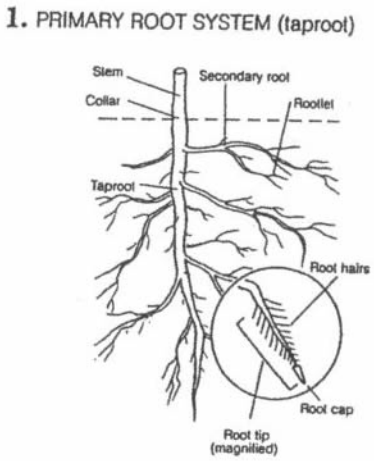
The Anatomy of Plants

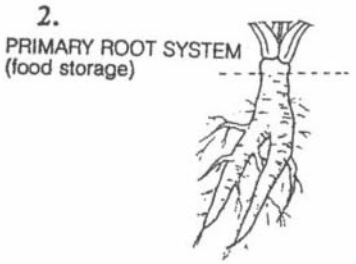
ROOTS

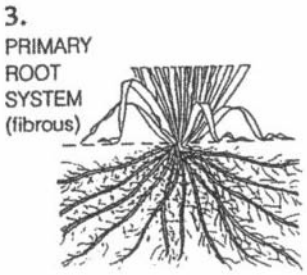
Roots anchor a plant to the soil, from which they absorb water and dissolved mineral nutrients. The root then transports these substances from the point of absorption (root tip) to the stem. In many species, roots are food storage organs. Some have medicinal or nutritional value; others are poisonous. Primary root systems develop from the seedling's embryonic root into either a dominant taproot or a cluster of fibrous roots. An adventitious root system develops from a plant part other than a root, such as a stem (see next section), that sends down roots to produce new plants. Adventitious systems usually have fibrous roots. Both primary and adventitious roots can have fleshy parts that are sources of food and medicine.

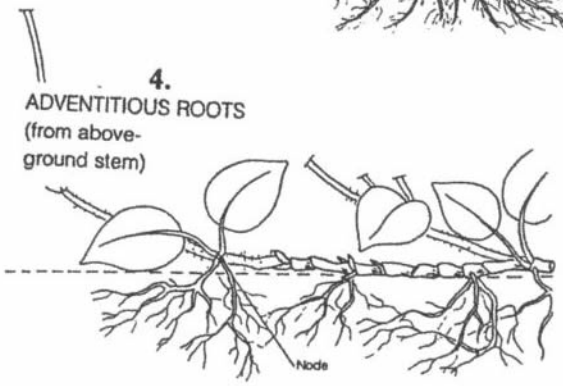


Primary Root Systems

1. A taproot is a dominant root with many smaller secondary roots and rootlets branching from it. The dividing line between the root and the stem (or shoot) is called the collar. At the root's other, or distal (underground), end is a root cap, shielding the new growth of the root tip from contact with the soil through which the root pushes. Behind the tip are ranks of threadlike root hairs. They "pump" in water for eventual use by the whole plant.
2. Some taproots that store food have long been important in the human diet. Examples are carrots, radishes, and parsnips.
3. Primary roots may also develop into a cluster of fibrous roots, all about the size of the seedling's primary root. Cereal grains and grasses are examples of plants with fibrous roots. The erosion resistant sod beneath a healthy lawn or prairie is a tangle of fibrous roots, usually interlaced with the underground stems called rhizomes.







Adventitious Root Systems

4. Many herbs have ground hugging stems that send down fibrous adventitious root clusters at intervals marked by nodes; new shoots grow from these clusters. Adventitious roots also grow on underground stems.

from Magic and Medicine of Plants, The Reader's Digest Assn., 1986

STEMS

The stem supports the leaves that catch the sunlight needed for photosynthesis. Stem tissues conduct water, minerals, and organic nutrients throughout the plant. Aerial stems grow above ground, underground stems spread below ground; but the distinction between them is not always obvious. The same plant, and even the same stem, may have both aerial and subterranean stem parts. Moreover, in form and function, underground stems are easy to confuse with roots. Some rootlike foodstorage organs, for example, are really stems. Herbal writers do not always make such distinctions, since these authorities are mostly concerned with indicating which part - in this case, the underground one - of a plant to use.

Aerial Stems

5. Branches and branchlets spreading from an aerial stem, form a plant's distinctive aboveground shape, or crown, characteristic of the species. (A plant's entire aboveground portion is often called its shoot or shoot system.) Herbaceous plants, such as grasses and most annuals, have fleshy and short-lived aerial stems, in contrast to the trunks of trees, which are woody and perennial aerial stems.

6. Strawberries, wild thyme, and certain other plants produce aerial stems called stolons, or runners. They creep over the ground, then root (adventitiously) to produce a plant like the parent plant. This plant sends out a runner that roots and makes another clone, and so on.

Underground Stems

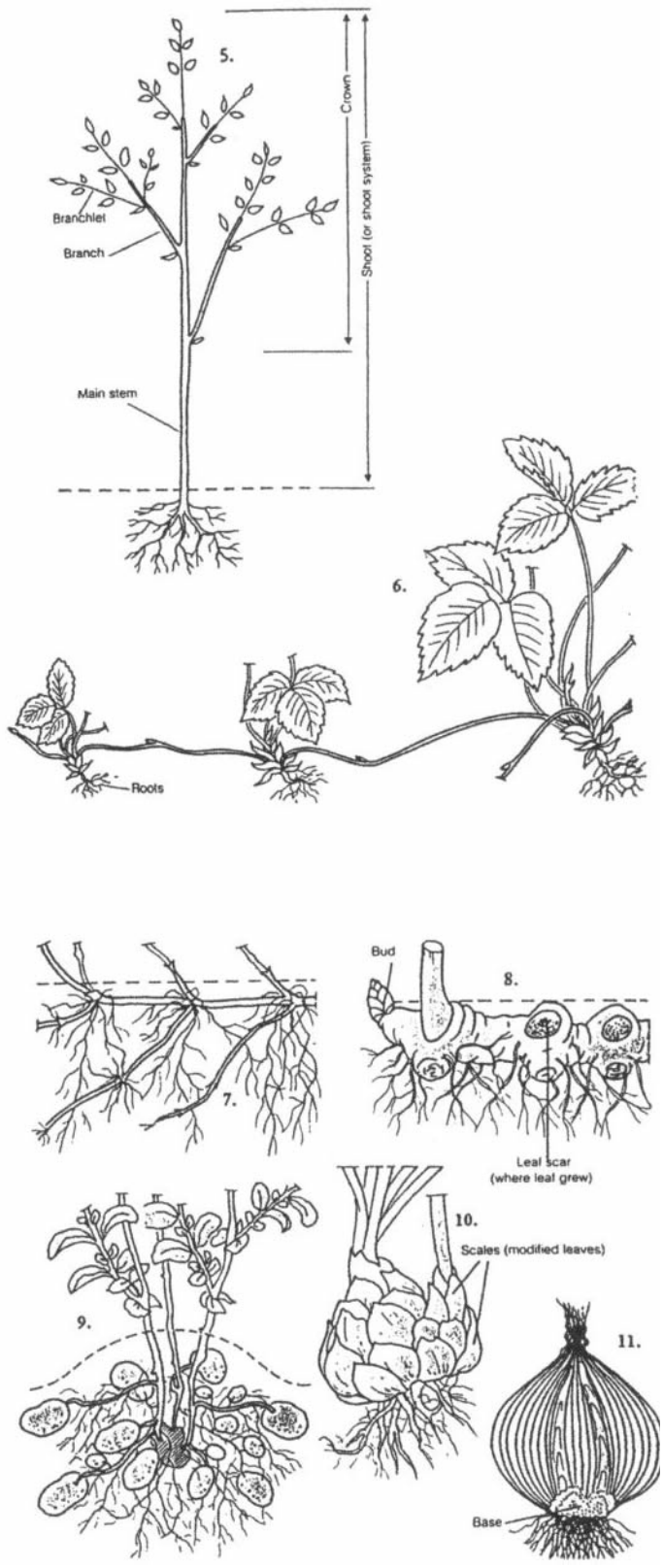
7. Rhizomes, which are also known as rootstocks, are stems that burrow beneath the soil, producing at intervals both adventitious roots and aerial stems and leaves.

8. Thick and fleshy rhizomes such as those of the iris can be rich sources of potentially useful chemical compounds.

9. Common white potatoes are tubers - thickened ends of rhizomes.

10. The lily bulb, like all true bulbs, is an underground bud that stores food in fleshy bulb scales (modified leaves). They encase the base of the stem and may be individually prominent as in the lily, or form a smoother wrap as in the tulip. The gladiolus and crocus rely on an underground stem called a corm, which does not have the true bulbs nourishing scales but sends down an adventitious root as its growth season begins.

11. Onions are bulbs whose food storage leaves (scales) form overlapping rings.



from Magic and Medicine of Plants, The Reader's Digest Assn., 1986

LEAVES -1

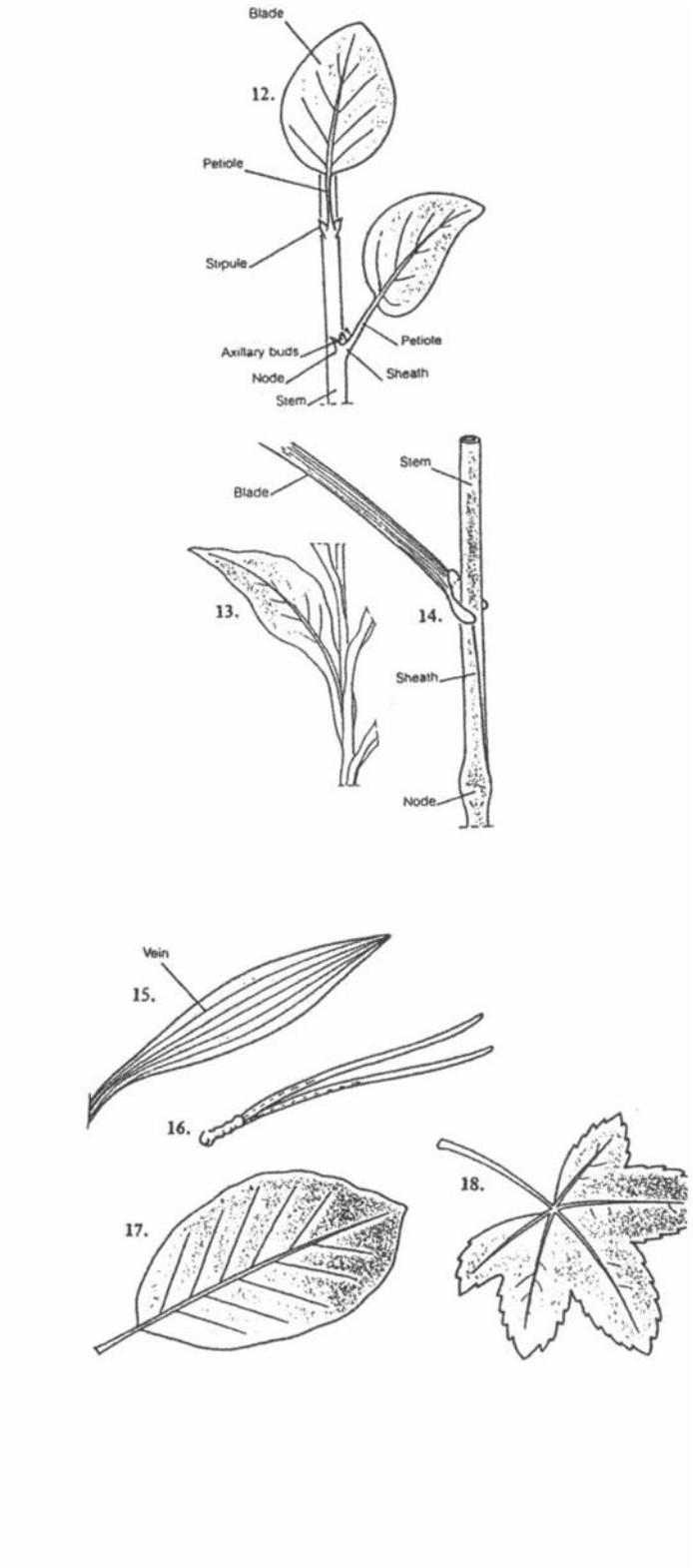
Appendages of the stem, leaves are the main organs of photosynthesis, the process by which a leaf's green chlorophyll pigments absorb solar energy and use it to make organic molecules from carbon dioxide in the air and water in the sod. The simplest of these organic substances are carbohydrates and sugars such as glucose; but with mineral elements from the soil added, more complex organic compounds, such as amino acids and fatty acids, are manufactured. These organic compounds are the building blocks of all living matter. As byproducts of this manufacturing process arise the medicinal compounds found in plants. Plant parts that are neither green nor leaves can carry out photosynthesis. Some nongreen pigments of algae have photosynthetic ability, as do the green stems of some plants. Nature's best adaptation for capturing the energy of sunlight, however, remains the green leg in its myriad shapes and sizes, from pine needles to giant jungle fronds.

Leaf Structure and Attachment

12. Most leaves consist of a blade and a stalk, or petiole. A blade's waxy upper surface helps retard the evaporation of water. The petiole connects blade and stem; on its base may be found outgrowths called stipules, which protect the budding leaf. Axillary buds form in the angle (axil) between petiole and stem; terminal buds, at the growing end of a stem. A node is where a leaf is (or was) attached, and the interval between one node and another is called the internode. At the node, the leaf may form a sheath partly or wholly enclosing the connecting portion of the stem.
13. Sessile leaves have no petiole; the blade attaches directly to the stem.
14. The sessile leaves of the plants in the grass family form a sheath around the stem as they grow from the node.

Veins

15. Extensions of the leafstalk, veins serve as the leaf's supporting skeleton and its network for the inflow and outflow of water, minerals, dissolved gases, and organic compounds. The parallel veins of grass and lily leaves are one pattern of venation.
16. Another venation pattern - a single vein running the leaf's entire length is found in pine needles. (Vein indicated by dotted line.)
17. A very common venation is pinnate, characterized by a dominant central vein (midrib) with smaller branching veins.
18. Maple leaves have palmate venation; that is, several veins of about the same size radiate from the petiole, or leafstalk.

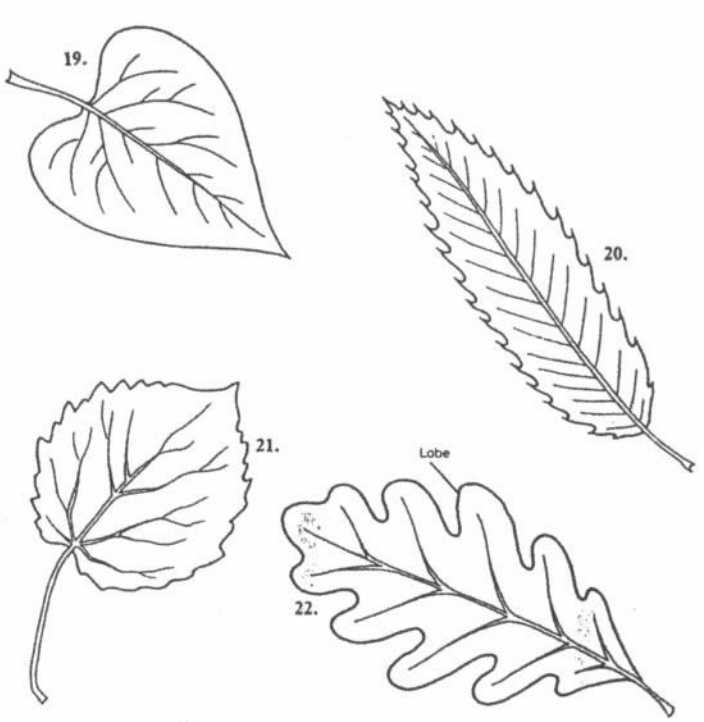


from Magic and Medicine of Plants, The Reader's Digest Assn.,

LEAVES -2

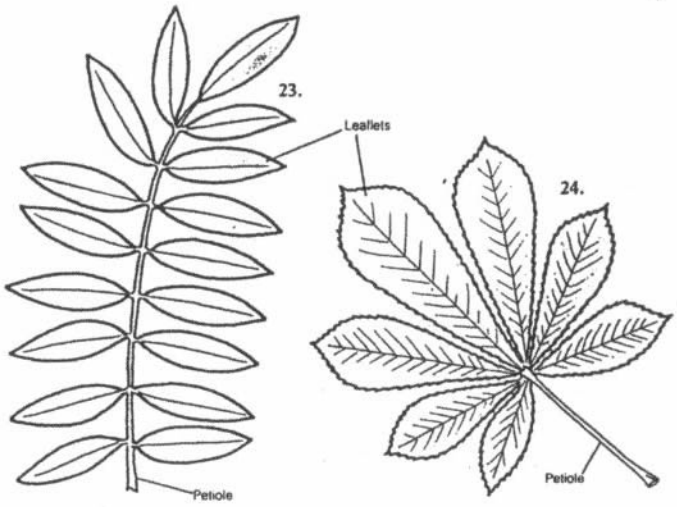
Simple and Compound Leaves

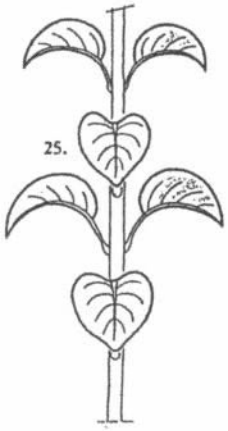
19. Simple leaves have a single blade. A simple entire leaf is one with a smooth edge (margin), like that of the lilac.
20. A simple toothed leaf, such as the chestnut leaf, has more or less regularly spaced little teeth on its margin.
21. Simple toothed leaves may also have teeth that form an irregular, wavy margin. Examples: great burdock, aspens, cottonwoods.
22. Simple lobed leaves have gaping indentations along their edges, as in oaks.
23. Compound leaves have a number of leaflets supported by one petiole. Leaflets of pinnately compound leaves grow on each side along an axis (rachis) extending from the petiole, as in walnuts and ashes. Each leaflet may have its own stalk, or petiole.
24. On palmately compound leaves, such as those of horse chestnuts, leaflets emerge from a single point at the top of the petiole.

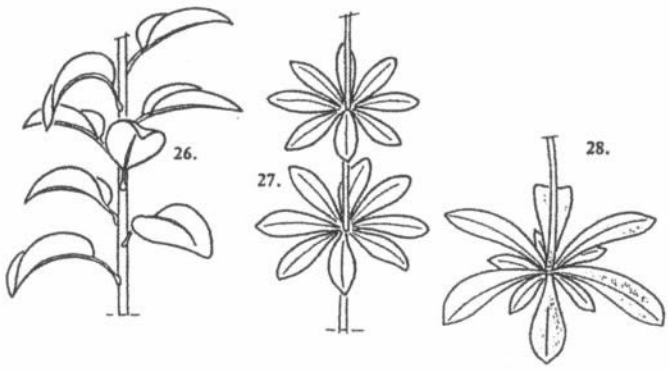


Leaf Arrangements

25. Opposite leaves grow in pairs at the stem node; the two leaves are opposite one another on different sides of the stem.
26. Alternate leaves grow singly at intervals along the stem, usually from defined points located in a spiral along the stem.
27. Whorled leaves grow in groups of three or more from the same node.
28. On some plants, such as the foxglove, leaves form a rosette (radiating cluster) at the base of the stem.







from Magic and Medicine of Plants, The Reader's Digest Assn., 198(

FLOWERS

The flower is an organ for sexual reproduction. What botanists call a perfect flower contains its own bisexual reproductive system: it has both male (stamens) and female (pistils) sex organs. Imperfect (unisexual) flowers, such as those of willows and corn, have one or the other kind of sex organs, not both.

Flower Parts and Structure

29. A flower is called complete when it has sepals, which arc usually green and collectively form the calyx; petals, which usually give the species its characteristic flower color and collectively form the corolla; a set of stamens, or pollen-producing male organs; and one or more pistils (also called carpels, a term some authorities prefer), the pollen-receiving, seed-producing female organs. Almost invariably the arrangement of these floral parts follows the same order, from the outside to the inside: sepals, petals, stamens, pistil. The technical term for flowers that lack any of these parts is "incomplete."

A stamen consists of a filament (stalk) and an anther, where pollen grains are produced. The pistil (with either one carpet or several carpels fused together) consists of an ovary containing one or more ovules (which mature into seeds); a stigma, which receives the pollen grains; and, connecting ovary and stigma, a necklike style by which the pollen reaches the ovary. Calyx (sepals) and corolla (petals) together are called the perianth. The flower's stalk is the pedicel, whose tip forms the receptacle, a platform to which the floral parts are attached. A flower lacking a pedicel is called sessile.

Some Common Variations

30. Seen from where the pedicel meets the floral parts, the perianth's calyx and corolla are most clearly visible. Some species have an outer calyx (epicalyx), as shown.

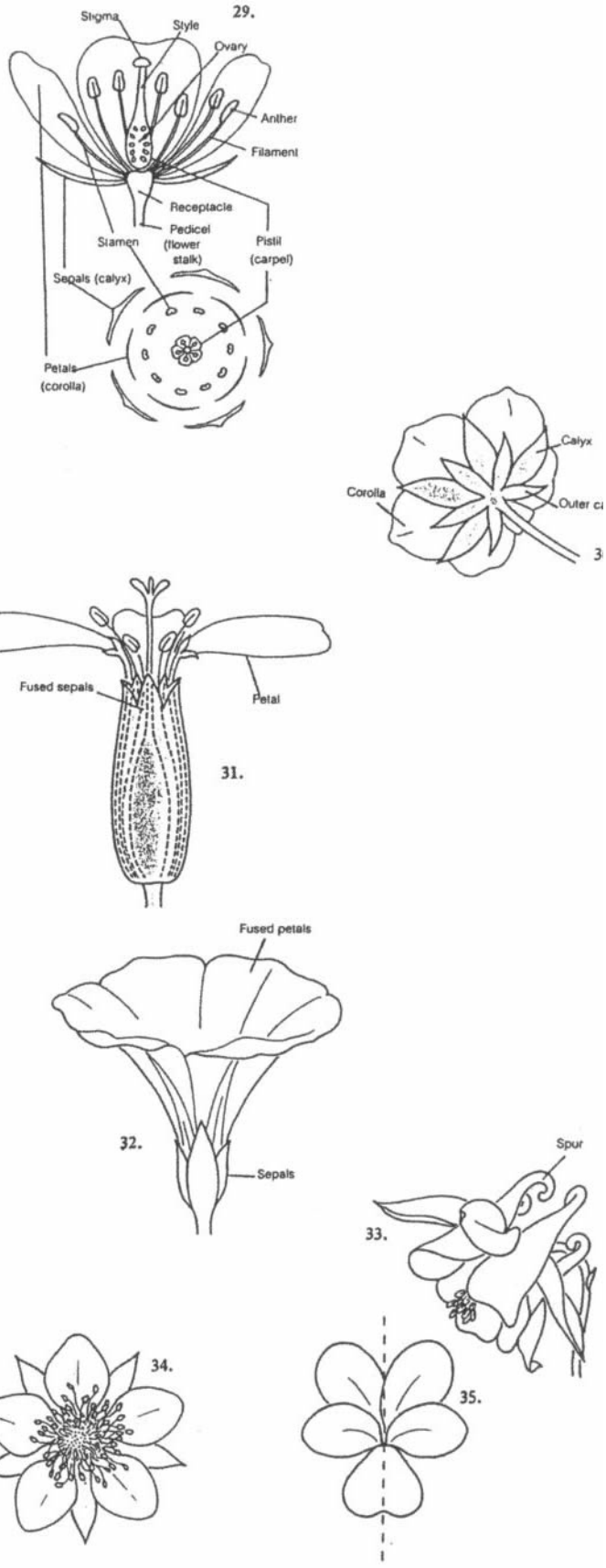
31. The sepals of bouncing Bet fuse into a tube around the inner parts of the flower.

32. In morning glories, it is the petals that fuse to form a funnel-shaped structure.

33. Columbine petals form projecting spurs. Insects probe for nectar in the spurs, pollinating the plant.

34. Regular flowers have radial symmetry: their parts are arranged evenly around a center, giving many planes of symmetry.

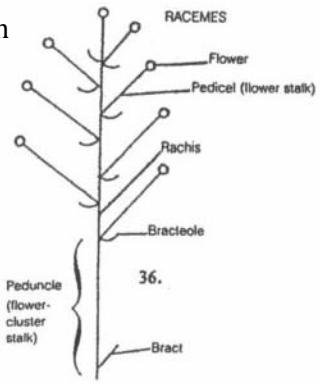
35. Irregular flowers such as violets display bilateral symmetry: they have only one plane of symmetry. Their two halves form mirror images of each other only if the flower is divided along one specific axis (the dotted line in the diagram).

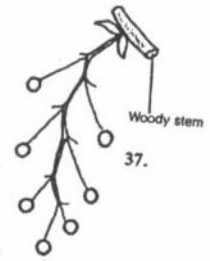


from Magic and Medicine of Plants, The Reader's Digest Assn., 19

FLOWER CLUSTERS

Many species, such as poppies and tulips, bear their flowers singly, one flower on a stalk. On other plants, flowers occur in a cluster, or inflorescence, borne at the end of a peduncle (stalk of a flower cluster). The names of such clusters differ, depending on the arrangement of their individual flowers. In a flower cluster, each flower is supported by a small leaflike structure called a bracteole; the structure that supports the whole cluster is called a bract.





Racemes

36. The kind of inflorescence called a raceme has a main stalk (rachis) on a peduncle; the rachis supports many flower-bearing pedicels, all of about equal length.

37. The raceme of the currant or of the wild gooseberry droops in a flowery cluster from the plant's woody stem.

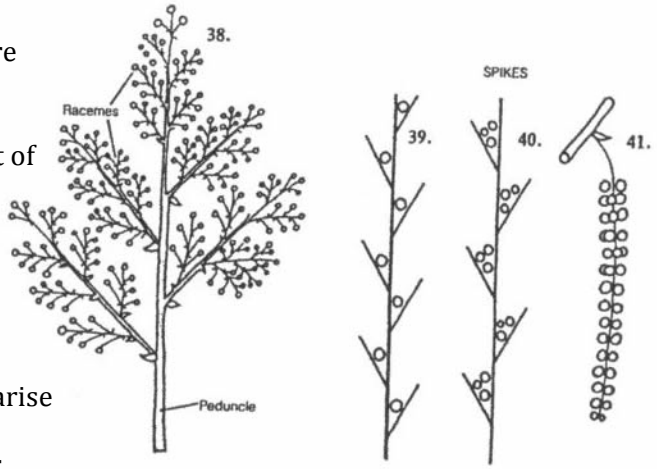
38. A compound, many-branched raceme -- racemes on racemes -- is called a panicle. The lilac's blossoms form a pyramidal panicle.

Spikes

39. A spike is an elongated inflorescence whose flowers are sessile (lacking individual pedicels and supported only by bracteoles), being attached directly to the main sulk as in gladiolus. A simple spike has only one flower at each point of attachment.

40. A compound spike has more than one flower at each point of attachment.

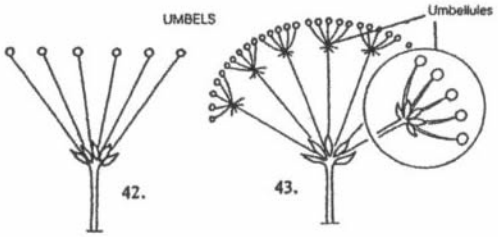
41. A catkin is a long spike, usually drooping and densely covered with flowers of one sex.



Umbels

42. In an umbel, many individual flower stalks (pedicels) arise from the same point at the tip of a stem or peduncle.

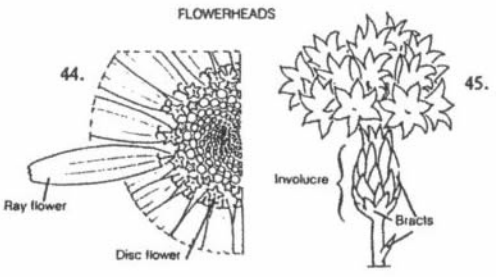
43. A compound umbel is a flower cluster of many smaller umbels (umbellules), as in Queen Anne's lace, or wild carrot. The scientific name of the carrot family is Umbelliferae, meaning “umbel-bearing.”



Flowerheads

44. Dense, compact clusters of flowers at the tip of a peduncle are called flowerheads. Characteristic of the composite, or sunflower, family, they resemble a single flower but really are many individual flowers. The white "petals" of daisies, for example, are flattened ray, or marginal, flowers ringing the margin of the head. The central "button" is a dense mass of individual yellow disc flowers. Many flower-leaves or bracts enclose a flowerhead. The collective term for these encircling bracts is involucre.

45. Cornflowers, or bachelor's-buttons, are flowerheads that lack ray flowers. But the base of the flowerhead - like that of all members of the composite family -- is surrounded by an involucre, or ring of overlapping bracts.



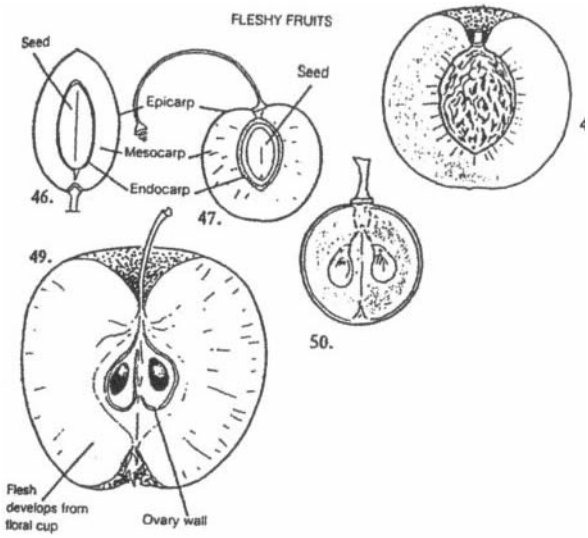
from Magic and Medicine of Plants, The Reader's Digest Assn., 19

FRUITS

A fruit is the mature product of a fertilized ovary or ovaries. The ovules within the ovary have matured into seeds, which are ready to germinate and give rise to other plants of the same species.

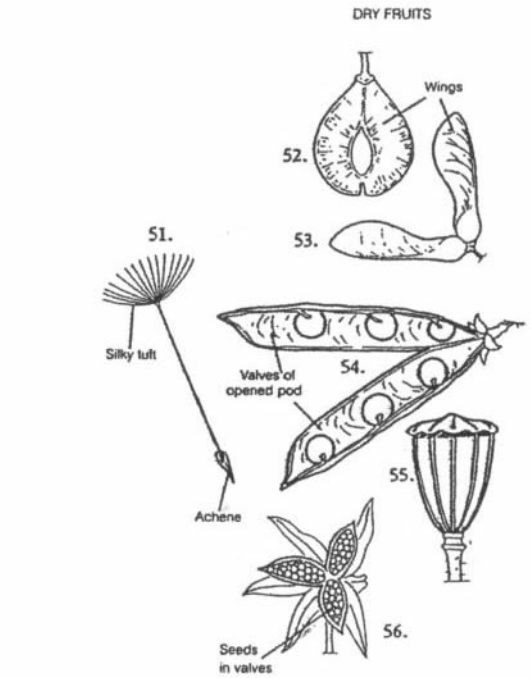
Fleshy Fruits

46. In the type of fleshy fruit known as a drupe, or stone fruit, one single seed is protected within a hard-walled stone, itself embedded in a juicy pulp surrounded by a somewhat tougher outer skin. Olives are typical.
47. Cherries too are drupes. Their mature ovary wall develops into a structure called a pericarp, which has three distinct layers: the epicarp (also called "exocarp), or outer skin; the mesocarp, or juicy flesh; and the stony endocarp enclosing the seed.
48. Peaches are drupes with an exceptionally thick, hard endocarp.
49. Apples arc examples of the fleshy fruits called pomes. Their mature ovary wall is less distinct than that of drupes and form only the inner core, a papery layer around the seeds (matured ovules). The apple's edible flesh develops from the floral cup that surrounded the ovary.
50. Berries which include grapes and tomatoes but not strawberries (see page 41) are fleshy fruits with many seeds embedded right in the juicy pulp, which is a pericarp that lacks the distinct layers found in drupes.



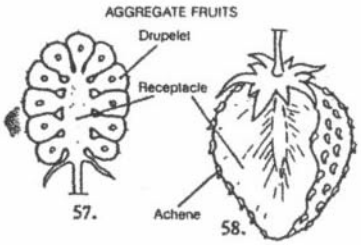
Dry Fruits

51. No juicy pulp surrounds the seeds of dry fruits. The small, one-seeded achenes of dandelions are dry fruits with silky parachutelike tufts that helps them be dispersed by the wind.
52. Another type of one-seeded dry fruit is the samara, of elms, with its papery wings.
53. Maple fruits are paired samaras, or “keys,” joined at their bases.
54. Legumes, such as peas, are dry fruits with woody or papery protective pods that at maturity usually split lengthwise down both sides into two matching valves.
55. Poppy fruits, called capsules, open when dry to release seeds. Capsules develop from a compound ovary -- that is, one capable of producing multiple seeds.
56. Capsules of violets split open (as shown) at maturity to release seeds.



Aggregate Fruits

57. Aggregate fruits form from a single flower that has many separate pistils. Each tiny spherical segment of a raspberry, for example, is a drupelet (tiny drupe) that has developed from its own ovary.
58. The fleshy part of a strawberry develops from the receptacle, the tip of the stalk where the flower was attached. Each “seed” is an achene from a separate ovary.



from Magic and Medicine of Plants, The Reader's Digest Assn., 1986