment (q.v.).

REPRODUCTION: the duplication of a complete organism, cell, or organelle normally with the physiological and genetic potential of its originator. Of an organism, **asexual** when the exchange of genetic material from different sources is not involved (see regeneration, apomixis), **sexual** when the fusion of gametes from independent sources, with a consequent potential recombination of genetic material is involved (i.e. fertilization), **parthenogenetic** when only partially sexual. Reproduction of cells involves the division of a nucleus (karyokinesis) and cytoplasm (cytokinesis) to two cells with an equal sharing of the contents of the parent when the process (cell-division) is mitotic. or without definite sharing of the contents when the process is amitotic. See also conjugation.

RESIN: of plants, a complex water-insoluble mixture of compounds of aromatic hydrocarbons including terpenic types which, as an exudate, hardens on exposure to the air. Stored in cells, ducts or cavities within a variety of tissues, sometimes as a component of a latex, or frequently in association with an essential oil, gum, or tannin, the significance to the plant is unknown although a flow may be induced from a wounding.

A natural resin of commerce often is obtained by simple tapping of incised bark, a few, e.g. Kauri copal and amber, are of fossil origin. Shellac is derived from a secretion of the coccid, the lac insect **Tachardia lacca** which feeds on the stems of plants chiefly of India.

When semi-solid and containing an appreciable amount of essential oil, the resin is termed an oleo-resin, commercially of interest to pharmaceutical and histological fields. Included are the turpentine chiefly of **Pinus** (see under conifer) but including the so-called Canada Balsam from **Abies balsamea** and Venetian turpentine from **Larix decidua**. The term balsam refers strictly to resins containing benzoic or cinnamic acid, e.g. Balsam of Peru and Balsam of Tolu from the Central and South American **Myroxylon pereirae** and **M. balsamum** (trees of the **Papilionaceae**) respectively, benzoin and storax from **Syrax** (**Styraceae**), storax also from **Liquidamber** spp. (**Hamamelidaceae**).

When the resin is in mixture with a true gum to combine the features of both, it is termed a gum-resin. Such names as frankincense asafoetida and myrrh are familiar to the students of ancient history for the early (and continued) use in perfumes and other preparations and as constituents of incenses of religious rites. Frankincense and myrrh are from **Boswellia** and **Commiphora** spp. respectively, trees of the **Burseraceae** from north-east Africa and south-east Arabia, asafoetida is from **Ferula** (**umbelliferae**) of Persia and Afghanistan.

When solid, brittle, more or less transparent, and with little or no essential oil or gum, the resin of commerce is known as hard resin with wide applications to the production of varnishes, lacquers, paints, inks, adhesives, plastics, linoleum, etc., although gradually being replaced by synthetic resins (e.g. the phenolic and urea formaldehydes and acrylics). Familiar examples are:

The Australian 'grass tree' or accroid (acaroid) resins exuded at the bases of the leaves of **Xanthorrhoea**, yellow from **X. hastilis**, red from **X. tateana**, **australe** and others.

The copals - resins of relatively high melting point and degree of hardness applicable to varnishes required for external use. Congo copal from trees of **Copaifera** (Papilionaceae) chief in the semi-fossil state: Kauri copal, the fossil resin from the New Zealand **Agathis australis**.

The damars - resins of south-east Asia (e.g. the trees of **Hopea** and **Shorea**).

Amber - the fossil resin of the extinct **Pinus succinifera** of the Baltic regions.

Dragon's Blood - from the rattan palm of east Asia **Daemarops draco** or species of **Dracaena** (also of **Palmae**).

Lacquer - chiefly from the Chinese tree **Rhus verniciflua** (**Anacardiaceae**), cultivated in Japan.

Mastic - chiefly from **Pistacia lentiscus** (**Anacardiaceae**) of the Mediterranean countries.

Sandarac - from the North Africa **Tetraclinis articulata** and the Australian **Callitris verrucosa** (both of the **Cupressaceae**).

RESPIRATION: the energy-releasing oxidation of biosynthesised products to simpler compounds, the oxidising agent (electron acceptor) being either atmospheric oxygen (aerobic respiration) or other hydrogen acceptor (anaerobic respiration or fermentations), the energy released being available for processes concerning synthesis.

The processes proceed in a sequence of oxidation-reduction reactions, each reaction catalytic and requiring some energy for its progress but making available more energy than is absorbed. This is possible through such intermediaries as the co-enzymes nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP), and the greater energy-carrier adenosine triphosphate (ATP). NAD and NADP have the property of becoming reduced when absorbing energy and readily re-oxidised when releasing energy. ATP is an energy-carrier coupled with oxidative reactions and formed from adenosine diphosphate (ADP) and phosphate. Of concern to aerobic respiration are the cytochromes (q.v.) carriers also of electrons.

When glucose is the substrate and respiration is anaerobic (common to both autotrophic and heterotrophic organisms), and initiate stage, **glycolysis**, involves the splitting of glucose $C_6H_{12}O_6$ to pyruvic acid $CH_3.CO.COOH$. There is a sequence of some nine separate catalytic steps, the pathway known as the Emden-Meyerhof cycle from the two Germans who, in the 1930's, first traced the steps. The overall reaction may be expressed as:

glucose + 2NAD + 2ADP + 2 phosphate - 2 pyruvic acid + 2NADH₂ + 2ATP. Further anaerobic oxidation (fermentation) yields a number of other products dependent on the enzyme-systems functional in the organism, e.g. lactic acid, ethanol, glycerol, the acids acetic, butyric, citric, gluconic, propionic, etc., inorganic substances as nitrates and sulphur, with or without the evolution of carbon dioxide. Alternative pathways to the Emden-Meyerhof have been established.

Anaerobic respiration is a relatively inefficient process, a large input of substrate being required for a small return of energy, the end-product (when organic) retaining un-utilized energy. When oxygen is available as the oxidising agent, a much more efficient process ensues from the pyruvic acid formed by glycolysis. More complex systems of enzymes are required (e.g. cytochromes, oxidases), these being located in the mitochondria of the cell. A number of organic acids (e.g. citric, fumaric, malic, succinic) are formed which are intermediates of other metabolic reactions, e.g. the synthesis of amino acids. The sequence of reactions is known as the modified **Krebs Tricarboxylic Acid** or

Citric Acid cycle, has an over-all result, starting from glucose through glycolysis, which may be expressed as:

glucose + 28 phosphate + 60₂ + 44H₂O + 38 ATP.

See also cytochrome, fermentation, oxidation-reduction, phosphorylation, photosynthesis.

RESPIRATORY QUOTIENT (RQ): of respiration, the ratio of the amount of carbon dioxide evolved to the amount of oxygen consumed, unity attained when sugars are the substrates, less than unity when the substrate is a fat, and greater than unity when the substrate is an organic acid formed during the citric acid cycle.

rest(is) L.: as in **restiaceae**, **restio**, a rope or cord.

RESUPINATE: turned completely around so as to appear upside down. From L. **resupinere**, to bend back.

ret(e) L.: as in **retacious**, **retiform**, a net (or network).

retcul(us) L.: the diminutive of **rete**.

RETICULAR, RETICULATE: forming a network, as a venation of many dicots.

RETICULE, RETICLE: a network, as the venation of many dicots, instruments (e.g. a microscope) a net- or grate-work of finely engraved lines on glass inserted in the optical system as a means, e.g. of measurement.

retro L.: as in retrogressive, backwards (hence reverting to the primitive state; degenerating).

RETTING: of stems for the extraction of fibres (e.g., of jute, flax, hemp), the controlled partial separation of the bark and fibre of the phloem from the surrounding softer tissues, through exposure to the atmosphere or steeping (in water) and exposure to the fermentation action of certain soil-dwelling bacteria.

RETROSE: turned or directed backwardly. Also retroverse. From L. **retorsum**, backwards.

RETUSE: of an apex when obtuse and with a broad, shallow, central notch. From L. **retusus**, blunted.

REVERSIONARY: turning back to an ancestral form. Returning from the domesticated (cultivated) state to the wild.

REVOLUTE: of a lamina when its margin is directly downwardly and towards the central line (e.g. mid-rib) of the undersurface. Cf. involute. From L. **revolvere**, to roll back.

rhabd (os) Gk.: as in rhabdoid, a rod.

rhachi(s) Gk.: a spine. See under rachi.

rhag: as in **rhagodia**, a berry. From Gk. **rhax**, a grape.

ramn: as in **ramnus**, a tuft of branches. From Celtic **ram**.

ramph(os) Gk.: as in **rhamphophylla**, a needle.

rheo(s) Gk.: as in **rheoplankton**, a flow or stream (hence plankton of streams and watercourses).

RHEOTACTIC: responsive to the stimulus of a current (of water, air, electricity, etc.).

rhin: as in **rhinanthus**, a snout. From Gk. **rhise**, nose.

hip(s): Gk. as in **hipidate**, **hipidum**, a fan.

RHIPIDIUM: see under cyme.

hip(s) Gk.: as in **hiphognium**, a flexible branch (of willow).

rhiz(a) Gk.: as in **rhizomorphous**, **mycorrhiza**, a root.

RHIZOID: the absorbing and anchoring filamentous structure of non-vascular plants, especially of the bryophytes.

RHIZOMATOUS: developing rhizomes.

RHIZOME: a main shoot when more or less horizontal, subterranean or prostrate, developing adventitious roots and scale-leaves within the axils of which are buds. Usually laterally branching by the determinate nature of a segment when terminated by a bud which develops to an aerial leaf, frond, or leaf-sheath, or a floral axis, further growth of the rhizome being continued from an axillary bud. Sometimes wiry and creeping, as of some grasses (e.g. couch) and ferns, sometimes fleshy and serving mainly for storage (e.g. the sources of asparagus (**Asparagus officinalis**), ginger (**Zingiber officinale**), licorice (**Glycyrrhiza glabra**) and the rhubarbs (**Rheum officinale**, **R. rhaponticum**)). Each segment with an intact growth point is capable under suitable conditions of growth as an independent individual.

RHIZOMORPH: of a pteridophyte (the fossil lepidodendrids and the extant **Isoetes**), the basal part of the shoot bearing branched roots. Of a fungus, a cord of thread-like mass of hyphae, sometimes (e.g. the tree-parasitic **Armillaria mellea**) extending for several metres.

RHIZOPHORE: of a lycopod, a part of a stem from which develop temporary adventitious roots.

RHIZOSPHERE: the part of a soil immediately associated with a root-system.

rhod(on) Gk.: as in **rhodanthe**, **rhododendron**, rose.

RHOMBIC: of a lamina when quadrilateral, with obtuse lateral angles and acute basal and apical angles.

RHOMBOID: of a three-dimensional structure when rhombic in several planes. rhynch(os) Gk.: as in **rhynchosia**, **macrorrhyncha**, a snout or beak. In such compounded words as **macrorrhyncha** (**macro(r)-rhyncha**), **microrhiza**, **glycyrrhiza**, **xanthorrhoea**, derived from the Greek, it is customary to place an 'r' before the 'rh'.

rhyti(s), rhytid(os) Gk.: as in **rhytisperma**, **rhytidophyllum**, a wrinkle (hence the seed and the leaf respectively with a wrinkled appearance).

RHYTIDOME: the outer bark.

RIB: a costa (q.v.). Of venation, a vein when major or prominent (e.g. a mid-rib).

RIBOSOME: a globular organelle of cytoplasm composed essentially of ribonucleic acid (rRNA), the major site of protein synthesis. Formerly sphaerical bodies with an undetermined function are sphaerosomes.

ricino-: as in **ricinocarpus**, of the Castor Oil Plant **Ricinus communis**, the generic name derived from L. **ricinus**, a tick in reference to the tick-like seeds.

RIFT VALLEY: a valley formed by the subsidence of land between two approximately parallel faults, e.g. the gulfs of Spencer's and St Vincent's of South Australia.

rigens, rigid(us) L.: stiff; unbending; not pliable.

rim(a), diminutive rimul(a) L.: as in **rimose**, **rimulose**, a cleft or fissure.

RIND: a firm, leathery outer wall (exocarp) of certain baccate fruits, e.g. the hesperidium of citrus, the pepo of cucurbits, the berry of banana.

RINGENT: gaping. Of a labiate corolla when the upper lip is widely arched.

RING-POROUS: of hardwoods, with vessels tending to be arranged in concentric rings.

RIPARIAN: of, or located on, the banks of rivers. From L. **ripa**, a river-bank.

riv(us), diminutive **rivul(us)** L.: as in **rivose**, **rivulose**, a stream and streamlet respectively (hence marked by winding lines or channels to a greater or lesser degree).

rivalis, **rivularis** L.: of a watercourse.

RIVERAIN: the region in the immediate vicinity of a river. Also riverine. the low-lying, flat lands subject to flooding from the Murray River system support a Riverain forest in which the Red Gum **Eucalyptus camaldulensis** is dominant.

robust(us) L.: of sturdy habitat; robust.

ROCK: in general, mineral matter, not necessarily hard or compact, which forms portion of the earth's crust and from which soil may be derived. Usually of igneous, sedimentary, or metamorphic origin.

ROGUE: of progeny, a member displaying features not normal to the average. **Rogueing:** the removal (culling) of a rogue.

ROOT: the absorbing, anchoring, storing, usually subterranean organ of a vascular plant continuous with the stem, frequently branched with outgrowths of the epidermis, **root-hairs**, in a region (piliferous layer) close to the growth tip which provide the major absorbing surface, and a **root-cap** at the tip constantly replaced by actively-dividing meristem during its function of protection against abrasion. See also adventitious root, aerial root, buttress-root, cortex, endodermis, epidermis, knee, passage cell, pericycle, plerome, prop-root, primary root, transpiration-cohesion-tension, vascular system.

r(h)ops Gk.: as in **chaemarops**, a bush.

rose(us) L.: of the rose **Rosa** (**Rosaceae**).

ROSETTE: a cluster radiating from a common source, e.g. a cluster of radicate leaves.

rostr(um), diminutive **rostell(um)** L.: as in **rostellate**, **rostrate**, a beak (hence with a small beak- (rostellum-) and beak- (rostrum-) like projection).

ROSULATE: arranged in a rosette.

ROTUND: rounded, almost orbicular.

ruber-, **rubid(us)** L.: as in **rubens**, **rubrus**, **rubicundus**, **rubidus**, red.

rubell(us) L.: reddish.

RUBIGINOUS, **RUBIGINOSE:** rust-coloured; brownish-red.

rub-: as in **rubrioides**, of **Rubia** (**Rubiaceae**).

RUDERAL: growing on rubbish dumps or waste lands. From L. **rudus**, debris.

RUFIOUS: red; reddish-brown. From L. **rufus**, reddish.

rug(a) L.: as in **rugose**, a wrinkle; a crease.

RUGOSE: with a wrinkled surface. Marked by irregular raised or depressed lines. **Rugulose**: the diminutive condition.

RUMINATE: in general, appearing as though chewed. Of endosperm when its surface is marked irregularly by distinct depressions.

RUNCINATE: in general, sharply incised. Of a lamina when divided into a number of triangular lobes which have their points directed towards the base, as in the Dandelion **Taraxacum officinale**.

RUNNER: a slender, prostrate and creeping stem developing adventitious roots, and leaves, from nodes. On death of the segment of a runner on either side of the node, the developed structure has the potential for establishment as an independent plant. Usually taken as an equivalent of stolon.

RUN-OFF: of rainfall, that part discharged or drained from the land.

rupes L.: a rock or cliff.

RUPESTRINE, RUPICOLOURS: growing among rocks.

riticola L.: inhabiting the country (**rus**).

rusci-: as in **ruscifolia**, of **Ruscus (Liliaceae)**.

russul(us) L.: somewhat red.

RUST: of disease, especially of cereals, one caused by a member of **Uredinales (Basidiomycetes)**, e.g. the several species of **Puccinia**.

rustican(us) L.: of the country; rural.

rutilans L.: becoming reddish in colour.

s.l.: **sensu lato** (in a broad sense); **sp.**: a species; **spp.**: species, in plurality; **(et) seqq**: **(et) sequentes** (and the following):

ssp.: subspecies; **s.str.**: **sensu stricto** (in a narrow sense). **sabul(um)** L.: as in **sabuline**, gravel or sand.

SACCATE: forming a sac or sacs, e.g. of a sepal or petal when dilated on one side to form one or more depressions. Also gibbous.

sacchar-: as in **saccharide**, a sugar. From Gk. **sakchar**.

sagitta L.: as in **sagittate**, **sagittifolia**, an arrow.

SAGITTAL: of a section when in a central longitudinal plant.

SAGITTATE: of a lamina when its apex is acute and, like an arrow-head, the base is divided to two acute lobes which point downwardly.

sal L.: as in **saliferous**, salt.

salici(s) L.: as in **salicifolia**, the willow **Salix (Salicaceae)**.

salignus L.: of the wood of willow. From **sali(-l)-ignus**.

SALINE SOIL: a non-alkaline soil with sufficient accumulation of salts (e.g. of sodium, calcium, magnesium, potassium) to be toxic to plants other than halophytes.

salmoni(s) L.: as in **salmoniphloia**, a salmon (hence with salmon-coloured, or yellowish-pink, bark).

salpi(nx) Gk.: as in **salipiglossis**, a tube.

SALSOLACEOUS: relative to the halophilous members of **Chenopodiaceae** known for their value as drought-resisting fodder plant, e.g. the saltbushes and the bluebushes (q.v.). The name is taken from **Salsola** a cosmopolitan genus of the same family, also halophilous but known in this country far less for useful members, e.g. **Salsola kali** is a declared weed, the widespread 'roly-poly'.

sals(us) L.: as in **salsuginous**. saline: brackish (hence growing in soils high in salt content).

SALT: in a general sense, sodium chloride but extended to (in plant physiology) a soluble form of a mineral nutrient, e.g. potassium nitrate, calcium phosphate, magnesium sulphate, etc. Chemically, the product of an acid and base reactant in equivalent proportions, particularly when these substances are strongly ionising. When on is weak, an acidic or basic salt may form by hydrolysis.

SALTBUSH: a community of, or a members of, **Atriplex**, **Enchylaena**, and **Rhagodia** in the inland and arid interior of the continent, with long-established recognition as drought-resisting fodder-plants (although small shrubs). A community of soils with clay texture, often saline (e.g. **Atriplex vesicaria**). See also bluebush.

SALT PAN: a shallow, usually rounded, depression of land occurring in arid and semi-arid regions, in which the underlying rock is impregnated with salt brought to the surface by capillary action during the dry season. Many of the salt 'lakes' of inland Australia (e.g. Lakes Frome, Eyre, Corwell, Moore, etc.) are of this nature. Lake Eyre of about 180,000 sq. miles has claim of being the driest part of the continent; its average annual rainfall is from four to six inches.

saltuos(us) L.: wooded, **saltuensis**: belonging to, or originating from, forest.

salubris, salutaris L.: health-promoting; salubrious (e.g. from some principle contained by a plant).

SAMARAL a dry, indehiscent, one or few-seeded fruit (an achenial fruit) with the pericarp extended as a winged margin of aid in dissemination by wind. Sometimes multiple when derived from a bi- or tri-carpellate ovary, then the individual unit known as a mericarp.

SAMAROID: resembling a samara.

SAMPHIRE: a halophilous succulent characteristic of salt-marsh communities either estuarine or littoral. A member of such a community when of the family **Chenopodiaceae**, viz. **Arthrocnemum**, **Pachyornia**, **Salicornia**.

SAND: of soil, the fraction in which the particle size varies from 1.00 to 0.05 mm. See also texture.

sanguine(us) L.: blood-red.

SAP: of a cell, an aqueous solution of inorganic salts, sugars, amino acids and other solutes stored in a vacuole.

SAPLING: the growth stage of an erect tree beginning with the shedding of branches from the base of the crown as the bole increases in height, commencing on average after three or four years of active growth of the main stem.

sapo L.: as in **saponaceous**, **saponin**, soap.

SAPONIN: a glycoside (q.v.) which forms soapy foams and stable emulsions with oils, fats and resins, hence of value as an emulsifying agent and surfactant. Occurs generally in leaves, roots and seeds, e.g. Black Bean **Castanospermum australe** (seed), Whitewood **Atalaya hemiglauca** and Red Ash **Alphitonia excelsa** (foliage).

sapro(s) Gk.: as in **saprobic**, **saprophilous**, rotted; decaying.

SAPROGENIC: causing, or resulting from, decay.

SAPROPHYTE: a plant dependent for nutrition on the reduction of organic matter (i.e. decay and putrefaction) from the dead tissues or production of other organisms. Also saprobe.

SAPWOOD: of secondary xylem white still functional for water-transport before its conversion to an inner zone, heartwood, i.e. before blockage of cells by such products as gums, resins, tannins, and the desiccation of parenchyma occurs. The outer, often lighter-coloured, zone of wood as distinct from heartwood.

sarcina L.: a package.

sarco-: as in **sarcostemma**, of flesh; fleshy. From Gk. **sarx**.

sarissa L.: a pike.

sarment(um) L.: a twig.

SARMENTOSE: forming long runners.

sativ(us) L.: sown; cultivated.

SATURATED: of a process in respect to a factor when an increase in the intensity of the factor no longer causes an increase in the rate of the process. Of a chemical compound when undergoing with difficulty reactions adding new atoms to atoms or groups of atoms already present, although readily responsive to reactions replacing or substituting those atoms already present.

SAVANNAH: a community, dominated by perennial xeromorphic grasses with a scattering of shrubs and trees, of occurrence in tropical and sub-tropical regions with a summer rainfall and a definite dry season. **Savannah Woodland:** a woodland (q.v.) open and dominated by scattered trees, with a poor development of shrubs but with a continuous lower stratum or grasses. A community of both tropical and temperate regions. **Tree (or shrub) savannah:** a savannah with scattered trees (or tall shrubs or small trees), occurring singly or in small stands. From Spanish **salbana**. See also steppe.

sax(um) L.: as in **saxatile**, **saxicolous**, a rock; a large stone.

scaber, scabious(us) L.: rough, **scabriuscul(us)**, the diminutive: **scaberim(us)**, the superlative.

SCABROUS: of a surface when roughened by minute protuberances. Also scabrate.

scaev(us) L.: as in **scaveola**, on the left side (of the genus alluding to the unilateral, fan-like corolla).

scala L.: as in **scalariform**, a ladder.

SCALAR: of a quantity measurable in a single dimension, e.g. of weight, volume, length.

SCALARIFORM: marked by a series of transverse bars or lines, as certain tracheids and vessels when marked by an arrangements of pits.

SCALD: of land when eroded by wind, the surface soil being completely removed to leave bare patches in a vegetation.

SCANDENT: climbing, e.g. by tendrils.

SCAPE: the floral stem or peduncle of an otherwise stem-less plant (e.g. a rosette plant) bearing one or more flowers and (usually) scales or bracts. **Scapigerous**, **scapose:** bearing or producing a scape.

SCARIFICATION: of seed, the breaking of dormancy by removal, through physical or chemical means, of a barrier resistant to the permeation of water (e.g. a barrier formed by a covering of the seed-coat with a fatty substance).

SCARIOUS: of a structure when dry, thin, and membranous, usually not green.

SCARP: for the general sense, see escarpment.

sceptr(us) L.: a 'royal staff' or sceptre. **Sceptriferous**: bearing a sceptre-like structure.

schisto(s) Gk.: as in **schistorrhiza**, cloven; split.

SCHIST: a rock with a tendency to form flakes by cleavage, e.g. mica.

schizo Gk.: as in **schizolepis**, to cleave; to split.

SCHIZOCARPIC FRUIT: a fruit when dry and formed from a synocarpous ovary, with the carpels separating as one-seeded mericarps but usually not dehiscent. Includes the carcerulus, cromocarp, lomentum, regma, multiple samara.

SCHIZOGENOUS: formed by, or originating from, a cleavage. Of a cavity within a tissue when formed by the retraction or spatial movement of cells.

SCHIZOLYSIGENOUS: of a cavity within a tissue when formed by a combination of retraction and lysis (dissolution) of cells.

SCHIZOPHYTE: a plant when reproducing by the simple 'splitting apart' of a cell (binary fission); a bacterium or blue-green alga, a procaryote.

SCION: of a graft (q.v.), the part (usually a shoot or bud) from a source external to the grafting (i.e. introduced to the stock).

scio-: as in **sciophilous**, shade. From Gk. **skia**.

SCIOPHYTE: a plant adapted to conditions of constant shade, i.e. a sciophilous plant.

scissilis L.: cleavable.

SCISSILE: splitting as though cut into thin sheets.

scler(os) Gk.: as in **scleranthus**, **sclerid**, **sclerophyll**, hard.

SCLERID: a unit of sclerenchyma, a cell with a lignified, thick and pitted wall and usually devoid of, or with very little, protoplast.

SCLERENCHYMA: a supporting tissue of cells with thickened walls.

SCLERIFICATION: of parenchyma, a change to sclerenchyma by a development of secondary-thickened walls, often with a desiccation of protoplasts and a lignification.

SCLEROPHYLL FOREST: a closed community dominated by evergreen sclerophyllous trees (e.g. eucalyptus) with flat-topped crowns and trunks equal to or longer than the depths of the crowns.

SCLEROPHYLLOUS: hard leaves, i.e. with leaves coriaceous and evergreen, usually with an abundance of sclerenchyma, the feature of a sclerophyte.

SCLEROPHYTE: a plant not succulent in its vegetative parts, its leaves coriaceous, often with sunken stomates and a thick cuticle.

SCLEROTIC: of a plant cell when hardened by a deposition of lignin.

SCLEROTIUM: (plural sclerotia) of a fungus, a mass of hyphae forming a hardened, usually rounded structure; a resting-body, e.g. the stone-like 'Blackfellow's Bread' formed by **Polyporus myllitae**.

scobin(a) L.: as in **scobinate**, a file (hence with a rasp-like surface).

scole(x) Gk.: as in **scolecarpus**, a worm (hence with worm-like fruit).

scol(os) Gk.: as in **scolymus**, a thorn (hence thorny or spiny).

scop(a) L.: as in **scopate**, **scopiform**, **scoparium**, a broom or brush. **scopula**, a small brush.

-scope, -scopic, -scopy: as in **microscope**, **basiscopic**, **microscopy**, an instrument for, an aspect of, and the process or technique of (respectively) viewing. From Gk. **skopos**, a watcher.

scorpi(os) Gk.: as in **scorpioid**, a scorpion (hence coiled like the tail of a scorpion). See also under cyme).

scot(os) Gk.: as in **scotophilous**, darkness.

SCRAMBLER: a climbing or semi-climbing plant without special means of securing a hold to a support.

scrobi(s) L.: as in (the diminutive) **scrobiculate**, a ditch (hence marked by minute pits or depressions).

SCRUB: a community dominated by evergreen tall shrubs or small, low-branching trees, frequently forming entangled dense covers, e.g. the mallee, mulga, brigalow scrubs of the mainland, the 'horizontal scrub' of south-west Tasmania formed by entangled, impenetrable **Andopetalum biglandulosum** (Cunoniaceae).

SCURF: the hairs of an epidermis when stellate and connected to form scale-like plates. Scurfy: with an abundance of scurf (or scales) to appear silvery.

scut(um) L.: as in **scutigerous**, **scutiform**, a shield, **scut(us)**: bearing a shield.

scutul(um) L.: as in **scutelligerous**, **scutelliform**, a small shield.

SCUTELLUM: of the embryo of many monocots, a shield-shaped part of the cotyledon which absorbs nutrient stored in the seed but outside the embryo.

scyph(os) Gk.: as in **schyphoid**, **scyphiform**, a cup.

scyt(os) Gk.: as in **scytopetalus**, of leather; leathery.

SEA GRASS: an herbaceous monocot of an estuarine community occurring submerged at varying depth. Prominent in waters of the coast are **Zostera** (shallow flats with mud-bottom), **Halophyla** (deep muddy water), **Psoidonia** (sandy slopes) and **Ruppia** (semi-saline waters).

SECONDARY GROWTH: of growth when incrementing primary growth through the activity of a vascular system cambium and (often) a phellogen. See cambium.

SECRETORY CELL: a cell occurring singly, or in a series to form a group, gland, duct or tube, within a tissue functioning for the storage of specific secretions (e.g. nectar, latex, resin, oil).

SECTILE: cut into parts. From L. **secare**, to cut.

SECUND: of parts (e.g. pinnae) or organs (e.g. flowers) when arising from one side of an axis, i.e. unilaterally. From L. **secundus**, following.

SEDENTARY: of soil when developed directly from earlier rocks and deposited as a sediment (usually in layers) under, or from solution in, water. e.g. limestone, sandstone, shale.

SEDIMENTATION: the settling out of suspension of solid particles in a liquid by gravitational force, to produce a more or less two-phased system, an upper relatively clear effluent and a lower relatively solid sludge (or sediment).

SEED: a matured ovule within which develops an embryo. The integument of the ovule becomes the **testa** (seed-coat), the second fertilization concurrent with the formation of the zygote produces an **endosperm** of nutritive value to the embryo, and in some cases, a development from the integument or nucellus produces an accessory nutrient tissue, **perisperm**. See also dormancy, scarification, stratification, fruit, dissemination.

SEGREGATION: of alleles (q.v.), their separation (at meiosis) so that gametes ultimately formed carry one or other of the alternative factors.

sege(s) L.: as in **segetalis**, **segetum**, a cornfield; a crop.

segmentum L.: a cutting a part (hence **segmentation**, the division of an object into parts of segments).

segnis L.: slow; late.

seismo(s) Gk.: as in **seismonastic**, a shaking; a shock.

SEISMONASTIC: responsive to a stimulus created by a vibration.

SELECTION: of evolution, see natural selection.

selen(e) Gk.: as in **selenotropic**, the moon.

SELENIFEROUS: containing or yielding the mineral selenium.

SELENOTROPIC: turning in the direction of the moon.

SELF FERTILIZATION: the union of gametes contributed by the one individual, the genetic effect being an increase in homozygosity.

SELFING: self fertilization, e.g. when induced from normally cross-fertilizing individuals by artificial means. **Self**: the progeny or product of selfing.

SELF MULCHING: of soil when forming its own mulch after rain by the breaking-up of the surface, when redried, to fragment less than half an inch in diameter. Usually associated with a presence of free lime in the surface layer.

SELF POLLINATION: the transference of pollen from an anther to the stigma of the same flower, not necessarily implying a successful self-fertilization, e.g. self sterility may be a barrier.

SELF STERILITY: the incompatibility of male and female gametes contributed by the individual (e.g. a self-pollinated flower). In angiosperms, the incompatibility concerning the pollen-grain and stigma, the pollen tube and style, or the male gamete and the egg-cell within the embryo sac.

sema Gk.: as in **brachysema**, a standard.

semen, seminis L.: seed; race; progeny.

semi(s) L.: half.

SEMI-PERMEABLE: of a membrane when selectively permeable to water and certain of its solutes (in solution) but not other solutes.

semper L.: at all times; always (hence **sempervirens**, evergreen).

seneci-: as in **senecifolia**, of **Senecio (Compositae)**. From L. **senex**, an old man.

SENESCENCE: the process of ageing; physiological decline.

sent(us) L.: rough; thorny.

seors(um) L.: as in **seorsifolia**, scattered; apart from.

SEPAL: the leaf-like unit of calyx, sometimes petaloid or reduced to a lobe, tooth, scale, bristle or border.
Sepaloid: resembling a sepal. Derived from L. **separatio**, a separation.

sepes (saepes) L.: as in **sepicolous**, **sepiarius**, a hedge (hence forming, or growing as a hedge).

sepsis Gk.: putrefaction. **septicos**: putrefactive.

SEPTATE: divided by partitions (septa), each partition a septum. From L. **septum**. **Septal**: of a septum.

septem, septi(ens) L.: as in **septifoliolate**, seven, and seven times respectively. **septeni**: seven each;
septimus: the seventh.

septentrionalis L.: northern.

SEPTICIDAL: of dehiscence when along the septa common the adjacent carpels.

sepulc(h)ralis L.: belonging to a burial place; sepulchral.

SEQUESTERING AGENT: see chelate.

SERIAL: of ecology, relative to a sere or succession.

SERE: a succession (q.v.) or stage in a succession, e.g. **lithosere**: a sere on rock (or stone);
psammosere: on sand; **xerosere**: in aridity; **subsere**: arising from a disturbed habitat; **prisere**:
from a completely changed habitat.

SERICATE, SERICEOUS: of hairs when silk-like, or of a surface when silky-haired. From L. **sericatus**,
clothed in silk.

SEROLOGY: of plants, a biochemical approach to classification through an assessment of reactive
property of the plant's protein as an antigen when in the form of an extract or serum, it is introduced
to protein from another source.

SEROTINOUS: flowering late in the season; late-maturing. From L. **serus**, late.

serpens L.: creeping.

serphylli- (L.): as in **serpyllifolium**, of wild thyme **Thymus (Labiata)**.

serrat(us) L.: as in **serrate**, **serriform**, notched, like the cutting-edge of a saw.

SERRATE: of a margin when sharply indented to appear like the forward-pointing teeth of a saw.

SERRULATE: the diminutive condition of serrate.

SESSILE: of a structure when borne without a supporting pate, e.g. the petiole of a leaf, the filament of an
anther, the pedicel of a flower etc.

sesqui L.: as in **sesquiterpene**, one and a half (hence with one and a half times the carbon and
hydrogen atoms of true terpenes, $C_{10}H_8$. i.e. with empiric formula $C_{15}H_{24}$).

seta L.: as in **setaceous**, **setose**, **setigerous**, a bristle.

SETACEOUS, SETOSE: of a surface when covered by bristle-like hair.

sex- (L.): as in **sexfid**, six (from **sex**), or as in **sexual**, sex (from **sexus**).

SEX-LINKED: of inheritance when the factor/s for a character/s is/are linked is the chromosome (sex chromosome) carrying sex-determining genes.

SEXUAL REPRODUCTION: see under reproduction.

SHALE: a laminated sediment with clay texture.

SHIELD: of geology, a region of very ancient rocks compacted at an early stage to a solid mass resistant to later disturbances. A physical structure typical of lands with low relief, as the continent of Australia.

SHOOT: a stem considered with the parts arising from it, e.g. foliage and inflorescence.

SHRUB: a woody plant usually not above twenty feet in height of which apical dominance (q.v.) is replaced at an early growth-stage by lateral branching so that no single stem is dominant.

SIAL: the rocks forming the upper part of the earth and underlying the continents, compounded from silicon and aluminium, elements contained by granite, an acidic rock.

sic L.: so, in this manner.

sicc(o) L.: as in **desiccate**, **exsiccate**, to dry (hence, in common usage, to dry, and a substance or material freed from moisture respectively).

sidere(us) L.: of the stars; glittering.

sider(os) Gk.: as in **siderophloia**, iron (hence 'iron-barked').

SIEVE ELEMENT: a unit of phloem concerned in the translocation of synthesised substances, either a **sieve-cell** when simple or a **sieve-tube member** when one of a series forming a **sieve-tube**, an elongate cell enucleate when functional with primary wall modified by a perforated region traversed by cytoplasmic strands ensheathed by callose (q.v.).

Especially of the end-walls of angiosperms, perforated regions, **sieve areas**, occur in definite parts of the sieve-tube member, the parts known as a **sieve plate**. A frequent association is a proteinaceous viscous substance, **slime**, contained by the vacuole of the member and originating from slime bodies of various form and number. See also Companion Cell.

SIGMOID: with the shape of the letter S.

sign(e) L.: as in **signatus**, **signorum**, to mark; to adorn.

SILICEOUS: of, or with the nature of, silica or sand. From L. **silex**, flint.

SILICULA: a siliqua (q.v.) when short and flat, e.g. of **Capsella** and **Coronopus**.

SILIQUA: a capsular fruit derived from a bicarpellate ovary with a dissepiment (false septum), dehiscent from the base upwards and with the two valves remaining attached to the tip of the septum. Chiefly of **Cruciferae**. From L. **siliqua**, a pod.

SILT: of soil, the fraction in which the size of particles varies from 0.02 mm to 0.002 mm (the upper limit for clay).

silv(a) L.: as in **silvaticus**, **silvestris**, a woodland or forest.

SILVICULTURE: the art of forest management from the aspects of protection, regeneration, maintenance and utilization of the crop.

SIMA: the rocks underlying the sial (q.v.) and the surface of the ocean floor, the word compounded from silicon and magnesium, elements contained by basalt, a basic rock.

similis L.: resembling.

simplex L.: simple; a single series of kind.

sinensis L.: of Chinese origin.

SINISTROSE: spiralling to the left, from L. **sinistrors(us)**, to the left.

SINUATE: of a margin when alternatively deeply concave and convex.

SINUS: in general, a cavity or recess.

siphon Gk.: as in **siphonogamous**, a tube (hence fertilizing through a pollen-tube).

SIPHONOSTELE: a stele when in the form of a hollow cylinder enclosing a central core of parenchyma. Especially of ferns. See also dictyostele.

SKELETAL: of soil, relative to the type in which the parent rock is close to the surface and imperfectly weathered or consolidated to stone. A feature of tableland and range.

skia- Gk.: see scia-.

SLASH: of a forest, the accumulated litter from leaf and branch shed.

SLIME BODY: an inclusion, e.g. of a sieve-tube member, proteinaceous in nature, which disperses as a slime.

SLIME MOLD: see under fungus.

SMUT: of plant disease, one caused by a member of the order **Ustilaginales** of the **Basidiomycetes** (see under fungus).

SOBOLIFEROUS: bearing or producing a number of creeping and rooting stems below the surface of the soil, e.g. Couch grass **Cynodon** spp. From L. **soboles**, an offshoot.

SOIL: the weathered superficial layer of the earth's crust together with the flora and fauna (edaphon) present within, and the produced of their decay.

Azonal: without a well-developed profile either through immaturity or by a prevention of the weathering process from the parent material.

Brown (including Grey): a soil group possessing free lime throughout the profile, little contrast in texture, and low content of organic matter although with moderate fertility. Occurs widely throughout the semi-arid region of the continent, in virgin state supports communities ranging from grassland to shrub steppe.

Heavy: when the texture is clay, named from the aspect of working.

Immature: when developing from recently-laid deposits or denuded horizons and not appearing with definite profile.

Intaonal: with a profile reflecting a very moderate or slight influence of climate and vegetation on its development.

Light: when the texture is sand, named from the aspect of working.

Zonal: with a profile reflecting a dominant influence of climate and vegetation on its development. See also texture.

-sol: as in **aerosol**, a colloidal solution (hence one in a gaseous phase).

solaris L.: of the sun; solar.

SOLARISATION: of photosynthesis, an inhibition when the intensity of light extends beyond its saturation.

solen Gk.: as in **solenogyne**, a tube.

SOLENOSTELE: a siphonostele (q.v.).

SOLITARY FLOWERED: of an inflorescence when a flower arises singly from within an axil of a leaf of a vegetative shoot (the inflorescence then solitary- and axillary-flowered) or a single flower terminates a vegetative shoot without other flowers directly below it (the inflorescence then solitary-flowered and terminal).

SOLONIZATION: of soil, the leaching of colloids (clays) to some depth by their replacement with sodium ions (see cation exchange), the general effect being that the solonised soil is either high in content of sodium salts (then a **solonchak**) or is highly alkaline in reaction (then a **solonetz**). Both soil groups are of extensive occurrence in the low rainfall regions (i.e. less than 17 inches) of southern Australia: in the virgin state, the community typically supported is a mallee scrub (q.v.) in South Australia, western Victoria and New South Wales, and a salmon gum (**Eucalyptus salmonophloia**) woodland in Western Australia. From Russian **solonet**, to become salty.

solstitialis L.: in one sense, of mid-summer or summer heat. Also of a summer-growing plant or an ephemeral.

SOLUBILITY: of a solute, the maximum mass dissolvable in a standard mass of solvent at a given temperature.

SOLUTE: of a solution, the substance (solid, liquid, gas) dissolved by the dispersing medium, the solvent, e.g. water, known as the universal solvent.

SOLUTION: the dispersal of a solute in a solvent to form a homogenous mixture, **true** when not an emulsion or colloidal solution.

soma Gk.: a body. In **soma**, **somatic**, **somatogenic**, in relation to a plant, the vegetative body as distinct from the reproductive. in **chromosome**, **ribosome**, **sphaerosom**, a body in the sense of a particle.

SOMATIC CELL DIVISION: the division of a vegetative cell to two parts with equal sharing of the content of chromosomes, mitochondria and other organelles of the original (parent) cell. A second division of nuclei (karyokinesis or mitosis) and cytoplasm (cytokinesis) restores to each the original content of the parent, and eventual reorganisation of nuclear membranes and cell walls lead to the establishment of the parts as individual identities.

SOMATROPHIC: of nutrition when stimulating vegetative growth.

son(us) L.: as in **sonic**, sound.

SONIFICATION: the subjection of a substance to an ultra-high frequency of sound produced by a 'sonifer'. A method of precipitating substances from suspension by vibrations.

sonch-: as in **sonchus**, hollow. From Gk. **somphos**.

SORAL: relative to a sorus or to sori.

sorbeo L.: to suck up. In **absorb**, **adsorb**, **sorbefacient**, **sorption**, the intake or uptake of a substance.

soro(s) Gk.: a heap.

SORUS: of spore-bearing plants, a cluster of sporangia.

SPADICEOUS: resembling a spadix.

spadice(us) L.: with the colour of the date (the fruit of **Phoenix**).

SPADICIFEROUS: bearing a spadix, or spadices.

SPADIX: (plural spadices) a spike (q.v.) with a fleshy-textured (succulent) axis, the flowers often partly embedded. From L. **spadix**, a palm-branch, the inflorescence of a palm (e.g. **Phoenix**) being a panicle of spadices each subtended by a sometimes woody spathe.

SPARSE: of distribution when of scattered occurrence, i.e. occurring in a number of unconnected localities.

sparto(n) Gk.: as in **spatothamnus**, cordage.

SPATHE: a bract or leaf, sometimes petaloid, enclosing at least in the bud stage a spadix. From L. **spatha**, a two-edged broad sword.

SPATHACEOUS, SPATHOSE: bearing, or resembling, a spathe.

spatula L.: a spoon.

SPATULATE: of a lamina when the apex is broad and rounded, and tapered to the base, somewhat in the form of a spoon or spatula.

SPECIATION: the evolution of species by the segmentation of a previously continuous population into two or more populations which are morphologically discontinuous and reproductively isolated from one another.

SPECIES: of classification, a category below the level of a genus; a category basic to a classificatory scheme. As a taxonomic group, one uniting individuals with genotypic and phenotypic similarities, which breed freely among themselves (or have the potential for such) and are reproductively isolated from other groups. From L. **species**, an appearance; a model.

SPECIFIC: relative to a species, or to a definite object of character.

SPECIFICITY: the condition of being specific. The limitation of a factor to a species or to a definite object of character.

specios(us), superlative speciosissim(us) L.: beautiful.

specul(um) L.: as in **specularia**, a mirror.

spelai(on) Gk.: as in **spelaecolous**, a cave (hence cave-dwelling).

sperma Gk.: as in **angiosperm**, **angiospermous**, **leptospermum**, **spermatophyte**, a seed.

SPERM: the male gamete. Of conifers and angiosperms, developed as a nucleus within a pollen-tube but in other fertilizing groups (algae, bryophytes, pteridophytes, cycads) a flagellate cell actively motile (a spermatozoid) formed within usually definite structures, antheridia.

SPHACELATE: withered; decayed. From Gk. **sphakelos**, gangrene.

SPHAEROID: globular; ellipsoid; spherical.

SPHAEROSOME: a globular inclusion of cytoplasm with unknown function.

sphaira Gk.: as in **spheroid**, **spherical**, **spheroid**, **sphaerocarpous**, **atmosphere**, a globe or ball.

sphen Gk.: as in **sphenoid**, a wedge.

SPHENOPSID: a pteridophyte (q.v.) differentiated to a definite jointed and ribbed stem, whorled and minute leaves (microphylls) ensheathing the node of the stem, and adventitious roots developed from a rhizome. Eusporangiate sporangia are borne on special structures (sporangiphores) collected into a terminal spike-like strobilus. The prothallus is free-living (exosporic); the male gametes are multiflagellate.

A member of the class **Equisetae** or **Sphenopsida** of some authors, or a division **Calamophyta** of others, with history dating to the Devonian period, reaching optimum development during the Carboniferous periods when both arborescent and herbaceous habits were adopted. the surviving genus, **Equisetum**, (order **Equisetales**) of about 23 herbaceous species with sympodial branching, is chiefly of the northern hemisphere, usually aquatic or associated with wet or moist habitats, absent from Australia.

spheno(s) Gk.: as in **sphenotome**, to cleave.

SPHINGOPHILY: pollination by hawkmoths.

spica L.: as in **spicate**, **spiciferous**, **spiciferous**, **spicigerous**, **spicose**, a spike.

spicula L.: as in **spiculate**, **spiculigerous**, a small spike (hence bearing needle-like bodies, spicules).

SPIKE: an unbranched indeterminate inflorescence (a simple raceme) with sessile flowers.

SPIKELET: of a grass, the unit of an inflorescence subtended by a pair of bracts (glumes) and bearing up to 5 florets, each floret axillary within a palea.

SPINE: of plants, a sharp sclerified structure formed from a leaf, either modified from part of it as in the Yuccas and Agaves (apex and margin) and certain acacias (e.g. **Acacia farnesiana** where formed by a stipule), or replacing the leaf as in the gorse **Ulex europaeus**. cf. thorn.

SPINESCENT: of a lamina or branch when terminating in a spine-like point.

SPINIFEX: of a grassland community, or the dominant grass of the community, when developed on sand-dunes. When the dune is littoral, **Spinifex hirsutus** often is the dominant where it is a pioneer sand-binder; when of the sandy desert of the eremaen and occurring in dense, tussock-like masses, **Triodia basedowii** is the usual dominant.

SPINOSE, **SPINOUS**: bearing spines or thorns.

SPINULOSE: bearing small spines or thorns.

spir(a) L., Gk.: as in **spiriferous**, **spiroid**, **spirochaete**, a coil or spiral.

spirill(um) L.: as in **spirillar**, **spirillum**, a small coil.

splendens: epithet, shining; glistening.

spongi(a) L.: as in **spongiose**, a sponge (hence of open or porous texture; spongy).

spora Gk.: as in **sporanigal**, **sporophyte**, **microspore**, a spore.

SPORADIC: of distribution when not continuous, i.e. scattered.

SPORANGIOPHORE: a stalk-like structure supporting a sporangium, e.g. an aerial hyphae of a fungus; the structure forming the cone of a sphenopsid.

SPORANGIUM: a cell or structure within which spores are produced. When the spores are dimorphic (i.e. the plant heterosporous), a **microsporangium** when producing microspores (e.g. the sporangium

contained by each of the four anther-lobes of an angiosperm), and **megasporangium** when producing megaspores (e.g. the sporogenous cells within an ovule).

SPORE: a cell or (rarely) a group of cells concerned in reproduction, usually asexual and formed from meiotic division of spore mother-cells (hence haploid in genetic condition), giving eventual rise to the gametophyte through, e.g. germination to a prothallus. When dimorphic (e.g. of the heterosporous groups of gymnosperms and angiosperms), either a **microspore** (e.g. a pollen-grain) or a **megaspore** (the mother-cell of the female prothallus or (angiosperms) embryo-sac). See also under fungus. See also meiospore, mitospore, and under the various taxonomic groups.

SPOROCARP: of a heterosporous fern (e.g. **Marsilea**) see under fern; of a fungus, a fruiting-body.

SPOROGENOUS: spore-producing.

SPOROgonium: see under bryophyte.

SPOROPHORE: in general, a structure bearing spores.

SPOROPHYLL: in general, a leaf or leaf-order part bearing a sporangium (or sporangia), e.g. as a unit of the cone or strobilus of the lycopods, gymnosperms, the stamen and carpel of angiosperms. When a male structure, a **microsporophyll**, when female **megasporophyll**.

SPOROPHYTE: of a plant with an alternation of generations (q.v.) the asexual spore-producing, genetically diploid generation, represented in vascular plants by the conspicuous vegetative body.

SPORT: the product of a somatic mutation, the phenotypic character so modified that the individual may be continued as a clone but not as a genetically distinct segregate.

SPORULATION: the formulation and release of spores.

SPREADING: of a structure when extending transversely or outwardly.

spumos(us) L.: frothing; foaming.

SPUR: of a corolla or perianth, a slender, long, hollow prolongation of the lower part (or parts). Well-marked in the commonly cultivated 'Snap-dragons' of **Antirrhinum** as well as several orchids. See also gibbous.

SPURIOUS: false in the sense of resembling but without the anatomic or morphologic structure, e.g. a dissepiment of an ovary or fruit when appearing like a true septum.

squam(a) L.: as in **squamate**, **squamose**, **squamous**, **squamiform**, a scale (hence covered by scales or scale-like bracts (**squamae**)).

SQUARROSE: roughened by prominent projections.

stachy(s) Gk.: as in **stachystemon**, **brachystachya**, an ear of corn (hence in the sense of a spike).

STAMEN: the unit of an androecium typically comprising a pollen-bearing anther and a supporting filament. The microsporophyll of angiosperms, basically of leaf rank.

STAMINAL: relative to a stamen.

STAMINATE: of a flower when its functionally fertile parts are all stamens. cf. pistillate.

STAMINIFEROUS: bearing stamens.

STAMINODE: (plural staminodes) a sterile stamen-like flora part (of some flowers), sometimes representing a transition to a petal or a rudimentary stamen, in some cases, a nectary. Also staminodium (plural staminodia).

STAND: an area occupied by a stable community or a group of plants forming a concrete community, usually in the sense of a single species.

STANDARD: of a papilionaceous flower, the uppermost petal, distinct and usually larger, than the other petals. A vexillum.

staphyl(e) Gk.: as in **staphylococcus**, **staphylocarpus**, a bunch (of grapes); a cluster.

STARCH: a polysaccharide, usually made up of two components amylose and amylopectin, the major reserve carbohydrate of plants where it is stored at various sites, e.g. within the stems, tubers, roots. Synthesised in chloroplasts but with little known of origin and manner of synthesis, appears in a granule (leucoplast) of various size and form as a series of concentric layers. It is readily broken down by the enzyme phosphorylase to glucose phosphate from which it is derived and through the amylase group of enzymes may be converted to maltose, further hydrolysis by maltase leading to glucose (the complete hydrolysis may be duplicated by boiling with dilute acid). Reactant with iodine to give a deep blue colour. Forms a sol with hot water which gels on cooling.

stasi(s), stat(os) Gk.: as in **stasimorphic**, **stasis**, **bacteriostatic**, **thermostat**, a standing (still) hence used in the sense of an arrest or an equilibrium.

staur(os) Gk.: as in **stauranthus**, **staurochilus**, a cross.

stear, steat(os) Gk.: as in **staetocarpa**, fat; tallow.

steg(e) Gk.: as in **steganthum**, **calystegia**, a covering.

stele Gk.: as in **prostele**, **siphonostele**, a pillar; a column.

STELE: the primary arrangement of a vascular system. The central vascular cylinder of a root-shoot system developed from a plerome.

stell(a) L.: as in **stellaris**, **stellate**, a star.

STELLATE: in general, radiating from a common centre to appear star-like. Of epidermal hair when several hairs arise from a common centre and lie flat.

STEM: the basic axial organ of a plant which, with its appendages, forms the shoot.

stemma L.: as in **cryptostemma**, a crown.

stemon Gk.: as in **callistemon**, **stemodia**, a thread. Extended to mean a stamen or stamened. e.g. in **stemodia**, **stemo(n)di(s)** twice, the four stamens in two pairs.

sten(os) Gk.: as in **stenomerous**, **stenophyllous**, narrow.

STENOTOPIC: of distribution when within a restricted geographic range.

stephan(os) Gk.: as in **stephanocarpa**, a crown.

STEPPE: a community of saline soils, a **shrub steppe** when the dominants are halophilous semi-erect and semi-succulent shrubs, e.g. of the arid and semi-arid regions of the continent where saltbush (of **Atriplex**, **Rhagodia**, **Bassia**, etc.) and bluebush (**Kochia**) are the dominants.

sterc(us) L.: as in **sterculla**, of manure or dung (hence a reference to a somewhat fetid odour).

stere(os) Gk.: as in **stereophylla**, stiff; rigid; solid.

STEREOISOMERIC: of a compound when occurring in two or more chemically and physically different forms (isomers) due to the different arrangements in space possible of the atoms of its molecule.

STERILE: not fertile, e.g. for reproduction. Aseptic. Of soil when below optimum in nutrients available for active plant growth. **Male sterile:** of a plant with a genetic system carrying factors for male sterility, the plant thus 'self-emasculating'.

STERIGMA: (plural sterigmata) of fungi, a supporting structure for a sporangium, conidium, or basidiospore. From Gk. **sterigma**, support.

STEROID: resembling or chemically related to a sterol (e.g. saponin), or the substance featuring this property.

STEROL: an unsaturated alcohol of complex ring structure, universally distributed in plants but of unknown significance. Of high commercial interest for its value as a starting material in the preparation of synthetic hormones (e.g. sitosterol from the seeds of several monocots, stigmasterol from the seeds of the soya bean) and vitamins (e.g. ergosterol from yeast). Sterols from certain fungi have been considered as an intermediate in the synthesis of cortisone, a drug of clinical use in the treatment of arthritic complaints, certain skin diseases, and forms of cancer.

stich(os) Gk.: as in **distichous**, a row; a line.

stict(os) Gk.: as in **sticta**, spotted.

STIGMA: of a carpel, the part which carries the pollen-receptive stigmatic tissue, frequently continuous with the ovary by a style.

STIGMATIC RIDGE: a stigma of primitive form reduced to a ridge along the margins of the carpel, e.g. of **Drimys (Winteraceae)**. Also stigmatic crest.

STILLSTAND: a land with unchanging base-level, e.g. the Wianamatta Stillstand encircling the city of Sydney where no warping has occurred since its formation in the late Triassic.

STIMULOSE: bearing stinging hairs. From L. **stimulus**, a sting; a stimulus.

STIPE: in general, a supporting structure or stalk. Of a carpel, a basal supporting projection. cf. gynophore. From L. **stipes**, a stalk.

STIPEL: a stipule, or segment of a stipule, at the base of a leaflet.

STIPELLATE: bearing stipels.

STIPULATE: borne on a stipe or stalk. Also stipose.

STIPULE: a lateral part of a leaf borne either near or at the base of the leaf, one on each side, or on the stem free from the lamina but originating from the leaf-base.

STIPULATE: with stipules.

STOCK: of a grafting, the rooted plant receiving the introduced scion. Of heredity, the descendants in line from an original ancestor, i.e. lineage.

stoechas L.: French Lavender (**Lavandula latifolia**).

STOLON: a shoot curving towards the ground and developing adventitious roots, each section of stem with its root on division (or layering) with the potential for independence from the parent. Often a synonym or runner.

STOLONIFEROUS: developing or bearing stolons.

stoma Gk.: a mouth; an opening or pore.

STOMATE: (plural stomates) one of the numerous perforations of a leaf epidermis through which ensues the gaseous exchange during photosynthetic and respiratory processes and the transpiration of water vapour to the atmosphere. A pore formed by two crescent-shaped guard-cells which, through changes in their turgidity, control the opening and closing of the pore. Also stoma (plural stomata).

STOMIUM: (plural stomia) of a sporangium, a region or opening formed by thin walled cells, or by their splitting apart, with consequence release or dehiscence of spores.

STONE CELL: a sclereid (q.v.).

STONE FRUIT: a succulent fruit with a hardened or woody endocarp (the stone). A drupe. See also putamen.

STRAMINEOUS: with the texture of straw. From L. **stramen**, straw.

STRATIFICATION: of a plant community, the arrangement of strata (or layers) made up by the aggregation of plant of similar habitat, ranging from a tall stratum, e.g. of forest trees, to a low stratum, e.g. of mosses on the forest floor. Of rock, an arrangement in definite layers (strata) indicating a difference in formation.

STRATIFICATION: of seed formant from the need of after-ripening (q.v.), treatment by chilling under moist conditions for a period of time varying from a few days to several months, according to species, at a temperature from -1° to 4°C. e.g. the seed of Snow Gum **Eucalyptus pauciflora**, as a general practice, is held for four days at a temperature of 4° before sowing.

strat(um) L.: as in **stratified**, **stratose**, **substratum**, a layer; a covering.

STRATUM: (plural strata) of ecology, a layer or level in a community formed by plants of similar habit, e.g. a tree, shrub, or herbaceous stratum. Of geology, a layer of rock.

strept(os) Gk.: as in **streptococcus**, twisted (hence a general appearance when the cocci form a chain).

STRIATE: of a surface when marked by longitudinal lines or channels. Of venation when the veins are several to numerous, fine and parallel with the margin.

STRICT: of habit when erect and straight.

STRIGILLOSE: the diminutive of strigose. From L. **strigilla**, a small ridge.

STRIGOSE: of a surface when appressed by straight and stiff hairs or bristles. From L. **striga**, a ridge.

STRIKE: of geology, the general horizontal direction of a stratum. As an adjective, e.g. strike fault, relative to features roughly parallel with the strike. The downward slope of a stratum, taken from the horizontal (or strike) is **dip**.

STRINGYBARK: of eucalypts, a member of a botanic group (**Pachyphloia**) typified by a bark persistent, with texture thick, rather spongy, stringy from long fibres, capable of being pulled away from the trunk in long wide strips, grey or reddish-brown in colour. A eucalypt of the eastern coast and tablelands, or of Tasmania and (**Eucalyptus baxteri**) of South Australia, commonly a commercial timber tree with woody very durable and brown in colour. Frequently planted as a shade and shelter tree, it may also be a valuable source of pollen or nectar for the bee-keeper. Included also are some mallees, or small trees, e.g. **E. camfieldii**, **E. alpina** both of restricted occurrence.

The common name designating the stringybark may be based on the colour of the wood, e.g. Red Stringybark **Eucalyptus macrorrhyncha** (a commercial sources of rutin) with a pink tinge to a light-brown colour, Brown **E. capitellata**, White **E. globoidea** not white but often paler than normal. Other names may refer to the colour of the inner bark, e.g. Yellow **E. muelleriana**, or to the foliage, e.g. Silver-leaf **E. laevopinea**, Blue-leaves **E. agglomerata**, Narrow-leaved **E. oblonga**, Broad-leaved **E. caliginosa**.

Messmate Stringybark **E. obliqua** and Mountain Ash **E. regnans** chiefly of Victoria and Tasmania, and Brown Barrel **E. fastigata** of the tableland of New South Wales and adjoining Victoria are atypical in the bark character, the fibre being much shorter, the bark of **E. regnans** persistent only at the base of the trunk. The three are tall, shaft-like timber trees, usually are associated with the Ash group (q.v.). Other stringybarks of note are **E. youmanii** (also a source of rutin) of the northern tablelands of New South Wales and **E. blaxlandii** of the Blue Mountains of this State.

striol(a) L.: as in **striolate**, a small channel (hence finely striate).

STROBILOID: resembling a strobilus. From Gk. **strobilos**, a fir-cone.

STROBILUS: (plural strobili) a reproductive structure when composed of an axis bearing sporophylls, as the cone-like structure of conifers and lycopods.

STROMA: (plural stromata) of a fungus, a spore-producing mass of hyphae, sometimes hardened and sclerotium-like.

stromb(os) Gk.: a spiral or helix, **strombulos**, the diminutive.

strongyl(os) Gk.: as in **strongylocarpa**, rounded.

stroph(e) Gk.: as in **strophanthus**, a twisting or tuning.

STROPHIOLE: of a seed, an aril (q.v.) when restricted to a crest. Strophiolate: bearing a strophiole. From L. **strophium**, a small garland.

stroph(os) Gk.: as in **strophotaxis**, twisted.

STRUCTURE: of ecology, the spatial arrangement of plants within a community without reference to the individual members. Structural forms within the continent include bog, feldmark, grassland, heath, saltbush, scrub, mallee, woodland, sclerophyll forest, rainforest. Categories for structural groupings including formation and sub-formation.

STRUCTURE: of soil, the arrangement of primary particles and their adherence in clusters (as aggregates) which collectively characterise its physical properties. cf. texture.

strum(a) L.: as in **strumose**, **strumiform**, a small tumour (hence with, or in the form of, a cushion-like swelling).

STUPOSE: with a tuft of matted filaments. From L. **stupa**, tow.

STYLAR: relative to a style. From Gk. **stylos**, a column.

STYLE: of a carpel, a sterile, usually filamentous part connecting a stigma with the ovary and through which an 'accepted' pollen-grain develops its tube.

styp(e) Gk.: as in **stypandra**, two; waste flax or hemp, short and broken in texture.

styphe(os) Gk.: as in **stypheia**, hard-textured.

suave L.: sweet-smelling. Also **suaveolens**.

sub L.: as in **subsoil**, **substrate**, underlying; as in **sub-sessile**, **sub-marginal**, almost; as in **sub-microscopic**, less than; as in **sub-species**, below.

suber L.: as in **suberous**, **subiferous**, **suberin**, cork.

SUBERIN: a cork-like substance formed by derivatives of fatty acids, impermeable to steam and water and with low thermal conductivity. Chemically related to cutin, in the plant it is incorporated in the walls of the cork cells of phellem.

SUBERIZATION: the deposition or incorporation of suberin in cell walls.

SUBEROSE: with the texture of cork.

sublimis L.: high, lofty.

SUBLIMATE: a substance which passes, when heated or vaporised, directly from the solid to the gaseous state without formation of a liquid, i.e. its melting point is higher than the point of temperature when its vapour pressure equals the atmospheric pressure.

SUB-MICROSCOPIC: of size when less than that discernible or resolved by the highest powers of the light microscope.

SUBSOIL: in general, the soil below from six to eight inches from the surface (i.e. below the topsoil or plough depth).

SUBSPECIES: a category below the level of a species. A taxonomic group within a species united, e.g. by geographic or ecologic distinction. Often used as a synonym of variety.

SUBSTRATE: of a fermentative organism (fungus, bacterium), or enzyme, the substance activated or catalysed.

SUBSTRATUM: (plural substrata) a layer (e.g. of soil, rock), especially in the sense that it provides a place for growth.

SUBTEND: to stand below or close under, as a bract subtending a flower.

subtilis L.: fine, delicate; finely woven; subtle.

SUBULATE: of a lamina when very narrow (its breadth almost equalling its depth) and tapered to a very fine point, to appear like an awl.

SUCCESSION: of ecology, the progressive change in structure of a vegetation from initial colonisation to ultimate climax.

succin(us) L.: of amber.

SUCCULENT: as an adjective, of soft and fleshy texture. As a noun, a plant adapted to conditions of aridity or salinity by the production of abundant water-storing tissue and a means for reducing transpiration, e.g. development of a heavily cutinised epidermis, by sunken stomates, by the shaping of succulent parts to structures with the least surface to greatest volume, i.e. structures cylindrical, prismatic, spherical.

With a reduction of the surface for transpiration, there is consequent reduction of photosynthetic and respiratory activity, and growth-rate. Succulents are perennial often of long life, for some (e.g. **Cactaceae**, some **Euphorbia**) a succulent stem (cladode) has taken over the function of the leaf, in others (e.g. **Mesembryanthemum**, samphires and other chenopodiaceous halophytes), the leaves are succulent, often cylindrical or prismatic and in rosettes from short internodes of the stem.

succ(us) L.: juice; sap.

SUCKER: a shoot developed from a root or (as from a lignotuber) from a stem close to or below soil level. Suckering: the process of forming suckers.

SUFRUITICOSE: of an herbaceous perennial with that part of the stem immediately above soil level more or less woody and perennial.

SUGAR: one of the carbohydrates (q.v.) when of crystalline form, with high solubility and sweetness in taste. In general, either a monosaccharide (e.g. glucose) or disaccharide (e.g. sucrose). When a

monosaccharide, is either an aldose when containing a -CHO aldehyde group (e.g. glucose) or a ketose when containing a -CO ketone group (e.g. fructose).

suill(us) L.: of swine.

SULCATE: of a surface when grooved or furrowed. From L. **sulcus**, a furrow.

SULPHUREOUS: resembling, or with the colour (pale yellow) of, sulphur.

super- (L.): as in **superficial**, **supernatant**, above, on top of.

superb(us) L.: outstanding.

SUPERCOOLED: of a liquid when cooled to a temperature below its freezing point without the formation of the solid state, crystallisation thus being delayed.

SUPERIOR: in general, at a higher level (in space), as an ovary of a hypogenous flower which has the other floral parts inferior to it.

SUPERNATANT: in general, floating on the surface. Of a two or more phased fluid system, the uppermost phase.

SUPERPHOSPHATE: calcium hydrogen phosphate $\text{Ca}(\text{H}_2\text{PO}_4)_2$ together with calcium and other metallic sulphates present as impurities. The water-soluble product, used as a source of available phosphorus for plant growth, derived by controlled treatment of the insoluble calcium phosphate $\text{Ca}_3(\text{PO}_4)_2$ with concentrated sulphuric acid, its quality quoted on the basis of phosphorus pentoxide P_2O_5 content.

SUPERSATURATED: of a solution when remaining as such while cooled to below the temperature at which saturation by the solute is obtained, crystallisation occurring when the solution is in contact with a solid form of the solute.

SUPERSPECIES: a hypothetical ancestral form or stock from which closely related species were derived.

SUPINATE: leaning backwards. From L. **supinus**.

supra- (L.): as in **supra-axillary**, above upper (hence arising immediately above an axil).

surcul(us) L.: a shoot.

SURFACTANT: an agent, e.g. a soap, wetting agent, detergent, with the ability even in low concentration to reduce the surface tension of water. Also surface active agent.

SURFACE TENSION: of a liquid, a property, measurable as a force, which tends to confine the volume in the least space available. Since there is attraction of molecules to each other, the attraction of the molecular layer at the surface will be equal in horizontal direction but unequal in vertical direction, the positive attraction being towards the centre of the liquid. The unbalanced attraction effects a force, maximum at the surface which appears to act as an elastic membrane. The force usually is expressed in dynes (one dyne is approximately equal to the gravitational force of one milligram), e.g. surface tension force of pure water is 13 dynes which may be lowered by the addition of a surfactant (q.v.).

SURFACE VOLUME RATIO: for a cell or organism, an index of the proportion of surface area available for diffusion in relation to its volume, a sphere having the least surface area for unit volume.

SUSPENSOR: of seed-plants, a single cell, a row of cells or (in gymnosperms) a multiseriate layer of cells developed from a zygote within an embryo sac or archegonium, which positions the zygote or its pro-embryo to the region of endosperm.

SUTURAL: relative to a suture.

SUTURE: a line marking the junction of two parts when meeting, or a furrow made when a single part is infolded.

sylv(a) L.: see **silv(a)**.

sym- (before b, m and p), **syn-** (Gk.): as in **symbiosis**, **sympetalous**, **synandra**, **synerigid**, **synsepalous**, together, united.

SYMBIONT: an organism living symbiotically.

SYMBIOSIS: in a narrow sense, an association of organisms with an effect of mutual benefit. In a general sense, an association which may be either non constant, or with the symbionts not in close contact (i.e. **disjunctive symbiosis**) or both close and constant (**conjunctive symbiosis**). When disjunctive, the benefit may be nutritive, either at the expense of one (e.g. carnivorous plants and their prey) or reciprocal (e.g. dispersal of seed through ingestion by an animal of its fruit). When disjunctive and not nutritive, one plant may effect benefit to another (e.g. by casting shade or providing some other factor of habitat required by the other).

Parasitism is a conjunctive symbiosis with a nutritive benefit for one but at the expense of the other. **Mutualism** is conjunctive and of reciprocal benefit, e.g. of lichens, nitrogen-fixing bacteria, mycorrhiza). **Commensalism** is conjunctive but not nutritive, it benefits one (the commensal, e.g. a liana or epiphyte) but not the other. See also amensalism.

SYMBIOTIC: living in symbiosis.

SYMMETRY: the regularity of form or similarity of structure on each side of an axis, the condition of being symmetrical.

SYMPATRIC: of distribution when duplicated in the same or overlapping regions. cf. **allopatric**.

SYMPETALOUS: of a corolla with petals connated by their margins.

symphy(os) Gk.: as in **sympionema**, united.

symploce Gk.: as in **symplocos**, a connection.

SYMPODIAL: relative to, or resembling, a sympodium.

SYMPODIUM: a branching system where apical dominance (q.v.) is replaced by lateral development. cf. **monopodium**.

SYNAPSIS: of meiosis (q.v.), the pairing of homologous chromosomes (bivalents) at zygonema.

synapt(os) Gk.: as in **synaptantha**, joined.

SYNCARP: a fruit when multiple and formed from several more or less coalescent carpels.

SYNCARPOUS: of a multicarpellate gynaecium when the carpel walls are fused to form a single ovary.

SYNCHRONIC: occurring at the same time; contemporary. cf. **allochronic**.

SYNCLINE: see under **fold**.

SYNDROME: of disease, the complexity of factors (symptoms) apparent.

SYNECOLOGY: ecology from the aspect of the community.

SYNERGIC: relative to an increase in the development or rate of a reaction by as association of two factors, one (the synerigid) by itself unreactive.

SYNGAMOUS: of reproduction when involving a fusion of gametes, i.e. fertilization.

SYNGENESIOUS: of an androecium when the anthers are united to form a column around the style, often the filaments free, e.g. of **Compositae**.

SYNSEPALOUS: of a calyx when the sepals are connate by their margins.

SYNSTEMONY: the cohesion of stamen by their filaments or anthers alone or by both.

SYNTHETIC: relative to the building-up (synthesis) of a complex from its essential parts. cf. analytic.

SYSTEMATICS: research attempting, by the use of criteria drawn from current biologic science and techniques, e.g. classification, taxonomy and nomenclature, a logical order of knowledge concerning the diversity and relationships of organisms.

SYSTEMIC: of an insecticide, e.g. metasystox and certain other organophosphate compounds, when its action concerns a translocation by the plant where applied (at a concentration not toxic to the plant) to regions of insect feeding at a concentration lethal to the insect.

syring(x) Gk.: as in **syringa**, a tube; a pipe.

syzyg(os) Gk.: as in **syzygium**, coupled (hence, in the genus, a reference to the opposite nature of the leaves).

TABLELAND: in general, a plateau (q.v.) but sometimes restricted to one when its slope is abrupt and cliff-like and rises from the surrounding lowland in strong relief.

tachy(s) Gk.: as in **tachysporous**, quick.

TACHYSPOROUS: rapidly dehiscing or dispersing seed or spore.

TACTIC: relative to a movement (a taxis) in a direction positive or negative to the source of a stimulus, or to the stimulus inducing such motion. From Gk. **taktos**, arranged.

TACTILE: sensitive to touch, e.g. the pulvinus of the Sensitive Plants of **Mimosa**. From L. **tactilis**, that may be touched.

taeni(a) L.: a strap or ribbon. **taeniola**, the diminutive.

taeter L.: as in **taetrolens**, offensive (hence evil-smelling).

TALUS: the accumulated debris from the gravitational fall of fragmented rocks from cliffs and rocky slopes.

TANNIC ACID: an aromatic acid of diverse and complex nature occurring naturally throughout the plant kingdom in cells or sacs (usually within vacuoles) of tissues or sites of various nature but with unknown significance, possible as a side product of a metabolic process. In the plant it has been shown to possess fungistatic properties and, chemically, has the property of precipitating from solution proteins and alkaloids and (usually) yields green, blue, or black precipitates with ferric salts. In taste it is bitter and astringent.

When water-soluble, with acidic reaction, and readily hydrolysed by boiling dilute acid or the enzyme tannase to gallic acid and glucose, generally referred to as a tannin. When more complex and not readily hydrolysed, is often a catechol or derivative. Both types may be oxidised to coloured phlobaphenes which appear as red or dark-brown pigments of woody tissues and bark (and probably are the dark spots prominent in the leaves of dried essential oil-bearing leaves, e.g. of myrtaceous and rutaceous plants).

A property of the tanning substance in converting crude hide to stable leather created a commercial demand. A number of Australian plants are, or have been, commercial sources, e.g. the Wattle Barks chiefly of **Acacia mearnsii**, **A. pycnantha**, **A. irrorata**, Mallet Bark (chiefly Brown Mallet **Eucalyptus astringens**) and to a more limited extent Mangrove Bark from several native mangroves. Suck barks have sufficiently high tannin content to be used directly. Other barks with tannin high in quality but low in content are processed, the extract being the marketable product. Wandoo bark from **Eucalyptus wandoo** yields a solid extract, myrtan, of high commercial interest. See also under gall.

TANGENTIAL SECTION: a section cut lengthwise from a cylindrical structure so that it occurs at right-angles to a radius of the transverse section.

TAPETAL: relative to a tapetum.

TAPETUM: a nutritive layer investing sporogenous tissue within a sporangium. From L. **tapetum**, drapery; tapestry.

taphr(os) Gk.: as in **taphrophyte**, a ditch.

TAP ROOT: the primary persistent root typical of dicots and gymnosperms from which lateral roots are developed in acropetal succession.

taut(os) gk.: as in **tautonym**, the same (hence a name duplicated for both genus and species).

taxis Gk.: as in **taxon**, **taxonomy**, **monotaxis**, **phyllotaxy**, an arrangement in an order.

taxi-: as in **taxifolia**, of the Yew **Taxus** (from Gk. **taxon**, a bow).

TAXIS: movement (in toto) as a response to a stimulus, e.g. by a motile alga when stimulated by light (then a phototaxis).

TAXON: (plural taxa) a taxonomic unit. A group of plants sharing a relationship (i.e. a taxonomic group) which may be assigned to one of the categories of a classification.

TAXONOMIC: relative to a feature of classification or of taxonomy.

TAXONOMY: the study of the principles involved in a system of classification and the formulation of these principles to clear and definite rules and procedures.

tect(um) L.: as in **tecticornia**, **tectifera**, **tectorum**, a covering; a roof.

TECTONIC: relative to the structure of rock resultant from movements of the earth's crust, i.e. relative to the tectonosphere. From Gk. **tekton**, a builder.

tele Gk.: at a distance; far off (hence **telopea** seen at a distance).

TELLURIC WATER: water held by the earth; underground water, e.g. much of the mesophytic flora of monsoonal Australia (including the Kimberley region) is dependent on water stored by the earth during a six months drought period, the water brought by rains of the wet season. From L. **tellus**, the earth; soil.

teleos Gk.: complete; perfect.

telos Gk.: an end.

TEMPERATE: of climatology, relative to the region north (for the Northern Hemisphere) and south of approximately latitude 30° to the upper limit of the polar regions at approximately 66° (1° is equivalent roughly to 69 miles). In Australia the region marked by rainfall with a winter incidence but rarely entirely absent over the seasons, and relatively low to moderate relative humidity and temperature.

TEMPERATE ZONE: in Australian phytogeography, a floristic zone traversing the southern coast and inland of the continent and including Tasmania, i.e. from the south-west province of Western Australia eastwards through the region marked by rainfall in excess of 10 inches and northwards to latitude 26°, thus overlapping the tropical zone, and southwards to include Tasmania. Within the zone, 'temperate' climatic conditions vary from cool temperate to sub-tropical, and rainfall from uniform throughout the year to a summer or winter incidence.

tenax L.: tough; tenacious.

TENDRIL: a twisting thread-like segment of a leaf or stem functioning for the securing of a hold on a support.

tenui(s), diminutive **tenell(us)** L.: thin; fine; delicate.

TENSION WOOD: the wood (reaction wood) of dicots when modified by a physical state of growth, e.g. by the lateral position of a branch when the wood on the upper side is reduced in number and size of vessels and its fibres thickened by cellulose. cf. compression wood (of conifers).

TEPAL: a unit of a perianth, either sepaloid or petaloid.

tephr(os) Gk.: as in **tephrosia**, **tephrous**, ashy; ash-coloured.

-ter, -tre, -tris L.: as in **rupester**, **rupestre** (from **rupes**, a cliff), **campestris** (from **campus**, a plain), suffices indicating of a habitat.

TERATOLOGY: the study of abnormal development; of plants tumours, galls and other malformations. From Gk. **teras**, a monster.

terebrans L.: boring into; perforating.

teret(is) L.: as in **terete**, **tereticornis**, rounded (in cross-section, usually also in the sense of the structure being tapered).

TERMINAL: at the tip of, apical. In epithets, e.g. **terminalis**, usually indicating the placement of structures (e.g. leaves) at one end (e.g. of a leaf-shoot).

tern(i) (L.): as in **ternate**, three together. **ter**: three times.

TERNATE: of leaves when arising in three's from the same node, or of leaflets when forming a trifoliolate leaf.

TERPENE: a hydrocarbon, unsaturated and usually monocyclic, with molecular formula a multiple of isoprene C_5H_8 (e.g. limonene $C_{10}H_{16}$). Usually a colourless, aromatic liquid, immiscible in water but volatile in steam, chemically reactive and often readily undergoing polymerisation and isomerisation (e.g. limonene, pinene, phellandrene, isomeric monoterpenes common constituents of essential oils).

Of general occurrence within plants, e.g. as constituents of essential oils usually as a monoterpene ($C_{10}H_{16}$) which may be reduced to an alcohol, aldehyde or ketone, a sesquiterpene ($C_{15}H_{24}$) or a diterpene ($C_{20}H_{32}$). Diterpenes and triterpenes ($C_{30}H_{48}$) are constituents of resins and latex, tetraterpenes ($C_{40}H_{64}$) of carotenes, and polyterpenes (C_5H_8)_n of rubber.

terra (noun), **terrestris** (adj.) L.: as in **terraneous**, **terricolous**, **terrestrial**, earth, the planet Earth.

TERRAIN: a region of land considered from the aspect of relief, physical features, soil, drainage, and vegetation.

teri(us) L.: as in **tertiary**, the third. **terito**: for the third time.

TESSELLATED: checked, marked in a pattern of squares.

TESTA: a seed-coat representing the usually hardened integuments of the ovule. From L. **testa**, a shell.

TESTICULATE: with a shape resembling a testicle, as the tuber of many orchids, the name **orchis** taken from the Greek meaning a testicle or testis.

tetra(s) Gk.: as in **tetrandrous**, **tetragonal**, four.

TETRAD: a group of four; the four spores formed by meiotic divisions of a spore mother-cell.

TETRADYNAMOUS: of stamens when occurring in a flower four long and in pairs opposite to each other and alternating with two solitary shorter ones.

TETRAGONAL: with four angles.

TETRAMEROUS: of four parts.

TETRANDROUS: of a flower with four stamens.

TETRAPLOID: of a genetic system with four times the number of chromosomes basic to the species. A polypoid with this nature.

TETRAPTEROUS: with four wing-like structures.

TETRATHECAL: with four loculi or theca (e.g. of anthers).

textilis L.: texture, woven.

TEXTURE: of soil, the proportions, by weight of the component particles of different size. The particle size and its conventional name correspond to some arbitrary system as that in use in Australia:

gravel . . . greater than 2 mm diameter.
coarse sand . . . 2 mm to 0.2 mm diameter.
fine sand . . . 0.2 mm to 0.02 mm diameter.
silt . . . 0.02 mm to 0.002 mm diameter.
clay . . . less than 0.002 mm diameter.

In general sense, soil texture may be expressed on the basis of the component which characterises its consistency, e.g. a coarse-textured soil is taken as one in which sand particles are well-represented, and is referred also as a light soil from its relative ease of working. A fine-textured soil contains much clay and, although lighter in weight per unit volume than sand, is called heavy from its toughness and plasticity in working. Intermediate to these is loam in which both coarse and fine particles are equally represented. Where gravel or silt (silt in the sense of an alluvium of very fine sand) are appreciable, the qualifying 'gravelly' and 'silty' are used.

Intermediate textures from sand to loam in increasing order of fineness and cohesion conventionally are loamy sand, sandy loam, loam and from loam to clay, sandy clay loam, clay loam, sandy clay.

thalassa Gk.: as in **thalassic**, **thalasophyte**, the sea.

THALLOPHYTE: a member of group of plants which, although diverse in physiology, reproductive methods, structure and size, shows limited differentiation to definite organs. An alga, bacterium, or fungus.

thall(os) Gk.: as in **thalloid**, **thallophyte**, **prothallus**, a young shoot (in usage meaning an undifferentiated structure).

THALLOSE: composed of a thallus.

THALLUS: a vegetative body undifferentiated to a root-shoot system.

thalp(os) Gk.: as in **thalpophilous**, warmth.

thamn(os) Gk.: as in **calothamnus**, a shrub.

thec(e) Gk.: as in **theca, thecal, thecate, microtheca**, a case.

THECA: (plural thecae) in general, a protective covering structure, e.g. a capsule or sporangium.
Thecial: relative to a theca.

thely(s) Gk.: as in **thelymitra**, female.

therm(e) Gk.: as in **thermal, thermograph, thermometer**, heat.

-therm, -thermy: suffixes donating for plants a tolerances to a particular temperature range, e.g. **stenotherm, stenothermy**, a plant adapted to, and the ability to live within, a very limited range of temperature; **microthermic**, adapted to conditions of the cold temperate zone; **mesothermic**, adapted to temperate conditions of the cold temperate zone; **mesothermic**, adapted to temperate (moderate heat) conditions; **megathermic**, adapted to moist heat (of the tropics).

THERMOPERIODICITY: the effects of differences in temperature during the photoperiod (q.v.).

THERMOPHILIC: tolerating high levels of heat, as certain bacteria and blue-green algae (thermophytes).

ther(os) Gk.: as in **therophyllous**, summer (hence developing and holding leaves only during the growing season).

THEROPHYTIC: with growth-cycle completed within a single growth season, the plant (an annual) passing the dormant season as seed.

thig(e)ma Gk.: as in **thigmotropic**, touch.

THIGMOTROPIC: responsive to the stimulus of contact, as a tendril when contacting a suitable surface.

th(e)ion Gk.: as in **thiophilic**, sulphur (hence adapted to high levels of sulphur).

THORN: a much-reduced shoot occurring as a flattened sharp structure, or a tip of a shoot when hardened and sharp-pointed.

thrix Gk.: hair. See also trich-.

THRUM-EYED: see Pin and Thrum-eyed.

thrypt(os) Gk.: as in **thryptomene**, diminished, impoverished.

thuy-: as in **thuyoides**, of **Thuja (Cupressaceae)**. The associated **thujona** of **Boronia (Rutaceae)** is taken from a principle constituent of its essential oil, thujone, originally isolated from **Thuja**. From Gk. **thyon**, a sacrifice.

thymi-: as in **thymifolia**, of **Thymus (Labiatae)**. From Gk. **thuo**, to perfume.

THYRSE, THYRSUS: a panicle inflorescence with a determinate main axis and indeterminate lateral axes, the whole forming a compact pyramidal cluster. From Gk. **thyrsos**, a wand.

thysanot(os) Gk.: as in **thysantus**, fringed.

TILLER: of a grass, a branch developed from a bud at the base of a stem. Tillering: the production of such a branch.

TILTH: of soil, the physical status in relation to plant growth. Usually refers to structure (q.v.) after tilling or cultivation.

tilos Gk.: a shredded material; down; flock.

TIMBER LINE: the limit of tree-growth in sub-alpine and alpine regions, or (as in dry timber line) the lower limit on mountains in arid regions where rainfall decreases with decrease in altitude.

tinctor(us) L.: dye-producing; used in dyeing.

tipho(s) Gk.: as in **tiphophyte**, a pond or pool.

TISSUE: an aggregation of cells from the same origin (the tissue then simple) or different origin (the tissue then complex) with a specific function. A fundamental structural unit of an organ. See collenchyma, parenchyma, sclerenchyma, vascular system.

tnesi(s) Gk.: as in **tnesipteris**, a notch; a fork (hence 'Fork-fern').

toc(os) Gk.: as in **monotoca**, a birth (hence the fruit with single seed).

tome Gk.: as in **atomic**, **microtome**, **biotomic**, **dichotomy**, a cutting or division.

TOMENTOSE: covered by matted hair (tomentum).

-tonic: as in **hypotonic**, **hypertonic**, **isotonic**, of concentration of a solution.

tono(s) Gk.: as in **tonoplast**, **tonotaxis**, tension.

TONOPLAST: the membrane of a vacuole.

TONOTAXIS: of movement when as a response to a change in the density of the containing medium.

topo(s) Gk.: as in **topography**, **topodeme**, a place.

TOPOGRAPHIC: relative to the general surface-configuration or relief of a geographic region.

TOPODEME: see under deme.

TOPSOIL: in a general sense, the superficial layer of soil down to six or eight inches, approximately the A horizon.

TOROSE: with knob-like, fleshy swellings. From L. **torosus**, muscular; fleshy.

torquat(us) L.: with a twisted collar or ring.

TORRID: parched; arid.

TORULOSE: cylindric but of varying diameter; moniliform.

TORUS: of a flower, the receptacle. Of a tracheid, the central thickened part (of two primary walls and a middle lamella) of a membrane of a bordered pit. It is surrounded by a thin, often perforated annulus of an unthickened primary wall and may block the pit when pressure forces it against the border. From L. **torus**, a swelling. Plural **tori**.

toxicon Gk.: a poison.

tox(on) Gk.: as in **toxanthus**, a bow.

TRABECULA: (plural trabeculae) in general, a row of cells extending across a cavity.

TRACHEARY ELEMENT: a specialised cell of xylem (both primary and secondary), usually elongate, non-living at maturity, lignified and with secondary-thickened walls strongly pitted. Either a **tracheid** or **vessel**, the vessel differing in that its walls are perforated for the ready passage of water and lacks the torus (q.v.) of the bordered pit of the tracheid.

The tracheid is considered the more primitive tracheary element, although not a distinguishing feature since vessels occur throughout most groups of vascular plants. Of angiosperms, the vessel occurs in all families except those considered primitive. See also xylem, vessel.

TRACHEID: see above.

TRACHEOPHYTE: a vascular plant. A member of those groups generally specialised for autotrophic existence through a division of parts, a development of a vascular system, and a life-cycle in which the gamete-forming phase is short.

trachy(s) Gk.: as in **trachymene**, **trachysperma**, rough.

TRADE WIND: one of the winds which blow from the tropical high pressure belt towards the equatorial belt of low pressure. In Australia, the main direction is from the south-east (at latitudes 15° to 35°) so that for locations with an easterly aspect the wind brings moisture from the sea, but the inland and interior with a westerly aspect, dry to arid conditions are maintained.

trago(s) Gk.: as in **tragopogon**, a goat.

trans L.: as in **translocation**, across; through.

TRANSECT: of ecology, a line or strip across a vegetation taken as a sampling of the components.

TRANSFUSION TISSUE: of the leaves of gymnosperms, a tissue associated with a vascular bundle, usually made up of tracheids and parenchyma or tracheids alone, generally considered to function in the conduction of solutes between the vascular bundle and the mesophyll.

TRANSLOCATION: within a plant, the transport of a solute. See vascular system, phloem, xylem. Of chromosomes, a structural rearrangement in which a segment is translocated to a different position of the same or different chromosome.

TRANSMITTED LIGHT: light when passing through a transparent or semi-transparent object to a degree determined by the physical nature of the object, e.g. ordinary glass will allow transmission of light at wave-lengths greater than 3.600 Å but is opaque to wavelengths less than this. Ultra-violet light thus is not transmitted.

TRANSPIRATION: the release of water vapour (evaporation) from a plant to the external atmosphere at a rate dependent initially on the equilibrium existing between the vapour pressure of moisture within the plant and the relative humidity of the surrounding atmosphere. Sunlight promotes the process by increasing the vapour pressure within the plant.

TRANSPIRATION STREAM: the movement or flow of water and solute through a plant from the region of uptake to the region of transpiration, e.g. the rise of sap. In vascular plants the conduction is through tracheids and vessels of xylem. The process is not yet fully clarified, one concept hypothesising a transpiration-cohesion-tension theory. In brief, transpiration from the surface of leaves creates deficits in the diffusion pressure existing in lower regions which, in consequence, draw on the vascular system for water to equilibrate the deficit. Tension, in turn, is created on the elements of xylem which, in equilibrating turgidity, transmit a downward tension effect through the xylem to the root, the cohesive force of water maintaining an upward flow. Roots also exert a powerful pressure (e.g. as evidenced by the 'bleeding' of stumps) and may aid in the maintenance of an unbroken water column.

TRANSVERSE: in a cross-wise direction.

TRANSVERSE SECTION: a section taken at right-angles to a longitudinal axis.

TRAPEZIFORM: in the form of a plane figure with four straight sides, no side parallel with another.

trauma Gk.: as in **traumatic**, **traumatotropic**, a wound.

TRAUMATIC ACID: a growth substance generated in a wounded tissue of a plant which, on diffusion to proximal uninjured cells, stimulated with division.

TRAUMATOTROPIC: relative to a curvature in growth when effected as a response to a wounding influence.

tremere L.: as in **trema**, **tremeloid**, a tremble (hence gelatinous).

TREE: the habit of a plant when perennial branches arise from a single woody stem (trunk), i.e. a monopodium. Of angiosperms, is the habit of about ten percent of total species, the habit considered more primitive than the herbaceous type. From Anglo-Saxon **treo**.

trepo Gk.: as in **treponema**, a turn (hence a turning thread).

tri-: as in **trifid**, **trimerous**, **tripartite**, three. From L. **tres**, Gk. **treis**.

TRIBE: a category at a level below a family (and its sub-unit) and above a genus. A taxonomic group within a family (or sub-family) sharing a relationship among certain of its genera.

The name given to the tribe is taken as a plural adjective used as a substantive, its suffix as recommended by the Code is **-eae** (**-inae** for sub-tribe) preferable ending the name of an included genus, e.g. the **Podalyrieae** of the family **Papilionaceae** unite such genera as **Podalyria**, of South Africa, and the Australia **Brachysema**, **Oxylobium**, **Chorizema**, **Gompholobium**, **Daviesia**, **Pultenaea**, **Dillwynia**, etc. partly on the relationship of free stamens.

tribol(os) Gk.: as in **triboloid**, a burr (hence burr-like or prickly).

tribon Gk.: as in **triboanthus**, a coarse cloak.

tribo(s) Gk.: as in **triboluminescence**, a rubbing (hence luminescence from friction).

tribul(us) L.: a prickly plant.

trich-: as in **trichoid**, **trichocarpus**, **acrotiche**, hair. From Gk. **thrix**.

trichin(os) Gk.: as in **trichinium**, hairy.

TRICHOBLAST: one of the cells of the epidermis of a root which gives rise to a root-hair.

TRICHOME: a general term for an outgrowth from an epidermis, a hair or scale which may be unicellular or multicellular, branched or unbranched, secretory, absorbing, or non-functional. Of a bacterium or blue-green alga, a filamentous chain of cells enclosed, typically, in a gelatinous sheath.

TRIGONAL: triangular; three-sided or -angled.

triplex L., triploos Gk.: threefold.

TRIQUETROUS: trigonal.

tristis L.: of a dull, sad or unattractive appearance.

TRISTYLOUS: of a species with flowers of three forms (1) styles long and anthers at two levels below the stigmas, (2) styles of intermediate length, one set of anthers above the stigmas, the other set below, (3) styles short, anthers at two levels above the stigmas. The heterostylous condition (tristyly) occurs in the families **Pontederiaceae**, **Oxalidaceae**, and **Lythraceae**.

trit(us) L.: as in **triticum**, a rubbin (the Latin name for wheat, derived from an allusion to its grain being rubbed down to make it edible).

troch(os) Gk.: as in **trochoid**, **trochocarpus**, **anthotroche**, a wheel.

troph(e) Gk.: as in **trophic**, **trophotropic**, **ectotrophic**, **hypotrophy**, nutrition.

TROPHOTROPIC: with the tendency to turn towards a nutrient supply.

trop(os) Gk.: as in **geotropic**, **phototropism**, **tropophilous**, **heliotropium**, **isotropis**, a turning or change in direction. Sometimes, as in **calotropis**, a keel.

TROPICAL: relative to the region between the two parallels of latitude, the tropic of Cancer and Capricorn roughly 23 1/2 °N and 23 1/2°S respectively, but often including latitudes a few degrees N and S of these parallels. In Australia, the region covers about 38 percent of the continent, the climate influenced by an incidence in summer of monsoonal rainfall.

TROPICAL ZONE: in Australian phytogeography, a floristic zone traversing the northern coast and inland of the continent, in the west close to the Tropic of Capricorn and in the east extending to the coast at approximately latitude 32°S.

TROPISM: the tendency of an organism to respond to the influence of an environmental factor with a greater intensity in a direction which may be positive or negative to the site of the stimulus. Such environmental factors include (a) the intensity or quality of an incident light (**phototropic curvature**), (b) gravity (**geotropic curvature**), (c) water supply (**hydrotropic movement**), (d) physical contact (**thigmotropic movement**), (e) specific chemical factor (**chemotropic movement**), (f) nutrient supply (**trophotropic movement**), etc.

When movement is an overall response effecting associated parts uniformly independent of the direction of the stimulus, it is termed a **nastic movement**. e.g. the downward curvature of a leaf when growth is more rapid on the upper surface, i.e. **epinasty**, and its reverse **hyponasty**. When movement concerns bodily movement, as by a motile cell, towards or away from the source of the stimulus, the movement is a **taxis**. When changes in cell volume are reversible, as at **transpiration**, **plasmolysis**, **wilting**, the response is known as a **turgor movement**.

TROPOPHILOUS: of a plant when shedding its leaves during the season unfavourable to growth.

TRUNCATE: of a structure when abruptly terminated, as though cut off.

TRUNK: the woody perennial stem of a tree.

TRYMA: a drupe with a fleshy or leathery rind of epicarp and mesocarp, and a hardened two-valved endocarp from the inner surface of which false septa extend to divide the seed into deep lobes. A drupe formed from a syncarpous ovary, e.g. a walnut of **Juglans regia**.

tuber, tubercul(um) the diminutive L.: as in **tuber**, **tuberous**, **tuberoise**, **tuberculate**, a swelling.

TUBER: in general, a rounded protuberance. A part of a stem when swollen, by the development of food-storing tissues. The tuber differs from a rhizome in that it is independent of a tuber of the previous season, whereas a new rhizome is an extension from a rhizome formed in the previous season.

TUBERCLE: in general, a small swelling or rounded protuberance.

TUBERCULATE: bearing tubercles or nodules.

TUBERCULE: a small swelling or rounded protuberance. Also tubercle.

TUBERIFEROUS: bearing or producing tubers.

TUBEROID: resembling a tuber, e.g. a fleshy, food-storing root (e.g. a carrot) which differs from a true tuber in the absence of leaf-buds (e.g. the 'eyes' of a tuber of potato) marking the nature of stem.

TUBEROUS: with the nature or appearance of a tuber. Of plants which bear tubers, or tuberoid structures.

TUBULAR: in the form of a tube or tubule.

TUBULE: a small tube.

tumeo L.: as in **tumid**, **tumefacient**, **intumescence**, to swell.

TUMEFACIENT: producing blister-like swellings, or tumours.

TUMID: swollen.

TUMOUR: an amorphous swelling: of plants, caused by a proliferation of cells when division is stimulated by a pathogen, e.g. the crown-gall formed by the bacterium **Agrobacterium tumefaciens**.

tumul(us) L.: a mound, a hill.

TUNICA: of the apical meristem of a stem, the outer tissue covering the corpus (q.v.) the cells believed to reproduce solely for the transverse system of leaves and lateral shoots.

TUNICATE: in general, invested by a membrane or tissue (L.: **tunica**).

TURBID: of a liquid when clouded by the suspension of solid particles. (From L. **turbid(us)**, agitated).

turbine(us) L.: as in **turbinate**, shaped like a spinning top (hence more or less obconical in shape).

turgid(us) L.: swollen; turgid.

TURGOR PRESSURE: the pressure, usually expressed in atmospheres, exerted by the cytoplasm of a turgid cell against the cell-wall. There is a counter-pressure from the wall so that when turgor pressure and wall pressure are equal, the tendency of water to enter or leave the cell is at neutral.

tylo(s) Gk.: as in **tylophora**, **tylosis**, a callus or pad.

TYLOSIS: (plural tyloses) a balloon-like extrusion in a vessel (q.v.) arising from a cell or ray-parenchyma, partially or wholly blocking the lumen of the cell when forced through a pit-cavity.

TYPE: (nomenclatural): the element of a taxon to which the name for the group is attached, either as a correct name or as a synonym. The nomenclatural type of a family is a genus (e.g. **Myrtus** for **Myrtaceae**), of a genus a species (e.g. **Myrtus communis**), and of a species a single specimen (e.g. the specimen cited by Linnaeus).

Contemporary code prescribed nomination of a specimen with a description, the specimen, **holotype**, taking precedence over all other specimens. Duplicates of the holotype usually are retained as **isotypes**. When no choice of a holotype was made but several specimens cited in an author's description, these specimens become **syntypes**, one of which may be chosen by a later worker as a **lectotype**. In the complete absence of specimens originally cited by an author, a **neotype** may be selected to serve as the nomenclatural type. In cases where it is impossible to preserve a specimen on which the name of a species of recent date is based, or no type specimen was selected (e.g. before 1890 when no rules applied), the type may be a description or figure.

typh(os) Gk.: as in **typha**, **typhonium**, a marsh.

TYPICAL: relative to the aggregate of characters shared by a large number of individuals of a particular group, i.e. to the type which characterises the essential features of the group, for a taxonomic group not necessarily inclusive of the nomenclatural type.

TYPIFICATION: the placement of taxonomic names with their correct nomenclatural types.

UBIQUITOUS: of widespread occurrence.

ud(us) L.: moist; wet.

-ule; -ulus, etc. L.: as in **tubule**, **scopulus**, **corniculate**, suffixes, the diminutive degree, i.e. less than.

ulici-: as in **ulcina**, of the gorse **Ulex** (**Papilionaceae**).

uliginos(us) L.: of marshy or moist places; uliginous.

ultra- L.: as in **ultra-violet**, beyond (hence the band of the spectrum of light beyond the violet, i.e. of shorter wave-length).

-um L.: as in **septum**, **capitatum**, **linum**, a suffix indicating neuter gender, singular number. When the compounded word is a noun, as **septum**, its plural becomes **-a**, e.g. **septa**. See also -ium.

UMBEL: a simple raceme with internodes of the peduncle so reduced that the secondary axes (pedicels) appear to arise from the apex. The secondary axes may divide to form smaller umbels (umbellules), the inflorescence then a compound umbel. A characteristic inflorescence of **Umbelliferae**, of which the Flannel Flower **Actinotus helianthi** is a member and develops an umbel resembling the capitulum of some members of **Compositae**.

UMBELLATE: borne in umbels; resembling an umbel although of a different order, e.g. the contracted dichasia of a majority of eucalypts. From L. **umbella**, a parasol.

UMBONATE: with a conical or rounded boss-like protuberance (an umbo).

umbra L.: as in **umbrosus**, shade; a shaded place.

umbratic(us) L.: as in **umbraticolous**, of the shade or a shaded place.

uncat(us) L.: hooked; ending in a hook (**uncus**).

uncinat(us) L.: hooked; uncate.

unct(io) L.: as in **unctuousus**, an ointment (hence with a greasy or oily feel).

unda L.: as in **undulate**, a wave; a surge (hence of a margin when slightly sinuous or wavy).

UNEQUALLY PINNATE: odd pinnate; imparipinnate; with a single terminal leaflet.

UNGUICULATE: contracted into claw-like structure. From L. **unguis**, a claw.

unguicul(us) L.: a small nail.

uni L.: as in **unicellular**, **uniseriate**, **unisexual**, one; single.

ura: as in **uraria**, **diuris**, **uromorphous**, **lepturus**, a tail. From Gk. **oura**.

urceol(us) L.: a small pitcher.

URCEOLATE: of a globular or ovoid structure (e.g. a fruit) when depressed below its rim to appear like an urn.

uredo L.: as in **uredospore**, blight (q.v.).

ur(o) L.: as in **urens**, to burn (hence biting; stinging).

urs(us) L.: a bear.

ustul(o) L.: as in **ustulatus**, to singe. Also **ustilo**, as in **ustilago** (hence with an appearance like a scorch-mark or singeing).

usiat(us) L.: as in **usitatissima**, familiar; customary.

-us L.: as in **nucleus**, **genus**, **helianthus**, **spicatus**, a suffix indicating singular number, masculine gender. When forming the plural of nouns with this ending, **-us** becomes **-i** as in **fungi**, **nuclei**, or **-era** as in **genera**. See also under epithet.

UTRICLE: an achene (q.v.) with pericarp relatively thin and loose or inflated not adherent with the seed.

utricul(us) L.: as in **utricule**, **utricularia**, a small sac; a bladder.

VACUOLAR: relative to a vacuole, as in **vacuolar membrane**, the bounding membrane of a vacuole.

VACUOLE: a sap-storing inclusion of a protoplast which, while beginning as one of a number of small cavities within cytoplasm, ultimately may become a single large cavity reducing the cytoplasm to a lining of the cell-wall.

vacu(us) L.: as in **vacuole**, empty.

vagin(a) L.: as in **vaginate**, **invaginate**, **vaginiferous**, a sheath.

vag(o) L.: as in **vagans**, to ramble; to wander.

vag(us) L.: diffuse; wandering.

VALENCE: of an atom, the capacity to unite with other atoms, measured by the number of atoms of hydrogen (or its equivalent) one atom may combine with or displace in a chemical reaction. Of a chromosome, the capacity to pair (as a bivalent) with another (homologous) chromosome at a meiosis. Of ecology, amplitude (q.v.).

valid(us) L.: strong; robust.

vallat(us) L.: enclosed by a wall.

VALVATE: of parts in bud when at the same level and in contact only by their margins, no overlapping of members occurring, cf. imbricate. From L. **valva**, a fold.

VALVE: a segment formed by the splitting or separation of a dehiscent structure, e.g. a capsular fruit.

VALVULAR DEHISCENCE: the splitting of valves of a fruit for the release of its seed.

VAPOUR: the physical state of a substance when brought to the gaseous state by an increase in temperature or decrease in pressure or combination of both. A gas below its critical temperature, i.e. is returnable to the liquid state (or solid state) by an increase in pressure.

VAPOUR PRESSURE: of a substance, the pressure of its vapour phase when in equilibrium with its liquid or solid phase, i.e. the number of molecules of the vapour returning to the liquid or solid state equals the number of molecules entering the gaseous phase, an increase in temperature increasing the vapour pressure.

VAPOUR PRESSURE DEFICIT: of an atmosphere, the difference in pressures of water vapour actually present and the theoretic vapour capable of saturating the atmosphere at the same temperature.

varians L.: changing.

VARIANT: an individual, species or parameter departing in some character or characters from the mean of characters shared by a group of population.

variare L.: to change.

VARIATE: a quantity or feature which characterises a variant.

var(us) L.: as in **variable**, **variabilis**, **variant**, various; changing; changeable.

VARIATION: within a population, the expression of a single, or set of, differences in character as a result of a modification in genetic constitution or response to environmental factor, or a combination of both.

varicos(us) L.: with enlarged veins.

varie L.: in various ways; with various colours.

VARIEGATION: a condition of a leaf when regions of reduced or totally devoid green pigments, appear, the reduction or loss of chlorophyll often resultant of somatic mutation in addition of a pathogenic cause (e.g. by virus).

varietas L.: a difference; a variety.

VARIETY: a minor category at a level below a species. A group of individual within a species which have morphological similarities and a restricted geographic range, and maintain a distinction from other individual of the species. It is below the level of a sub-species, the latter category used in relation to a segment of a species with much broader distribution than the variety. In many floras, a distinction is rarely made and the terms variety many mean actually sub-species.

vas L.: as in **amphivasal**, a vessel.

VASCULAR PLANT: a plant with a well-defined alternation of generations, the sporophyte the conspicuous plant with vascular system, normally producing spores formed by meiotic division within sporangia, the spore leading to the gametophyte producing the gametes whose combination (fertilization) restores the diploid chromosome condition maintained up to the division of spore mother-cell. Because of its system of water-conducting tracheary elements, often referred to as a tracheophyte, its group is diversified by the pteridophytes, gymnosperms, and angiosperms.

VASCULAR SYSTEM: the arrangement of water- and solute-conducting tissues within a vascular plant. Basically either a protostele (q.v.) or a hollow cylinder enclosing a pith divided into strands of phloem which occur either on one side of the strands of xylem (the collateral bundle typical of gymnosperms and angiosperms), or on both sides of xylem (the bicollateral bundle of some dicots with internal phloem).

Additionally, one tissue may surround the other, either the xylem surrounding the phloem (the amphivasal bundle chiefly of ferns).

A majority of dicots and gymnosperms have persistent vascular meristems (cambria) developed from promeristem interpolated between the xylem (inner) and the phloem (outer). Most monocots (typically of scattered bundles predominantly collateral or amphivasal) remains as primary growth, secondary growth when developed, being dependent on protracted or rapid growth, secondary growth when developed, being dependent on protracted or rapid growth (some palms) or, as in other palms as arborescent liliaceous plants, the cambium may remain active after elongation of the shoot to initiate new bundled around the primary bundles.

vascul(um) L.: as in **vascular**, a small vessel.

vasi-: as in **vasicentric**, of a vessel. From L. **vas**.

VECTOR: of a pathogen, a carrier of transferring agent to a host. From L., a bearer.

vegetare L.: to enliven.

VEGETATION: the distribution of communities of plants in space and time to form a discernible pattern (see structure) determined by the environmental demands of the individuals which compose these communities.

VEGETATIVE: of the biosynthesising, assimilating phase of a plant as compared with its reproductively specialised phase.

VEIN: a strand of conducting tissue, a vascular bundle, which in series forms a venation functioning for the exchange of water and solute throughout a leaf. It is in direct communication with the vascular system of the stem by a leaf-trace (q.v.).

VELAMEN: in general, a membrane or sheath. Of an aerial root-forming epiphyte (e.g. an epiphytic orchid), the epidermis of the root when composed of an cuticularised single layer, and inner layers of water-storing tissues.

VELUTINOUS: with a velvet-like covering of short and fine erect hairs. From Italian **velluto**, velvet.

venal.: as in **venation**, **venose**, a vein. Diminutive **venula**.

VENATION: the arrangement of veins within a leaf or leaf-like part. Basically **pinnate** when the veins arise at intervals along a central major vein (mid-rib) and spread feather-wise through the lamina, and **palmate** when several common-order veins spread fan-wise from a point at the base of the lamina. Minor veins may form a reticulate or net-like system separating regions, **vein islets**. When secondary veins are parallel with the mid-rib, or all veins are common order and parallel lengthwise with one another, venation is termed **parallel**, and when the veins form a simple fork (as in the primitive ferns), venation is termed **dichotomous**. See also acrodromous, anadromous, catadromous, furcate.

VENOSE: with several prominent veins.

ventil(o) L.: as in **ventilago**, to fan; to expose to the wind.

VENTRAL: in general, facing the axis to which related, e.g. the uppermost (abaxial) surface of a leaf is the central surface.

VENTRICOSE: swollen, especially at the middle or on one side. From L. **ventriculus**, the diminutive of **venter**, the abdomen.

venula L.: diminutive of **vena**, a vein.

VENULOSE: with several fine veins.

venust(us) L.: graceful; attractive.

verati-: as in **venatifolia**, of **Veratrum** (**Liliaceae**), from L. **vere**, truly; **alter**, black, an allusion to the root.

VERMICULATE: marked by fine sinuate lines or depressions, or shades of colour. From the diminutive of **vermis**, L., a worm.

VERNACULAR: of the local or native name.

vernaculus L.: indigenous.

VERNICOSE: glossy-surfaced, as though varnished. From French **vernis**, polished.

vernalis L.: of the season of spring.

VERNALIZATION: literally, bringing to the spring condition. Of crops, the duplication of the overwintering process required by certain races (e.g. winter varieties of cereals) by cold treatment of seed or

seedling, i.e. chilling at temperatures of 1°-10°C for a definite number of days or weeks. The effect is that, when planted in the field in spring, promotion of an earlier flowering period is achieved when compared with the untreated spring-sown seed.

VERNATION: the arrangement of leaves in the bud state in relation to the individual leaf (see circinate, conduplicate, convolute, inflexed, involute, plicate, reclinate, revolute) and to the disposition of the leaves to one another (see contorted, equitant, imbricate, induplicate, obvolute, valvate).

verrucos(us) L.: warty (hence **verrucose**, covered by wart-like protuberances).

VERSATILE: of an anther when attached to a filament at a point about the middle of the back of its connective, thus free movement around this point being possible. From L. **versatilis**, revolving.

versicolor L.: changing colour.

versus L.: towards as an adverb; a row or line when a noun.

vertex L.: the top; the summit; a height; a whirl.

VERTICIL: a whorl or cycle. A radiation (e.g. of leaves around a stem) from a common centre or level. From L. **verticillus**, the diminutive of **vertex**, a whirl.

VERTICILLATE: arranged in verticils.

verto L.: as in **verticordia**, to turn (hence literally 'turning heart' but application unknown).

ver(us) L.: true; fitting.

vesica L.: a sac; a bladder. **vesicula**, the diminutive.

vesper L.: the evening, hence **vespertine**, of the evening.

vespertilia L.: a bat (the nocturnal animal).

VESSEL: of xylem, a series of (usually) thin-walled cells with common end-walls perforated to form perforation plates through which water may move freely, the length of the complete vessel indefinite, sometimes reaching several feet. See also tracheary element.

VESTIGIAL: incompletely or inconspicuously developed. From L. **vestigium**, a trace; a vestige.

vestit(us) L.: as in **vestiture**, a covering (e.g. of hairs).

ves(us) L.: feeble; wasted.

VEXILLARY: of or related to, a vexillum. Of the arrangement of floral parts in bud (aestivation) when the vexillum is folded over the other petals which lie face to face.

VEXILLUM: the superior, usually largest, petal of a papilionaceous flower, the standard. From L. **vexillum**, a standard.

VIABLE: capable of continuing life. Of seed or spore, capable of germination. From french **vie**, life. Viability: the condition of being viable.

via L.: as in **viatical**, way (hence of the wayside).

vibro L.: as in **vibrio**, to vibrate; to shake.

VIBRONIC: of the genus of curved bacteria, **Vibrio**, especially in relation to its pathogenic members.

VICARIOUS: of closely allied taxa (vicariads) when occurring in the floras of different regions, especially when their differentiation occurred after the dispersal of their ancestors to different regions. Allopatric. From L. **vicarius**, substituted: a substitute.

VILLOSE, VILLOUS: with a covering of long soft hairs. From L. **villus**, shaggy hair.

vim(en) L.: as in **vimineous**, twiggy.

viminalis L.: with long flexible twigs; viminal. Of, or like, the osier **Salix viminalis**.

vinace(us), vinealis L.: of wine; wine-coloured.

violace(us) L.: violet-coloured; violaceous.

virens, viridis L.: green. **virescens:** becoming green; virescent.

VIRAL: relative to a virus. From L. **virus**, a poison.

VIRESCENCE: becoming green, especially as an abnormal event, as the changing of the colour of petals to green.

VIRGATE: of habit when slender and straight with long flexible twigs.

virgat(us) L.: of twigs; rod-like.

viridans L.: making green.

viride, viridis L.: green in colour.

VIROSE, VIROSE: poisonous. From L. **virosus**.

VIRULENCE: of a pathogen, the degree to which it may induce a disease.

VIRUS: (plural viruses) a group with ultimate unit a **virion**, i.e. a sub-microscopic particles composed of a core of nucleic acid (RNA or DNA) with a coating of protein or, sometimes, additionally lipid. Known, as an intracellular parasite, from its effect of controlling the metabolism of its host cell, on which it is completely dependent, to replicate more viral particles with the same potential for cell disorganisation. It is capable of mutating to produce a different, sometimes more virulent strain, and has been likened to a rogue or fragment or genetic material. Has been isolated as a crystal small enough to pass a filter fine enough to arrest bacteria. As a filtrate, is incapable of replication.

The virus is transmissible to plants from an infected source which may concern physical contact, grafting, soil, insect vector, etc. Its effect may be a mosaic disease, e.g. the mosaic disease of the tobacco plant, dwarfing or other malformation, or be limited to a sometimes horticulturally desirable variegated or striped condition of leaf or flower.

As a pathogen of mammals, the importance of the virus is great. It is the causative of the common cold, influenza, chicken pox and shingles, measles and mumps, viral hepatitis, small pox, rabies, etc., myxomatosis of rabbits, foot and mouth disease of cattle, swine fever, etc. See also bacteriophage, and bacterium (**Rickettsiales**).

visc(o) L.: as in **viscid, viscous**, to make sticky.

VISCOSITY: the internal friction of a fluid which prevents its free flow.

vit(a), vi(s) L.: as in **vitamin, viable**, life.

VITAMIN: an organic biocatalyst synthesised only by plants where, in very low concentration, usually in conjunction with enzymes or other biocatalysts, an effect of little known nature is exerted essential for normal function. While sometimes displaying the 'chemical messenger' effect typical of

phytohormones (q.v.), e.g. thiamine and nicotinic acid, synthesised in leaf promoting growth of roots, usually is not translocated to operational sites but operates in the region of its synthesis.

The derivation of the name (**vita**, life; **aminose**, of an amine) from an early belief that the 'essential to life' substance was an amino derivative, and its original definition, have come from the biochemistry of animals whose complete dependence on the vitamin is well known. An absence causes disease, **avitaminoses**, in both animal and plant.

While the chemical structure of the vitamin is diverse, it is customary to refer to it as either water-soluble or fat-soluble. The fat-soluble Vitamin A, and Vitamin D (calciferol) are known in plants only by their precursors (provitamins) carotenes and sterenes respectively. Vitamin E (tocopherol), and Vitamin K (1, 4-naphthoquinone acetate) are believed associated with chlorophyll-production.

The water-soluble vitamins include thiamine (Vitamin B), riboflavin (B₂), nicotinic acid amide (niacin), pantothenic acid (pantothen), pyridoxine (B₆), biotin (H), inositol, ascorbic acid (C), citrine (P).

vitellin(us) L.: with the colour of the yolk of egg (**vitellus**).

vitis L.: as in **viticulture**, a vine (hence the culture of vine crops).

vitta L.: (plural **vittae**) a band; a ribbon, hence **vittae**, with longitudinal ridges or stripes.

VITTA: (plural vittae) of the fruit of an umbelliferous plant, with tube-like oil-secreting receptacle formed within the pericarp.

VIVIPAROUS: of reproduction by a plant when the germination of its seed proceeds within the fruit. From L. **vivus**, life; **parere**, to beget.

volva L.: a covering. See under Fungus (agaric).

VOLUBLE: twining spirally. From L. **volubilis**, revolving.

VOLUTE: rolled up. From L. **volutans**.

vomer L.: as in **vomeriformis**, a plough-share.

vor(o) L.: as in **carnivorous**, to devour; to consume.

VORTEX: of hairs when in a spiral arrangement.

vulgaris, vulgat(us) L.: common; usual.

WALLUM: an area of marshland (coastal lowland) in south-eastern Queensland in which an overlying depth of white sand up to a depth of two feet covers a water-impermeable sandstone up to three feet deep and below which is a water-holding brown sand. In virgin state supports, a wet heath of which **Banksia aemula** (also called wallum) is dominant, the vegetative cover rarely exceeding a few feet in height.

WATER BLOOM: a discolouration of water given by the development of certain algae particularly when the water is confined to shallow basins rich in organic matter and exposed to sunlight. From some of the causative algae (e.g. the blue-green **Anabaena flosaque** and **Anacytis cyanea**) toxins of high hazard to mammals may be diffused (e.g. the polypeptide microcystin). The condition may be controlled by suitable concentrations of copper sulphate.

WATER CULTURE: the technique of plant culture under controlled conditions of mineral intake (i.e. 'feeding' of mineral salts) with water the vehicle of transfer to roots or absorbing region. A similar technique is **sand culture**, water and solute being fed directly to the normally sterile sand.

WATER SHED: a boundary or divide between regions of drainage or two river-systems, e.g. the eastern highlands of the continent provide divides between regions of inland and coastal drainage.

WATER TABLE: the level below a soil or rock at which there is permanent water. Above this level, soil is close to saturation for two or three feet, the layer known as the **capillary fringe**.

wattle: from Anglo-Saxon, **watel**, interwoven twigs. A vernacular for **Acacia**.

WAX: a non-volatile solid ester of a fatty acid with a monohydric alcohol (both of high molecular weight). In plants, occurring as a deposit covering a cuticle, e.g. of the leaves of certain eucalypts especially of cold regions where a characteristic glaucousness is given, or occurring with cutin in a cuticular layer of an epidermis. The familiar and prized commercial wax carnauba is from the fronds of the north-east Brazilian carnauba palm **Copernicia cerifera**.

WEeping HABIT: a habit in which, through apparent inhibition of axillary buds to form lateral shoots, long common-order branches with an abundance of leaves are formed which curve towards the ground.

WETTABILITY: of a liquid, a property allowing its contact with a solid surface through the unrestricted attraction of its surface layer to the solid.

WETTING AGENT: a substance (other than a soap) with the property, when added to water or aqueous solution, of reducing its surface tension so allowing contact with (i.e. wetting) a solid surface presenting a barrier (e.g. of an oil, wax, grease). Teepol, a propriety name for a solution of alkyl sulphates, when added to water at low concentration, allows wetting of surfaces, cracks and fissures otherwise unwettable. It appears to act as two ionic components, a fat-soluble alkyl group, and a water-soluble sulphate group.

WHORL: of leaves or floral parts, a radiation from a common level of the stem. A verticil.

WILTING: of plants, a loss of turgidity due to the rate of transpiration being greater than the rate of water movement from cells at lower level or from root. The condition described as permanent wilted is applied when a slowing-down of transpiration (e.g. by the atmosphere being moisture-saturated) effects no restoration of turgidity. The percentage of water remaining in the soil when a plant reaches the permanent wilted condition (known as the permanent wilted percentage of the soil) varies from 1 to 15 percent, low in coarse sandy soil and high in fine clay soils.

WIND: of the atmosphere, the horizontal movement of air resultant from changes in atmospheric pressure (due, in part, to differences in temperature) in a direction from regions of high pressure to regions of low. Names in accordance with the direction, by compass, from where originating, e.g. a southerly 'blowing from' the south.

WINDWARD: on the side towards which the wind is directed.

WING: of an organ or part, a thin and flat, usually dry or membranous expansion. Of a papilionaceous flower, one of the two lateral petals.

WOOD: secondary xylem formed from a vascular cambium, composed of an axial system of cells and a radial system of cells. The cells of the axial system principally are of tracheary elements functioning for water-conduction, fibres for support, and parenchyma. Cells of the radial, or ray, system chiefly are of parenchyma and function for storage and translocation of various solutes.

With increase in age, cells of these systems become blocked by, e.g. resins, tannins, kinos, or reconverted storage materials, tyloses (q.v.) may block vessels, tori (see torus) may block pits of tracheids. The effect is a cessation of function and frequent darkening of the zone. This zone is the **heartwood**. The outer peripheral often lighter-coloured zone of functional cells, the **sapwood**, is variable in extent, sometimes extensive but, as in a majority of eucalypts, may be limited to a narrow periphery.

According to its origin, wood is termed **softwood**, when from conifers where the typical tracheary element is a tracheid, (hence the wood known also as non-pored), and **hardwood** when from

angiosperms where the vessel is the element (the wood known also as pored). In Australia, where the major hardwood is provided by the eucalypt, heartwood is divisible to two parts, an inner brittle core known as '**heart**', and '**truewood**' which is the utilizable part for timber. The sapwood, although susceptible to wood-boring larvae (e.g. **Lyctus brunneus**) from its storage of starch, varies little in mechanical strength from the heartwood and has the advantage, in the conversion of wood to timber, of providing a penetrable surface for wood preservatives to which the truewood is resistant. From Anglo-Saxon **wudu**. See also Growth Ring.

WOODLAND: a discontinuous or open community dominated by low to tall trees with trunks of length usually not greater than the depths of the crowns and below which is a continuous or discontinuous herbaceous stratum. Smaller trees and shrubs may be present also. In Australia, the trees represent evergreen sclerophyllous species mainly of eucalypts and acacias, or evergreen needle- or scale-leaved native cypresses and she-oaks.

When trees of woodland form are scattered and the herbaceous stratum (chiefly of grasses) is well-developed, the woodland is known as **savannah woodland**, e.g. the Yellow Box (**Eucalyptus melliodora**); White Box (**E. albens**) association of south-western New South Wales.

A **sclerophyll shrub woodland** also has been recognised. This is an open community in which single- or multi-stemmed evergreen sclerophyllous trees are scattered, a herbaceous stratum when developed is dependent largely on season, and a sclerophyllous shrub stratum is well-developed, e.g. the Scribbly Gum (**E. racemosa**, or **E. haemastoma**) - heath association of coastal New South Wales.

x: before the epithet of a specific name, or before a generic name indicates a hybrid. See under Nomenclature.

XANTHOPHYLL: an orange-yellow pigment associated with carotenoids in various parts of plants, often accompanying chlorophyll. Chemically, an oxidation product of a carotene crystallisable to yellow lustrous crystals, examples are lycoxathin ($C_{40}H_{56}O$ with a single hydroxyl radical derived from lycopene), lutein, zeoxanthin.

xanth(os) Gk.: as in **xanthorrhoea**, yellow (hence exuding a yellow resin. From **xantho(s)**, **rheo**, to flow).

xeno(s) Gk.: as in **xenogenous**, strange; alien (hence originating from an external source).

XERIC: arid. Adapted to arid conditions. From Gk. **xeros**, dry.

XENOMORPHIC: relative to a structural change as a consequence of a physiological process concerning moisture, e.g. regulation of osmosis, reduction in rate of transpiration. The change may concern, e.g. a reduction in cell size or leaf area, sclerification or cutinization, development of water-retentive tissue, and be of value in the conservation of water. In general, a reduction in rate of transpiration is effected only when water is in short supply.

XEROPHYTE: a plant which, by modification in form and/or function, is able to escape or endure recurrent drought. Besides xeromorphy (q.v.) other means include that of the desert ephemeral which escapes drought by completion of its life cycle within the period of water availability, thus in the dormant seed phase during drought.

xiph(os) Gk.: as in **xiphoid**, a sword.

XYLARY: relative to a xylem or its structural elements.

XYLEM: the water and mineral solute conducting system of vascular plants, a tissue composed of tracheary elements, parenchyma and fibres functioning also (especially when secondary xylem, i.e. wood) for support. When primary, developed from a strand of procambium as **protoxylem** (formed during elongation of the axis) and **metaxylem** (differentiated after cessation of elongation of the axis).

According to its radial development from the procambial strand, primary xylem is **exarch** when the protoxylem originates from the outermost edge of the strand and develops towards the centre of the axis (i.e. centripetally, the primitive condition typical of the roots of angiosperms), **endarch** when the protoxylem originates from the innermost edge of the strand and develops towards the periphery of the axis (i.e. centrifugally, the advanced condition typical of the stems of angiosperms), and **mesarch** when originating from within the strand and developing both centripetally and centrifugally so that the metaxylem surrounds the protoxylem.

According to the number of procambial strands from which originating, primary xylem is **diarch**, **triarch** and **tetrarch** when developed from two, three and four strands (as of roots) and **polyarch** when developing from more than four strands. See also tracheary element, wood.

xylin(os) Gk.: as in **xylinocarpa**, of cotton; cottony.

XYLOID: resembling, or with the nature of, wood. From Gk. **xylon**.

xyl(os) Gk.: as in **xyломelum**, of wood; woody (hence 'woody pear', from the apparent nature of the fruit).

XYLOPHILOUS: adapted to growth on, or in, wood.

xyr(os) Gk.: as in **xyrophylla**, acute.

ZEBRINE: striped with white or yellow. From African **zebra**, the striped quadruped.

zoe Gk.: as in **zoetic**, life (hence relative to living processes).

ZOOBIOTIC: parasitic on animals. From Gk. **zoon**, an animal.

ZOOCHORIC: dispersed by animals, e.g. seed and spores.

ZOOGLOEA: a cluster of bacteria enclosed by a gelatinous matrix.

ZOOPHILOUS: of plants when pollinating through the agency of animals.

ZOOSPORE: a motile asexual spore.

zyg(on) Gk.: as in **zygophyllum**, a yoke (hence with paired leaves).

ZYGOMORPHIC: divisible into two similar halves in one plane only. Bilaterally symmetrical; monosymmetrical.

ZYGOSIS: a union of gametes; a conjugation.

ZYGOTE: the production of the fusion of nuclei contributed by gametes, a normally diploid cell formed by the union of haploid sexually reproductive cells. Of an embryo, the initial cell formed at a fertilization.

ZYGOTIC: relative to a zygote.

zygot(os) Gk.: yoked; occurring as a pair.

zyme Gk.: as in **enzyme**, **zymobacterium**, a ferment.

ZYMOLYSIS: the destruction of cells by enzymes.

ZYMOTIC: relative to, or caused by, fermentation. From Gk. **zymosis**.

ZYGOPHORE: of a fungus, a part of a hypha specialised for the production of zygospores.

ZYGOSPORE: of a zygomycete (see under Fungus), a resting spore formed by fusion of the protoplasts of two gametangia.