

TABLE OF CONTENTS

<u>Contents</u>	<u>Page Number</u>
Series I and II Certificate Courses	2
Course Description	3
Course Outline	4
References for Further Study	5
Plant Taxonomy	6
Plant Classification and Identification	7
Plant Morphology, Leaf Morphology	16
Arrangement of Leaves	18
Types of Venation	19
Leaf Shapes	20
Leaf Bases, Margins, Apices	21
Stem and Bud Morphology	23
Bud Types	24
Floral Morphology	29
Fruit Morphology	32
Seeds	35
GLOSSARY OF RELATED TERMS	36
Quick Keys to Plant ID's	57
Leaf Shapes	61
Helpful Clues to Plant Names	64
“Patents and Trademarks on Plants”	67
“How Do You Say That?”	76
Previous Botany I Exam	79

Longwood Gardens Continuing Education Program **Series I and Series II Certificate Courses**

Longwood's Continuing Education Program offers certificate courses designed for serious gardeners wishing to expand their knowledge of horticulture. Two separate series of ten courses are currently available to students. Each of the courses offers an individual certificate to students who attend the course sessions and receive a grade of 70% or better on the course exam. Completion of all of the ten ornamental plant courses in Series I leads to the Certificate of Merit in Ornamental Plants. Completion of all ten courses in Series II leads to the Certificate of Merit II in Ornamental Plants.

Courses in Series I and Series II are not interchangeable for the purposes of the corresponding Certificates of Merit. Records are kept of each student's certificates and may be listed on resumes.

The course fee for the certificate courses in either series includes a detailed course manual, all classroom sessions, and the corresponding guided plant walks. Each fee also entitles the student to admission into Longwood Gardens and access to the Longwood Gardens Horticultural Library during regular hours, for the duration of the course.

Certificate of Merit in Ornamental Plants

Annuals and Biennials I
Botany for Gardeners I
Botany for Gardeners II
Broad-leaved Evergreens
Conifers

Deciduous Flowering Shrubs I
Deciduous Trees
Ground Covers
Perennials I
Small Flowering Trees

Upon successful completion of all ten of these courses, the student is awarded the Certificate of Merit in Ornamental Plants, a distinction that recognizes the detailed study of 500 plants.

Certificate of Merit II in Ornamental Plants

Annuals and Biennials II

Hardy Spring and Fall Bulbs

Botany for Gardeners III
Botany for Gardeners IV
Deciduous Flowering Shrubs II
Evergreens II

Ornamental Vines
Perennials II
Shade Perennials
Trees II

Upon successful completion of all ten of these courses, the student is awarded the Certificate of Merit II in Ornamental Plants, a distinction that recognizes the study of approximately 450 additional plants not offered in Series I.

Longwood Gardens
Kennett Square, Pennsylvania 19348

Botany I for Gardeners
“Plant Classification and Identification”
Spring 2002

COURSE DESCRIPTION

Lead Instructor: **Jeff Jabco** is Director of Grounds and Coordinator of Horticulture for the Scott Arboretum of Swarthmore College. Jeff earned a master of science degree in horticulture and plant pathology from North Carolina State University. He was an extension agent for six years and is owner of Countrie Greene, a landscape design and construction business. Jeff is the lead instructor for the four certificate botany for gardeners courses.

Lab Instructors and Assistants:

Five sessions: Monday, April 15, 22, 29; May 6, 13

Afternoon Session 1-3 PM (Outdoor lab session: Monday May 13, 1-4 pm)

Evening Session 7-9 PM (Outdoor lab session: Monday May 13, 5-8 pm)

Location: Visitor Center Auditorium

COURSE OBJECTIVES

1. Learn the structure of the plant kingdom.
2. Learn the plant taxonomy and the binomial system of naming plants
- 3.. Learn flower structure, types, and arrangement.
4. Learn leaf structure, types, arrangement, venation,. shape, margin, apices, and bases.
5. Learn stem and buds structure and pith types.
6. Learn fruit structure and classification.
7. Learn seeds anatomy and methods of dispersal.
8. Learn the use of botanical keys.
9. Know where to look for further information.

EXAMINATION INFORMATION

An optional examination will be given on Monday, May 20 during the afternoon and evening sessions. Students will be responsible for answering questions concerning class material covered in the lectures and outlined in the course manual.

Longwood Gardens
Kennett Square, Pennsylvania 19348

Botany I for Gardeners
“Plant Classification and Identification”
Spring 2002

COURSE OUTLINE

- I. **The Plant Kingdom** (Botany for Gardeners, pp 11-13; Visual Dictionary, pp 58, 6-21; article "Patents and Trademarks on Plants", article "How Do You Say That", article "Helpful Clues to the Meaning of Specific Plant Name") Optional - Vascular Plant Families, pp 12-20, 36-50, 60-69.

- II. **Plant Taxonomy**
 - A. Binomial System of Naming Plants

- II. **Plant Morphology**
 - A. Leaves (Botany for Gardeners, pp 45-50; Visual Dictionary, pp 30-31)
 - 1. Structure, types, arrangement, and venation
 - 2. Shape, margin, apices, and bases
 - B. Stems and Buds (Botany for Gardeners, pp 39-45; Visual Dictionary, pp 22-25)
 - 1. Structure
 - 2. Pith Types
 - C. Flowers (Botany for Gardeners, pp 162-171; Visual Dictionary, pp 34-37)
 - 1. Structure, types and arrangement
 - D. Fruit (Botany for Gardeners, pp 177-181; Visual Dictionary, pp 42-45)
 - 1. Structure and Classification
 - E. Seeds
 - 1. Anatomy
 - 2. Methods of Dispersal

- IV. **Use of Botanical Keys**

REFERENCES FOR FURTHER STUDY

Suggested Course Book:

Capon, Brian. 1990. *Botany for Gardeners*. Timber Press, Portland, OR.

Dirr, Michael. 1990. *Manual of Woody Landscape Plants*. Stipes Publishing Co. Champaign, IL.

Smith, James Payne. 1977. *Vascular Plant Families*, Mad River Press, Inc. Eureka, CA.

The Visual Dictionary of Plants. 1992. Dorling Kindersley, Inc. New York.

Other References:

Armitage, Alan. 1989. *Herbaceous Perennial Plants*. Varsity Press, Inc. Athens, GA.

Baumgardt, John. 1982. *How to Identify Flowering Plant Families*. Timber Press, Portland, OR.

Coombes, Allen. 1985. *Dictionary of Plant Names*. Timber Press, Portland, OR.

Harlow, William M. 1959. *Fruit Key and Twig Key to Trees and Shrubs*. Dover Publications, Inc. New York.

Harris, James G. and Melinda Woolf Harris. 2001. *Plant Identification Terminology: An Illustrated Glossary*. Spring Lake Publishing. Payson, UT.

The RHS Plant Finder 2001-2002. 2001. Dorling-Kindersley, Ltd. London.

There are numerous college texts for botany and plant science that would be good sources for information and extremely helpful in providing further reading for this Botany I for Gardeners course. It is difficult to recommend one over the other, and, for the most part, the basic information for this subject has not changed in the past twenty years or so.

Kingdom	Distinguishing Characteristics and Representative Organisms	Nutritional Mode	Estimated Time of Origin
Monera	Prokaryotic cells, unicellular, or colonial unicellular. Lacking plastids, mitochondria, and lacking advanced (9+2 strand) flagella. Asexual reproduction by fission or budding; protosexual phenomena also occur. Bacteria, blue-green algae.	Predominantly absorption, some groups photosynthetic or chemosynthetic	3 to 4 billion years ago
Protista	Unicellular, multicellular, eukaryotic organisms that constitute a heterogeneous group. Many forms motile by means of advanced (9+2 strand) flagella. Euglenophyta, Chrysophyta, Pyrrophyta, Protozoans, flagellated fungi.	Diverse- photosynthesis, absorption, ingestion	1000 million years ago
Fungi	Uni - or multinucleate with eukaryotic nuclei dispersed in a walled, often septate mycelium. Primarily nonmotile, living in or on food supply. Both sexual and asexual reproduction. Chloroplasts and photosynthetic pigments lacking. Includes chytrids, water molds, bread molds, sac fungi, club fungi.	Absorption of food	1000 million years ago
Plantae	Multicellular eukaryotic organisms containing plastids. Generally nonmotile, living anchored in a substrate. Multicellular algae, liverworts, hornworts, mosses, vascular plants.	Photosynthesis	500 million years ago
Animalia	Multicellular organisms with eukaryotic cells lacking a rigid cell wall, plastids, and photosynthetic pigments. Reproduction chiefly sexual.	Ingestion	700 million years ago

Botany I for Gardeners
“Plant Classification and Identification”
Spring 2002

Plant Taxonomy: Common names vs. the binomial system

Binomial System (Linnaeus)

Kingdom

Division

(subdivision)

Class

(subclass)

Order

Family

Genus

Specific epithet

(subspecies), (variety), (form), (cultivar)

Kingdom **Plantae**

Bryophytes

Division Bryophyta (nonvascular plants)

Class Musci (mosses)
Anthocerotae (hornworts)
Hepaticae (liverworts)

Seedless Vascular Plants

Division Tracheophyta (vascular plants)

Subdivision Psilophytina (whisk fern)
Lycophytina (lycophytes, including club mosses)
Sphenophytina (horsetails)
Filicophytina (ferns)
Spermatophytina (seed plants)

Class Gymnospermae or Cycadinae (cycads)
Ginkgoinae (ginkgo)
Coniferinae (conifers)
Gnetinae (vessel-containing gymnosperms)
Angiospermae (flowering plants)

Subclass Dicotyledoneae (dicots)
Monocotyledoneae
(monocots)

	Dicot	Monocot
Cotyledons		
Flower Parts		
Leaf Venation		
Vascular Bundles in the Stem		
Secondary Growth		

Monocotyledoneae - has about 65,000 species; includes grasses, grains, lilies, irises, orchids, cattails and palms.

Dicotyledoneae - has about 170,000 species; includes almost all familiar trees and shrubs, other than conifers, and almost all annual herbs, except for grasses.

Kingdom	Plantae Fungi Animalia Protista (slime molds and protozoans) Monera (bacteria and blue-green algae)
Division	Tracheophyta (vascular plants) Bryophyta (non-vascular plants--mosses, liverworts, hornworts)
Subdivision	Spermatophytina (seed plants) Four subdivisions for ferns, clubmosses, horsetails, whisk ferns
Class	Angiospermae (flowering plants) Ginkgoinae Gymnospermae Cycadinae Gnetinae Coniferinae
Subclass	Dicotyledoneae (dicots) Monocotyledoneae (monocots)
Order	Ends in (-ales)
Family	Ends in (-ae) Compositae, Rosaceae, Aquifoliaceae, Ericaceae, etc.

Botany I for Gardeners

“Plant Classification and Identification”

Gleditsia triacanthos L.

<i>Gleditsia triacanthos</i>	L.	honeylocust
genus specific epithet	authority	common name

<i>Gleditsia triacanthos</i> var. <i>inermis</i>	thornless honeylocust
Variety	

<i>Gleditsia triacanthos</i> var. <i>inermis</i>	‘Skycole’
	cultivar

Variety, subspecies, form, cultivar - all differ from others of the same species in one or a very few characteristics.

Variety - is from a wild population of plants; may or may not have a clear geographical distribution; at least 90% of the variety's seed-propagated progeny will exhibit the special characteristic. (var.)

Geranium sanguineum var. *striatum*

Subspecies - has a recognizable geographic distribution within the range of the species. (subsp.)

Acer saccharum subsp. *grandidentatum*

Form - minor genetic variants that occur sporadically in populations (f.)

Ilex verticillata f. *aurantiaca*

Cultivar - cultivated variety; may derive from an abnormal individual in the wild, be developed by hybridization or be selected under cultivation; maintained in cultivation by vegetative propagation or by selection. (No longer appropriate to use cv.; must capitalize cultivar name and place in single quotation marks).

Euphorbia dulcis 'Chameleon'

Interspecific Hybrids

Viburnum × *rhytidophylloides* ‘Dart's Duke’ (*V. lantana* × *V. rhytidophyllum*)

Magnolia ‘Butterflies’ (*M. acuminata* × *M. denudata*)

Ilex × ‘Doctor Kassab’ (*I. cornuta* × *I. pernyi*)

Intergeneric Hybrids

× *Cupressocyparis leylandii* (*Cupressus macrocarpa* × *Chamaecyparis nootkatensis*)

× *Heucherella alba* (*Heuchera brizoides* × *Tiarella cordifolia* var. *collina*)

Trademark and Copyright Names

Cornus × *rutgersiensis* ‘Rutban’ Aurora® hybrid dogwood

Gleditsia triacanthos var. *inermis* ‘Skycole’ Skyline® thornless honeylocust

Rosa Othello® (Auslo) PP7212

Rosa Carefree Wonder® (Meipitac) PP7783

Other Confusing Names

Salvia × *sylvestris* ‘Blauhugel’, aka *Salvia* ‘Blue Hill’, *S. nemorosa* or *S. superba*

Nomenclatural Changes and Taxonomic Hierarchy

-Governed by the Botanical Congress

Rules of nomenclature are set out in the International Code of Botanical Nomenclature 1994 (ICBN) and the International Code of Nomenclature for Cultivated Plants 1995 (ICNCP).

Botanical names are derived from Latin and Greek, but all scientific names must be treated as Latin. Therefore, they must follow rules of gender and are pronounced in one of the many versions of Latin pronunciation.

"rule of priority" - first published names take priority over later names.

Carl von Linne (1707-1778) Swedish botanist; changed his name to Carolus Linnaeus

- published Species Plantarum in 1753. In it he keyed out 6000 species of plants in 1000 genera. He based his organization of the plants on the number and morphological arrangement of the flowers' stamens & pistils (sexual parts) which tend to remain unchanged during evolution. This publication established binomials as standard practice. Linnaeus didn't invent the binomial system, but he was the first to apply it to the whole plant kingdom (he also systematized the animal and "mineral" kingdoms).

Previous to Specis Plantarum, a plant's scientific name was a polynomial that was descriptive.....

1576 Convolvulus folio althaeae

1623 Convolvulus argenteus althaea folio

1738 Convolvulus argenteus foliis ovatis divisis basi truncatis: laciniis intermediis duplo longioribus

NOMENCLATURAL BASICS

A classification system has been devised which divides the plant kingdom into progressively smaller groups or categories. The names for these groups are governed by an internationally accepted Code of Botanical Nomenclature and are as follows: division, class, order, family, genus, species, variety, form. Intermediate categories may be formed by adding the prefix **sub-** to the preceding terms, for example: subfamily, subgenus, subspecies. Since living organisms do not always fit into rigidly defined categories, occasionally there are disagreements among botanists as to what constitutes these categories. For example, a particular group of plants that appears to constitute a species to one botanist might be judged a variety by another. Horticulturists are often concerned with differences between plants that are not distinguished by the preceding botanical categories. The term cultivar (cultivated variety) was coined to serve this purpose. The naming of cultivars is governed by a Code of Nomenclature for Cultivated Plants.

A **family** is a group of genera whose members resemble one another in several respects. Some families are large and some very small. The grass family (*Poaceae*) contains about 9,000 species in 650 genera. The ginkgo family (*Ginkgoaceae*) contains one genus and one species, *Ginkgo biloba*.

A **genus** (plural: genera) is made up of closely related and similar plant species. The rules of nomenclature state that all plants must have a binary (two-parted) name consisting of the generic name followed by the specific epithet (see below). The generic name is always capitalized.

The **specific epithet** follows the generic name, and together these two parts make up the species name of a plant. In the case of *Molinia caerulea*, *Molinia* is the name of the genus, *caerulea* is the specific epithet, and *Molinia caerulea* is the name of the species. The specific epithet is normally not capitalized. A **species** (plural: species) is an assemblage of plants that are similar in a number of characteristics. Species are normally interfertile and breed true. A sugar maple seed grows into a sugar maple and a red maple seed grows into a red maple. Hybrids do occur in nature but are uncommon. The word species may be abbreviated **sp.** (singular) or **spp.** (plural).

A **subspecies** differs from others of the same species in several well-distinguished characteristics and has a recognizable geographic distribution within the range of the species. It may be abbreviated **subsp.** Subspecific epithets are normally not capitalized.

A botanical **variety** differs from others of the same species in few characteristics. A botanical variety has a recognizable geographical or ecological distribution. Varietal epithets are normally not capitalized. Botanical variety may be abbreviated **var.**

A **form** denotes minor genetic variants that sporadically occur in populations, such as the occasional pink-flowered dogwood that may be found in a normally white-flowered population. Formal epithets are normally not capitalized. Form may be abbreviated **f.**

A **cultivar**, or cultivated variety, is a group of plants under cultivation whose members differ from other members of the same species in one or more characteristics. A cultivar may derive from an abnormal individual in the wild, be developed by hybridization, or be selected under cultivation. Unique characteristics of a cultivar are retained when it is propagated by appropriate means. Cultivar names should always be capitalized.

When inserted in text, generic, specific, subspecific, varietal and formal names should be set off by a typographic device such as italic or bold print or underlining. Cultivar names are not set off in such a way; however, they must be enclosed in single quotation marks. For example, when inserted in text, the tall upright cultivar of purple moor grass may be written: *Molinia caerulea* subsp. *arundinacea* 'Skyracer' or *Molinia caerulea* subsp. *arundinacea* 'Skyracer'.

Prepared by R. Darke, R. Herald and D. Huttleston, revised by Tomasz Anisko 1/31/02

Examples of Scott Arboretum Name Labels

Insert Plant Morphology

Arrangement of Leaves

Types of Venation

Leaf Shapes

Leaf Bases, Margins, Apices

Additional Terms Related To Leaves

perfoliate – a leaf with the margins entirely surrounding the stem, so that the stem appears to pass through the leaf

ternate – in three's, as a leaf which is divided into three leaflets

trifoliate – with three leaves or leaflets

trifoliolate – compound leaf with three leaflets (usually replaced by term trifoliate),
clover

Stem and Bud Morphology

Bud Types

Dormant Stems - aids to identification

Buds -

- shape
- size
- color
- texture
- type of buds - flower, vegetative (leaf) or mixed
- bud arrangement on stem
 - alternate
 - opposite
 - whorled
- leaf scar associated with bud
 - vascular bundle scars (trace) in leaf scar – arrangement

Accessory buds

- collateral
- superposed

Cover of buds

- none (naked) Viburnum
- valvate (scales meet exactly without overlapping)
 - Cornus florida
- imbricate (scales overlap)
- one-scaled

Terms used to describe

Stems/twigs, Buds and Leaves:

- dull/polished
- glabrous
- indumentum
- lustrous
- pubescent
- rugose
- striate

Stems/twigs

- Shape, in cross-section
- circular (terete)
- 3 to 5-angled
- oval

Pith

pith

- {homogeneous
- {continuous (solid) - {
- {
- {diaphragmed
- {
- {-spongy (porous)
- {
- {-chambered
- {
- {-hollow (excavated)

shape of pith may be –

- circular – (terete)
- oval
- triangular
- 5-angled
- star-shaped

Presence of stipule scars

Terminal bud scale scars

Parts of a Flower

Definitions related to flowers:

Tepals - name given to petals/sepals when they are inseparable because of size, shape, color or texture

Apetalous - without petals

Asepalous - without sepals

Terms used to describe the Flower:

complete - have all parts (sepals, petals, stamens, pistils)

incomplete - lack one or more whorls of floral parts

imperfect - lack stamens or pistils

perfect – have both stamens and pistils

Terms used to describe the Plant:

monoecious - (*one-house*) - staminate and pistillate flowers on the same plant, with flowers imperfect

dioecious – (*two houses*) - staminate and pistillate flowers on different plants, with flowers imperfect

polygamo-dioecious - mostly dioecious, but with some perfect flowers

polygamo-monoecious - mostly monoecious, but with some perfect flowers

Floral Morphology

Fruit Morphology

I. Simple fruits

Dry fruits	
Indehiscent fruits - doesn't split when mature	
achene	one-seeded fruit with seed attached to pericarp at only one place
caryopsis	like achene but seed coat inseparable from pericarp
samara	membranous wing
nut	bony, hard, one-seeded fruit
utricle	like achene, but ovary wall is thin and fits loosely around seed
nutlet	diminutive of nut

Dry fruits

Dehiscent fruits - fruit splits when mature

legume (pod)	one carpel and opens along two sutures
follicle	one carpel and one suture
capsule	many seeded fruits from more than one carpel
silique	two carpels which separate at maturity
silicle	short broad silique
pyxis	capsule which opens around a horizontal ring

Fleshy Fruits	
Berry	entire pericarp is fleshy
hesperidium	berry with leathery rind
pepo	hard rind with fleshy inner matrix
Drupe	pericarp in three layers endocarp-strong; mesocarp-fleshy; exocarp-epidermis
Pome	pericarp surrounded by fleshy floral tube

II. Aggregate fruits - many fruitlets massed on one receptacle; results from one flower with many pistils

III. Multiple fruits - results from several flowers united into one mass

Insert Seeds

GLOSSARY OF RELATED TERMS

Abscisic acid:	A growth-inhibiting hormone.
Abscission:	The controlled separation of leaves, flowers and fruit from plants.
Abscission zone:	A layer of cells at the base of a leaf petiole, flower, or fruit stalk, the weakening of which causes the organ to separate from the plant.
Achene:	A dry indehiscent one-seeded fruit.
Acuminate:	Having an apex whose sides are gradually concave and tapering to a point.
Acute:	Having an apex whose sides are straight and taper to a point.
Adventitious root:	A root arising in an unusual position, such as from a leaf.
Adventitious shoot:	A shoot arising in an unusual position, such as from the side of a root.
After-ripening:	A maturation process in seeds of particular species after dispersal, required for germination.
Aggregate flower:	A flower heaped or crowded into a dense cluster.
Aggregate fruit:	A group of small fruits derived from several ovaries within a single flower.
Alkaloid:	A nitrogen-containing compound, frequently used as a chemical defense by plants.
Allopolyploid:	A hybrid arising from the combination of chromosomes from two different species.
Alternate:	An arrangement of leaves or other parts not opposite or whorled; parts situated one at a node, as leaves on a stem.
Alternation of generations:	The sequence of a haploid gametophyte and a diploid sporophyte during the course of a life-cycle.
Amitosis	Nuclear division or cell division that does not follow the pattern of mitosis.
Anaphase	The stage in mitosis in which the two chromatids of each chromosome are separated and move toward the respective poles of the spindle.
Aneuploidy:	A condition in which chromosome numbers are not in exact multiples of the haploid set; having extra or missing chromosomes within a nucleus.

Angiosperm:	A member of a class of plants characterized by the formation of flowers, and seeds in fruits.
Annual:	A plant completing its life-cycle within a single growing season.
Annual ring:	A cylinder of secondary xylem added to the wood in a single growing season.
Anther:	The pollen-bearing part of a stamen.
Antheridium:	The male sex organ of plants other than Gymnosperms and Angiosperms.
Anthocyanin:	A water-soluble pigment, varying from red to blue in color.
Apical bud:	A bud at the tip of a stem.
Apical dominance:	The inhibition of axillary bud growth by the apical bud.
Apical meristem:	A region of actively dividing cells at the tip of a growing root or stem.
Apomixis:	Development of a viable seed without fusion of gametes.
Archegonium:	The female sex organ of plants, other than Angiosperms.
Aril:	A fleshy appendage of the seed.
Auxin:	A plant hormone that principally controls cell elongation.
Awl-shaped:	Tapering to a slender stiff point.
Axil:	The angle between the upper surface of a leaf and the stem to which it is attached.
Axillary bud:	A bud located in an axil at the base of a leaf.
Bark:	All the tissues, collectively, formed outside the vascular cambium of a woody stem or root.
Berry:	A fleshy indehiscent pulpy multi-seeded fruit resulting from a single pistil
Biennial:	A plant completing its life-cycle within two growing periods.
Blade:	The flattened part of a leaf.
Bloom:	A waxy coating found on stems, leaves, flowers and fruits, usually of a grayish cast and easily removed.
Bolting:	The rapid growth of a stem prior to flowering.
Bract:	A modified leaf arising below a flower or inflorescence.

Bud scale:	A modified leaf protecting a bud.
Bulb:	A short, flattened stem bearing fleshy, food-storage leaves.
Bullate:	With the surface appearing as if blistered between the veins.
Bundle scar:	Seen in the leaf scar, the broken ends of the woody vascular strands that connected the leaf and the stem.
Callus:	A corky tissue developed by woody species to cover wounds.
Calyx:	Collectively, all of the sepals in a flower.
Cambium:	See vascular cambium, cork cambium.
Campanulate:	Bell shaped.
Cane:	A long woody pliable stem rising from the ground.
Carotene:	An orange-yellow pigment located in the chloroplasts.
Caryopsis:	The fruit of members of the grass family; not basically distinct from an achene.
Catkin:	A spike-like inflorescence comprised of scaly bracts subtending unisexual flowers, often somewhat flexuous and pendulous but not necessarily so.
Cell:	The smallest, independently alive unit from which plants and animals are constructed.
Cell plate:	An initial partition between two sister cells, formed in the cytoplasm in association with the spindle fibers, as part of the terminal stage in typical mitotic cell division in most plants.
Cellular respiration:	The chemical breakdown of food substances, resulting in the liberation of energy.
Cellulose:	A plant substance forming a part of the structure of cell walls.
Cell wall:	The outer covering of a plant cell.
Centomere:	A specialized part of the chromosome to which the tractile fibers are attached during mitosis.
Chlorophyll:	A green plant pigment located in chloroplasts.
Chloroplast:	A cellular body in which photosynthesis occurs.
Chlorosis:	An abnormal yellowing of leaves due to a reduced chlorophyll content.

Chromatid:	One of the two longitudinal halves that make up a chromosome during prophase and metaphase of mitosis.
Chromatin:	DNA plus its associated protein.
Chromonema	One of the threadlike, DNA-bearing structures within the nucleus, which give rise to the chromosomes during mitosis; and interphase chromosome.
Chromosome:	A thread-like structure bearing genes in a cell nucleus; each chromosome consists of two chromatids formed by the chromosome's longitudinal division.
Clasping:	A stalkless leaf, with the base partly surrounding the stem.
Clay:	An inorganic soil component having particles less than 0.002 mm diameter.
Clones:	Genetically identical organisms produced vegetatively from a single parent.
Cold hardening:	The process whereby some species prepare for seasonal periods of low temperatures.
Collenchyma	Thick-walled cells acting as supporting tissue.
Companion cell:	A phloem cell containing a nucleus, adjacent to a sieve tube.
Complete flower:	A flower having all of the normal flower parts.
Composite head:	An inflorescence composed of many tightly packed, small, ray and disc flowers.
Compound leaf:	A leaf in which the blade is divided into separate leaflets.
Concave:	Curved like the inner surface of a sphere.
Convex:	Curved like the outer surface of a sphere.
Cordate:	Heart-shaped, with a sinus and rounded lobes.
Cork:	The protective, outer tissue of the bark.
Cork cambium:	A layer of cells in the bark giving rise to the cork; a lateral meristem.
Corm:	A short, swollen, underground stem in which food is stored.
Cormel:	A small, undeveloped corm.
Corolla:	Collectively, all the petals in a flower.

Corona:	A trumpet-like outgrowth of petals.
Cortex:	The tissue in roots and stems immediately inside the epidermis.
Cotyledon:	A seed leaf: a food storage structure in seeds.
Crenate:	Rounded teeth on margin.
Crenate-serrate:	Having a mixture of blunt and sharp teeth.
Crenulate:	Having very small rounded teeth.
Critical photoperiod:	The maximum day length a short-day plant and the minimum day length a long-day plant require to initiate flowering.
Cross-pollination:	The transfer of pollen to a flower on another plant.
Crown:	The upper mass or head of a tree, also a central point near the ground level of a perennial herb form which new shoots arise each year.
Cruciform:	Cross shaped.
Culm:	Stem of grasses and sedges.
Cultivar:	A cultivated variety, produced by horticultural techniques.
Cuneate:	Wedge-shaped with essentially straight sides, the structure attached at the narrow end.
Cuspidate:	With an apex somewhat abruptly and concavely constricted into an elongated sharp-pointed tip.
Cuticle:	An outer film of dead epidermal cells, often waxy.
Cutin:	The waxy substance forming a cuticle layer.
Cyme:	A more or less flat-topped determinate inflorescence whose outer flowers open last.
Cytokinesis:	The division of the cytoplasm during cell division.
Cytokinin:	A plant hormone primarily stimulating cell division.
Cytoplasm:	The living protoplasm of a cell, excluding the nucleus.
Cytoplasmic membrane:	The membrane enclosing the cytoplasm.
Day-neutral plant:	A plant in which flower formation is not controlled by photoperiod.
Deciduous:	Shedding all of the leaves in one season.

Dehiscent:	Splitting open, the sides or segments of the splitting organ usually termed valves.
Deltoid:	Triangular.
Dentate:	Having marginal teeth whose apices are perpendicular to the margin and do not point forward.
Dissected:	Divided in narrow, slender segments.
Determinate growth:	Growth to a genetically pre-determined size.
Dicot:	A member of a subclass of Angiosperms characterized by having two cotyledons in their seeds.
Differentiation:	The process whereby parenchyma cells undergo morphological and physiological change in order to become specialized in function.
Diffuse secondary growth:	Thickening of a plant organ by scattered cell divisions, rather than growth originating from cambium tissues.
Dikaryotic:	Having two nuclei of different origin in each segment or cell of a filament.
Dioecious:	Having male and female sex organs on separate individuals.
Diploid:	Having two full chromosome complements per cell.
Disc flower:	A small, tubular flower at the center of a composite head.
DNA:	Deoxyribonucleic acid. The substance of which genes are made; the carrier of genetic information in cells.
Dormant, dormancy:	A state of reduced cellular activity.
Dominant trait:	A characteristic determined by a gene masking the expression of a comparable, but recessive gene.
Double serrate:	Serrations bearing minute teeth on margins.
Doubly compound:	Bi-pinnate-pinnate.
Doubly crenate, dentate,	Having small teeth of the given kind within the larger ones or serrate.
Downy:	Pubescent with fine soft hairs.
Drupe:	A fleshy indehiscent fruit whose seed is enclosed in a stony endocarp.
Drupelet:	A small drupe.

Egg:	A female sex cell.
Elliptical:	Having the outline of an ellipse, broadest at middle and narrower at each end.
Elongate:	Lengthened.
Emarginate:	With a shallow notch at the apex.
Embryo:	An immature plant within a seed.
Endocarp:	The inner layer of the pericarp.
Endodermis:	A layer of cells in roots between the cortex and vascular tissues.
Entire:	Having a margin without teeth or crenatins.
Enzyme:	A protein molecule functioning as a chemical catalyst in a biochemical reaction.
Ephemeral:	Persisting for one day only, of short duration.
Epidermis:	The outer layer of cells on an herbaceous plant organ.
Epigeous germination:	Seed germination in which the cotyledons are raised above the soil surface.
Ethylene:	A gaseous plant hormone produced in abundance by ripening fruits and damaged tissues.
Etiolation:	The condition of a plant when grown in darkness; its stem is pale and elongated, the leaves are undeveloped.
Evergreen:	A woody perennial plant bearing leaves throughout the year.
Exfoliate:	To peel off in shreds or thin layers, as bark from a tree.
Fasciated:	Abnormally flattened, and seemingly several unit fused together.
Fascicle:	A close cluster.
Fastigate:	Branches erect and close together.
Filament:	The stalk of a stamen, bearing an anther.
Filiform:	Long and very slender; thread-like.
Fleshy:	Applied to a fruit somewhat pulpy or juicy at maturity, as opposed to a dry hard or papery fruit.

Floret:	Technically a minute flower; applied to the flowers of grasses and Composites.
Flower:	The reproductive branch of an Angiosperm plant.
Follicle:	A dry dehiscent fruit opening only along one suture and the product of a single carpel (simple ovary).
Form:	A subdivision of a species which occurs occasionally in the wild, seldom breeds true, and does not develop a natural population or distribution.
Frond:	A leaf, once applied only to leaves of ferns but now to leaves of palms also.
Gamete:	A sex cell; sperm or egg.
Gametophore:	In mosses, the main body of the gametophyte, on which the archegonia and/or antheridia are borne.
Gametophyte:	A haploid, gamete-producing plant in the alternation of generations.
Gene:	A segment of a DNA double helix that acts as a template for the production of a particular kind of molecule of RNA. More generally, one of the individual bits of chromatin that is the unit of genetic inheritance and governs the hereditary characteristics of an organism.
Genotype:	The genetic constitution of an organism.
Genus:	A taxonomic category containing related species.
Geotropism	Growth of a plant organ in response to gravity.
Germination:	The beginning of growth of a seed, spore, or pollen grain.
Gibberellin:	A plant hormone regulating several processes including internode elongation and cell enlargement.
Glabrous:	Not hairy.
Glaucous:	Covered with a waxy bloom or whitish material that rubs off readily.
Globose:	Having a round or spherical shape.
Growth retardant:	A chemical substance slowing or inhibiting plant growth.
Guard cell:	One of a pair of cells surrounding a stoma.
Guttation:	Exudation of droplets of water, most often from leaf margins, as the result of water movement up a plant due to root pressure.

Gymnosperm:	A member of a class of plants forming seeds in an exposed condition, frequently in cones.
Haploid:	Having only one full set of unpaired chromosomes per cell.
Hastate:	Having the shape of an arrow-head and the basal lobes pointed outwards at or nearly at right angles to the mid-rib.
Head:	A short dense inflorescence of variable form.
Heartwood:	The central, dark-colored portion of secondary xylem in a tree trunk.
Herbaceous:	Soft, green and containing little woody tissue.
Hesperidium:	A fleshy berry-like fruit with hard rind and definite longitudinal partitions.
Heterozygous:	Having both dominant and recessive genes for a particular characteristic on homologous chromosomes.
Hilum:	The scar on a seed marking its point of attachment.
Homologous chromosomes:	Matching chromosome pairs.
Homozygous:	Having identical genes on homologous chromosomes.
Hormone:	An organic substance produced in small amounts and transported to sites where it controls growth and development.
Hybrid:	The offspring of two plants of the same or closely related species differing in one or more genes.
Hybrid vigor:	The increased vigor, size, and fertility of a hybrid compared to its parents.
Hypocotyl:	The part of a seedling between the roots and the place of attachment of the cotyledons.
Hypogeous germination:	Seed germination in which the cotyledons remain below the soil surface.
Imbibition:	The process of water absorption by a dry substance or structure, causing it to swell.
Incised:	Cut by sharp and irregular incisions more or less deeply, but intermediate between toothed and lobed.
Incomplete flower:	A flower lacking one or more of the normal flower parts.
Indehiscent:	Not opening regularly, as a capsule or anther.
Indeterminate growth:	Growth to an indefinite size.

Indumentum:	With a generally heavy covering of hair: a general term without precise connotation.
Inflorescence:	A shoot bearing clusters of flowers.
Intercalary meristem:	A meristem located between non-dividing tissues such as at the base of a leaf.
Internode:	The segment of a stem between two nodes.
Interphase:	The time of stage between mitotic divisions of a cell.
Interstice	Small or narrow space between things or parts.
Involucre:	One or more whorls or series of small leaves or bracts that are close underneath a flower or inflorescence; the individual bracts termed phyllaries by some.
Lacerate:	Irregularly torn or cleft.
Lamina:	A blade.
Lanceolate:	Much longer than wide, broadest below the middle and tapering to the apex.
Lateral meristem:	A region where cells divide, located along the length of a stem or root.
Leaf:	An outgrowth of a stem: the principal organ of photosynthesis.
Leaflet:	A portion of the blade of a compound leaf.
Leaf primordium:	An immature leaf, located at a stem tip.
Leaf scar:	A scar left on a stem after a leaf has fallen.
Leaf tendril:	A modified leaf or leaf part used as a grasping organ.
Legume:	A dry fruit dehiscing along both sutures and the product of a single carpel (simple ovary).
Lenticel:	A small corky spot on young bark made of loosely packed cells, providing gaseous exchange between the inner tissues and the atmosphere.
Lignified:	Woody, hardened.
Lignin:	A tough, durable plant substance deposited in cell walls, especially in wood.
Linear:	Long and very narrow, as in blades of grass.

Loam:	A mixture of sand, silt and clay.
Locule:	A cell or compartment of an ovary, anther or fruit.
Long-day plant:	A plant flowering in response to day lengths exceeding its critical photoperiod.
Macronutrient:	A mineral required by plants and animals in relatively large quantities.
Megaspore:	A spore that develops into a female gametophyte.
Meiosis	A cell divisional process in which the chromosome number is reduced by half.
Membrane:	A thin, sheet-like structure composed of protein and fats surrounding the cytoplasm, organelles, and other cell structures.
Meristem:	A region where cells actively divide.
Mesophyll:	The parenchyma tissue of a leaf between the upper and lower epidermis, including palisade and spongy cells.
Metabolism:	The sum of the biochemical processes of a living organism.
Metaphase:	The stage in mitosis during which the chromosomes become, and for a time remain, arranged in an equatorial plate.
Microfibril:	A fine thread of cellulose in a cell wall.
Micronutrient:	A mineral required by plants and animals in relatively small quantities.
Microsporangium:	The microspore-containing case; an anther sac.
Microspore:	A spore that develops into a male gametophyte.
Middle lamella:	A layer of pectin binding two adjacent cell walls.
Midrib:	The primary-rib or mid-vein of a leaf or leaflet.
Mitochondria:	Cellular bodies in which cellular respiration occurs.
Mitosis	A complex, orderly process of cell division in which the chromosomes are duplicated.
Monocot:	A member of a subclass of Angiosperms characterized by the presence of one cotyledon in the seeds.
Monoecious:	Bearing separate male and female flowers on the same plant.
Molecule:	A chemically bonded group of atoms.

Morphology	Form and structure, as of an organism, regarded as a whole.
Mucro:	A short, sharp, abrupt tip.
Mucronate:	Abruptly terminated by a mucro.
Multiple fruit:	A cluster of mature ovaries from several flowers on a single stem.
Mutation:	An induced, inheritable change in the structure of a gene.
Mycorrhiza:	An association between a fungus and the roots of a higher plant.
Naked bud:	One without scales.
Natural selection:	The action of the environment on organisms such that those better able to survive environmental stress are more likely to reproduce and perpetuate their species.
Necrosis:	The death of a plant tissue.
Nectar:	A sugary fluid secreted in some flowers.
Nectary:	A gland secreting nectar.
Node:	The segment of a stem to which leaves and axillary buds are attached.
Nucleus:	The body within a cell controlling its activities, including inheritance.
Nut:	A dry, indehiscent, 1-celled, 1-seeded fruit having a hard and bony mesocarp; the outermost endocarp may be fibrous or slightly fleshy.
Nutlet:	Diminutive nut
Ob-:	Prefix indicating the inverse.
Oblong:	Longer than broad; rectangular; the sides nearly parallel.
Obtuse:	Rounded, approaching the semi-circular.
Orbiculate:	Circular or disk-shaped.
Organ:	A part of a plant, composed of different tissues, that act as a functional unit.
Organelle:	A cell structure performing a specific function.
Organic:	Referring to substances containing, at least, both carbon and hydrogen.
Organism:	A living plant or animal.

Osmosis:	The diffusion of water across permeable cell membranes which select for or against specific substances.
Ovary:	The basal portion of a pistil that becomes a fruit.
Ovate:	Egg-shaped in outline, broadest below the middle, like an oval.
Ovule:	An immature seed.
Palisade cell:	A photosynthetic cell directly beneath the upper leaf epidermis.
Palmate:	Digitate, radiating, fan-like from a common point.
Palmately compound leaf:	A leaf in which the leaflets radiate from one point.
Panicle:	An indeterminate inflorescence whose primary axis bears branches of pedicelled flowers; a branching raceme.
Parallel venation:	A vein pattern in which the veins are arranged parallel to each other.
Parenchyma:	A thin-walled, undifferentiated cell.
Parthenocarpy:	Development of a fruit without pollination, fertilization or seed development.
Pectin:	A substance in cell walls binding cells together.
Pedicle:	The stalk of an individual flower in an inflorescence.
Peduncle:	The stalk of a flower cluster or a single flower when that flower is solitary, or the remaining member of a reduced inflorescence.
Peltate:	Having the petiole attached inside the margin, such a leaf is typically shield-shaped.
Pendulous:	More or less hanging or declined.
Perennial:	A plant living through several growing seasons.
Perfoliate:	The leaf-blade surrounding the stem.
Perianth:	The two floral envelopes of a flower; a collective term embracing both corolla and calyx as a unit; often used when it is not possible to distinguish one series from the other and the parts then call tepals.
Pericarp:	The fruit wall; derived from the ovary wall.
Pericycle:	A root tissue giving rise to branch roots.
Petal:	A frequently flattened, conspicuously colored flower part.

Petiole:	A leaf stalk.
pH:	A measure of relative acidity or alkalinity.
Phenotype:	The physical appearance of an organism.
Phleom:	The food-conducting tissue of plants.
Photoperiodism:	The initiation of flowering in response to relative lengths of day and night.
Photosynthesis:	The process in which light energy is used to form foods from carbon dioxide (CO ₂) and water (H ₂ O).
Phototropism:	Curvature of a plant organ in response to light.
Pinnate venation:	A vein pattern in which the major veins are arranged in rows on each side of the midrib.
Pinnately compound leaf:	A leaf in which the leaflets are arranged on both sides of a common axis.
Pistil:	The female part of a flower.
Pit:	A small opening in a cell wall.
Pith:	The central part of a twig, usually lighter or darker than the wood.
Plasmodesmata:	Fine strands of cytoplasm that pass through cell walls, connecting adjacent cells.
Plasmolysis:	Shrinkage of cytoplasm away from the cell wall as a result of excess water loss.
Plastid	Specialized protoplasmic structures in the cytoplasm; the site of photosynthesis and production of starch.
Pod:	A dry dehiscent fruit.
Pollen:	A structure that develops from a microspore in Angiosperms and Gymnosperms to become a male gametophyte.
Pollen tube:	An outgrowth from a pollen tube grain conveying the sperm to the female gametophyte.
Pollination:	Pollen transfer from an anther to a stigma or in Gymnosperms, from a male cone to a female cone.
Polygamo-dioecious:	Having male and female flowers on separate plants, but these plants having perfect flowers as well.
Polygamous:	Bearing unisexual and bisexual flowers on the same plant.

Polyploid:	Having three or more sets of chromosomes per cell.
Pome:	A type of fleshy fruit represented by the apple, pear and related genera, resulting from a compound ovary.
Primary growth:	Growth arising from cellular activities in apical meristems.
Primary phloem:	Food conducting tissue formed by growth activities originating in apical meristems.
Primary tissue:	A tissue formed during primary growth.
Primary wall:	The first layer of cellulose laid down during development of a new cell wall.
Primary xylem:	Water-conducting tissue formed by growth activities originating in apical meristems.
Primocane:	The first year's shoot or cane or a biennial woody stem.
Prophase:	An early stage in mitosis, in which the chromonumata give rise to the chromosomes.
Prostrate:	Lying flat on the ground.
Protein	A large class of nitrogenous substances consisting of a complex union of amino acids and containing carbon, hydrogen, nitrogen, oxygen, frequently sulfur, and sometimes phosphorus, iron, iodine, or other elements.
Protoplasm:	The living substance of cells, including cytoplasm and nucleus.
Pubescent:	Covered with short soft hairs.
Punctate:	With translucent or covered dots, depressions, or pits.
Pyriform:	Pear-shaped.
Raceme:	A simple indeterminate inflorescence with pedicelled flowers.
Rachis:	Axis bearing leaflets or the primary axis of an inflorescence.
Radicle:	An embryonic root.
Ray flower:	One of several small flowers often forming a ring around the disc flowers in a composite head.
Receptacle:	The enlarged end of a flower stalk to which the flower parts are attached.

Recessive trait:	A genetic characteristic the expression of which is masked by a comparable but dominant gene.
Reduction division:	The process by which the number of chromosomes in a cell is reduced from $2n$ to $1n$.
Reniform:	Kidney shaped.
Resin:	A viscous, protective secretion of many conifers that is insoluble in water and hardens on contact with air.
Reticulate:	Like a net, the interstices closed.
Rhizome:	An underground, horizontal stem.
Rhombic:	With four nearly equal sides, but unequal angles, diamond shaped.
Ribosome:	A cellular particle; the site of protein synthesis.
RNA:	Ribonucleic acid, an essential participant in the synthesis of proteins.
Root:	Generally the underground portion of a plant; an organ anchoring the plant to the soil and absorbing water and minerals.
Root cap:	A protective cover over a root tip.
Root hair:	A hair-like projection of a root's epidermal cell.
Root nodule:	A small swelling on a root resulting from invasion by nitrogen-fixing bacteria.
Root pressure:	The pressure developed by living cells in a root forcing water up the xylem.
Root tuber:	An enlarged, food-storage root bearing adventitious shoots.
Rugose:	Wrinkled, usually covered with wrinkles.
Runner:	A horizontal stem growing above ground that may form roots at its tip or at nodes.
Sagittate:	Shaped like an arrow-head with the basal lobes pointing directly downward (backward) or inward.
Sand:	An inorganic soil component the particles of which range between 0.02 and 2 mm in diameter.
Sapwood:	The outer, light-colored, water-conducting region of secondary xylem.
Scale:	A small and usually dry bract or vestigial leaf or a structure resembling such.

Scape:	A leafless peduncle arising from the basal rosette of a few or no basal leaves; sometimes a few scale-like leaves or bracts may be borne on it; a scape may be one or many-flowered.
Scarify:	To scratch or etch a thick seed coat to improve water uptake.
Schizocarp:	A dry dehiscent fruit that splits into two halves.
Sciop:	A plant part inserted into a root stock during grafting.
Sclereid:	See stone cell.
Sclerenchyma	Double-walled, lignified cells for support or protection
Secondary growth:	Growth resulting from the activities of lateral meristems (vascular and cork cambia).
Secondary phloem:	Food-conducting tissue formed by the vascular cambium.
Secondary wall:	The portion of a cell wall laid down inside the primary wall.
Secondary xylem:	Water-conducting tissue formed by the vascular cambium.
Seed:	A fertilized ripened ovule that contains an embryo and stored food.
Seed coat:	The protective outer layer of a seed.
Seedling:	A young plant, shortly after seed germination.
Self-pollination:	The transfer of pollen from an anther to the stigma of the same flower.
Senescence:	The aging process; a breakdown of cellular structures leading to death.
Sepal:	A flower part that usually encloses and protects the flower bud.
Serrate:	Saw-toothed, the teeth pointing forward.
Serrulate:	Minutely serrate.
Sessile:	Without a stalk.
Sessile leaf:	A leaf in which the blade is directly attached to the stalk.
Setose:	Covered with bristles.
Shoot:	A stem bearing leaves.
Short-day plant:	A plant flowering in response to days shorter than its critical photoperiod.
Shrub:	A woody plant with little or no trunk and having branches near its base.

Sieve plate:	The perforated end-wall of a sieve tube member.
Sieve tube:	A food-conducting cell.
Silicle:	The short fruit of some crucifers, which is usually not more than 1 1/2 times as long as wide.
Silique:	The elongated fruit of some crucifers, usually 3 times as long as wide or longer.
Silt:	An inorganic soil component the particles of which range between 0.002 and 0.02 mm in diameter.
Simple fruit:	A fruit formed from one ovary.
Simple leaf:	A leaf in which the blade is not divided into smaller units.
Sinuate:	With a strongly wavy margin.
Sinus:	The space between two lobes, segments, or divisions.
Sorus:	An area of spore production on the underside of a fern leaf.
Spadix:	A fleshy usually club-shaped axis on which are borne flowers and which is generally enveloped by a spathe; the inflorescence of most Araceae.
Spathe:	The bract or modified leaf surrounding or subtending a flowering inflorescence(usually a spadix); it may be herbaceous, colored, and “flower-like” as in the calla lily or the anthurium, or hard, dry and woody in many palms.
Spatulate:	Spoon shaped.
Species:	A group of individuals sharing many characteristics and interbreeding freely.
Specific epithet:	A taxonomic classification; the second part of a species’ scientific, binomial name.
Sperm:	A male sex cell.
Spike:	An inflorescence in which the flowers are attached to the main stem without stalks.
Spikelet:	A secondary spike.
Spindle:	A structure, formed during mitosis, which is associated with the movement of the chromosomes to the poles.
Spine:	A modified leaf part that is hard and sharply pointed.

Spore:	A reproductive cell that grows directly into a new plant.
Sporophyte:	A diploid, spore-producing plant in an alternation of generations.
Springwood:	Xylem laid down by the vascular cambium in spring and early summer.
Spur:	A tubular projection from a flower.
Stalk:	A supporting structure of a leaf, flower or fruit.
Stamen:	The male part of a flower, consisting of an anther and filament.
Starch:	The principal food-storage substance of higher plants; a carbohydrate consisting of numerous glucose units.
Stem:	The leaf- and flower-bearing part of a plant.
Stem tuber:	An enlarged tip of a rhizome containing stored food.
Stigma:	The part of a pistil that receives pollen.
Stipule:	An outgrowth from the base of a leaf stalk; sometimes functioning as a protective structure.
Stock:	A rooted plant into which a scion is inserted during grafting.
Stoma:	A pore in the epidermis of leaves and herbaceous stems (stomata, plural).
Stone cell:	A hard, thick-walled plant cell.
Stratification	(to stratify) A cold treatment given the seed of some species to improve the percentage of germination.
Style:	The narrow part of a pistil bearing the stigma.
Suberin:	A fatty plant substance present in the walls of cork cells.
Subopposite:	Pairs of leaves close but not exactly at the same level on the stem.
Subulate:	Awl-shaped.
Summerwood:	Xylem laid down by the vascular cambium in late summer.
Sympodial:	Continuing growth by the development of an axillary bud and not the terminal bud. season after season.
Tannin:	A substance occurring in the bark or leaves of some species, functioning to protect against predators.
Tap root:	A prominent root with few branches, sometimes swollen to store food.

Telophase:	The final stage of mitosis, in which the parent cell becomes completely divided into two cells, each having a reorganized nucleus.
Tendrils:	A modified stem or leaf, usually filiform, branched or simple, that twines about an object providing support.
Tepal:	A perianth part in flowers having no distinct petals or sepals.
Terminal bud scale scar:	A scar left on a stem after the bud scales have fallen.
Thigmotropism:	A growth response to touch.
Thorn:	A modified stem that is hard and sharply pointed
Tissue:	A group of cells of the same type having a common function.
Tomentose:	Densely woolly, the hairs soft and matted.
Torulose:	Twisted or knobby; irregularly swollen at close intervals.
Totipotency:	The capacity of certain cells, when isolated and properly grown, to regenerate a whole plant.
Tracheid:	A water-conduction cell in Gymnosperms and other lower vascular plants.
Transpiration:	The loss of water vapor from a plant, mostly from the stomata of leaves.
Transpirational pull:	The force exerted by transpiration from the leaves that draws water up through a plant.
Tree:	A large, woody, perennial plant having a definite trunk.
Trifoliate:	Three-leaves.
Tropism:	A growth curvature of a plant part caused by some external stimulus such as light or gravity.
Tuber:	A short, thickened, fleshy part of an underground stem.
Turgid:	Swollen and firm due to internal water pressure.
Turgor pressure:	The pressure developed in a cell as it becomes filled with water.
Umbel:	An indeterminate inflorescence, usually but not necessarily flat-topped with the pedicels and peduncles (termed rays) arising from a common point, resembling the stays of an umbrella.
Undulate:	Wavy, as a leaf margin.

Utricle:	A small dry thin-walled, usually dehiscent, 1-seeded fruit; an achene whose pericarp is loose and readily removed.
Vacuole:	A fluid-filled sac within a cell.
Variety:	Subdivision of a species having a distinct though often inconspicuous difference, and breeding true to that difference. More generally also refers to clones.
Vascular bundle:	A discrete group of conducting vessels.
Vascular cambium:	A narrow cylinder of cells that gives rise to secondary xylem and phloem; a lateral meristem.
Vascular plant:	Any plant containing water- and food-conducting tissues.
Vascular ray:	A narrow sheet of cells running radially across the secondary vascular tissues of a stem or root.
Vascular tissue:	A group of food- or water conducting cells.
Vein:	A strand of xylem and phloem in a leaf blade.
Vernalization:	A low temperature treatment promoting flowering.
Vessel:	A water-conducting cell in Angiosperms.
Viable:	Capable of germination.
Water-holding capacity:	The amount of water held in soil after gravitational run-off.
Whorl:	Arrangement of three or more structures arising from a single node.
Whorled:	Arranged in a ring.
Wood:	The dense tissue composed of secondary xylem in stems and roots.
Xanthophyll:	A yellow or almost colorless photosynthetic pigment.
Xylem:	The water conducting tissue of plants.
Zygote:	The product of union of a sperm and egg; a fertilized egg.

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