EXERCISE 18

Taxonomy: Classifying and Naming Organisms

OBJECTIVES

After completing this exercise, you will be able to

1. define *common name, scientific name, binomial, genus, specific epithet, species, taxonomy, phylogenetic system, dichotomous key, herbarium;*
2. distinguish common names from scientific names;
3. explain why scientific names are preferred over common names in biology;
4. identify the genus and specific epithet in a scientific binomial;
5. write out scientific binomials in the form appropriate to the Linnean system;
6. construct a dichotomous key;
7. explain the usefulness of an herbarium;
8. use a dichotomous key to identify plants, animals, or other organisms as provided by your instructor.

INTRODUCTION

We are all great classifiers. Every day, we consciously or unconsciously classify and categorize the objects around us. We recognize an organism as a cat or a dog, a pine tree or an oak tree. But there are numerous kinds of oaks, so we refine our classification, giving the trees distinguishing names such as "red oak," "white oak," or "bur oak." These are examples of **common names,** names with which you are probably most familiar.

Scientists are continually exchanging information about living organisms. But not all scientists speak the same language. The common name "white oak," familiar to an American, is probably not familiar to a Spanish biologist, even though the tree we know as white oak may exist in Spain as well as in our own backyard. Moreover, even within our own language, the same organism can have several common names. For example, within North America a gopher is also called a ground squirrel, a pocket mole, and a groundhog. On the other hand, the same common name may describe many different organisms; there are more than 300 different trees called "mahogany"! To circumvent the problems associated with common names, biologists use **scientific names** that are unique to each kind of organism and that are used throughout the world.

A scientific name is two-parted, a binomial. The first word of the binomial designates the group to which the organism belongs; this is the **genus** name (the plural of genus is *genera*). All oak trees belong to the genus *Quercus,* a word derived from Latin. Each kind of organism within a genus is given a **specific epithet.** Thus, the scientific name for white oak is *Quercus alba* (specific epithet is *alba*), while that of bur oak is *Quercus macrocarpa* (specific epithet is *macrocarpa*).

Notice that the genus name is always capitalized; the specific epithet usually is not capitalized (although it can be if it is the proper name of a person or place). The binomial is written in *italics* (since these are Latin names); if italics are not available, the genus name and specific epithet are underlined.

You will hear discussion of "species" of organisms. For example, on a field trip, you may be asked "What species is this tree?" Assuming you are looking at a white oak, your reply would be "*Quercus alba.*" The scientific name of the **species** includes *both* the genus name and specific epithet.

If a species is named more than once within textual material, it is accepted convention to write out the full genus name and specific epithet the first time and to abbreviate the genus name every time thereafter. For example, if white oak is being described, the first use is written *Quercus alba,* and each subsequent naming appears as *Q. alba.*

Similarly, when a number of species, all of the same genus, are being listed, the accepted convention is to write both the genus name and specific epithet for the first species and to abbreviate the genus name for each species listed thereafter. Thus, it is acceptable to list the scientific names for white oak and bur oak as *Quercus alba* and *Q. macrocarpa,* respectively.

Taxonomy is the science of classification (categorizing) and nomenclature (naming). Biologists prefer a system that indicates the evolutionary relationships among organisms. To this end, classification became a **phylogenetic system;** that is, one indicating the presumed evolutionary ancestry among organisms.

Current taxonomic thought separates all living organisms into six kingdoms:

- Kingdom Bacteria (prokaryotic cells that include pathogens)
- Kingdom Archaea (prokaryotic organisms that are evolutionarily closer to eukaryotes than bacteria)
- Kingdom Protista (euglenids, chrysophytes, diatoms, dinoflagellates, slime molds, and protozoans)
- Kingdom Fungi (fungi)
- Kingdom Plantae (plants)
- Kingdom Animalia (animals)

Let's consider the scientific system of classification, using ourselves as examples. All members of our species belong to

- Kingdom Animalia (animals)
- Phylum Chordata (animals with a notochord)
- Class Mammalia (animals with mammary glands)
- Order Primates (mammals that walk upright on two legs)
- Family Hominidae (human forms)
- Genus *Homo* (mankind)
- Specific epithet *sapiens* (wise)
- Species: *Homo sapiens*

The more closely related evolutionarily two organisms are, the more categories they share. You and I are different individuals of the same species. We share the same genus and specific epithet, *Homo* and *sapiens.* A creature believed to be our closest extinct ancestor walked the earth 1.5 million years ago. That creature shared our genus name but had a different specific epithet, *erectus.* Thus, *Homo sapiens* and *H. erectus* are *different* species.

Like all science, taxonomy is subject to change as new information becomes available. Modifications are made to reflect revised interpretations.

18.1 Constructing a Dichotomous Key *(About 45 min.)*

To classify organisms, you must first identify them. A *taxonomic key* is a device for identifying an object unknown to you but that someone else has described. The user chooses between alternative characteristics of the unknown object and, by making the correct choices, arrives at the name of the object.

Keys that are based on successive choices between two alternatives are known as **dichotomous keys** (*dichotomous* means "to fork into two equal parts"). When using a key, always read both choices, even though the first appears to describe the subject. Don't guess at measurements; use a ruler. Since living organisms vary in their characteristics, don't base your conclusion on a single specimen if more are available.

MATERIALS

Per lab room:

- several meter sticks or metric height charts taped to a wall

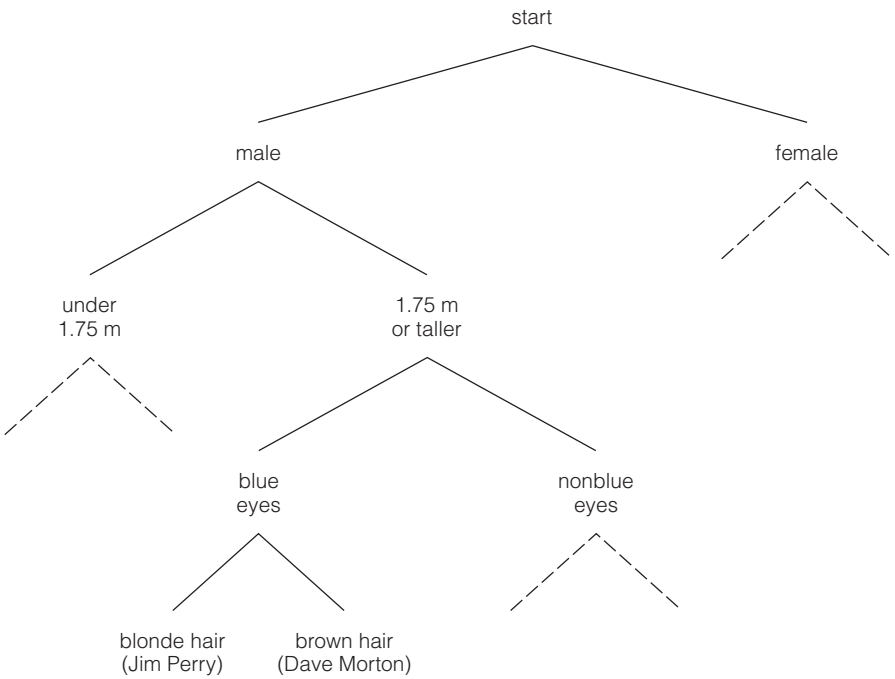
PROCEDURE

1. Suppose the geometric shapes below have unfamiliar names. Look at the dichotomous key following the figures. Notice there is a 1a and a 1b. Start with 1a. If the description in 1a fits the figure you are observing better than description 1b, then proceed to the choices listed under 2, as shown at the end of line 1a. If 1a does *not* describe the figure in question, 1b does. Looking at the end of line 1b, you see that the figure would be called an Elcric.
2. Using the key provided, determine the hypothetical name for each object. Write the name beneath the object and then check with your instructor to see if you have made the correct choices.

Key		
1a.	Figure with distinct corners	2
1b.	Figure without distinct corners	Elcric
2a.	Figure with 3 sides	3
2b.	Figure with 4 or more sides	4
3a.	All sides of equal length	Legnairt
3b.	Only 2 sides equal	Legnairtosi
4a.	Figure with only right angles	Eraqus
4b.	Figure with other than right angles	Nogatco

3. Now you will construct a dichotomous key, using your classmates as subjects. The class should divide up into groups of eight (or as evenly as the class size will allow). Working with the individuals in your group, fill in Table 18-1, measuring height with a metric ruler or the scale attached to the wall.
4. To see how you might plan a dichotomous key, examine the following branch diagram. If there are both men and women in a group, the most obvious first split is male/female (although other possibilities for the split could be chosen as well). Follow the course of splits for two of the men in the group.

   Note that each choice has *only* two alternatives. Thus, we split into "under 1.75 m" and "1.75 m or taller." Likewise, our next split is into "blue eyes" and "nonblue eyes" rather than all the possibilities.



5. On a separate sheet of paper, construct a branch diagram for your group using the characteristics in Table 18-1 and then condense it into the dichotomous key that follows. When you have finished, exchange your key with that of an individual in another group. Key out the individuals in the other group without speaking until you believe you know the name of the individual you are examining. Ask that individual if you are correct. If not, go back to find out where you made a mistake, or possibly where the key was misleading. (Depending on how you construct your key, you may need more or fewer lines than have been provided.)

TABLE 18-1 Characteristics of Students

Student (name)	Sex (m/f)	Height (m)	Eye Color	Hair Color	Shoe Size
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

Key to Students in Group _____
1a.
1b.
2a.
2b.
3a.
3b.
4a.
4b.
5a.
5b.
6a.
6b.
7a.
7b.
8a.
8b.

18.2 Using a Taxonomic Key

A. Some Microscopic Members of the Freshwater Environment *(About 30 min.)*

Suppose you want to identify the specimens in some pond water. The easiest way is to key them out with a dichotomous key, now that you know how to use one. In this section, you will do just that.

MATERIALS

Per student:

- compound microscope
- microscope slide
- coverslip
- dissecting needle

Per student group (table):

- cultures of freshwater organisms
- 1 disposable plastic pipet per culture
- methylcellulose in dropping bottle

PROCEDURE

1. Obtain a clean glass microscope slide and clean coverslip.
2. Using a disposable plastic pipet or dissecting needle, withdraw a small amount of the culture provided.
3. Place *one* drop of the culture on the center of the slide.
4. Gently lower the coverslip onto the liquid.
5. Using your compound light microscope, observe your wet mount. Focus first with the low-power objective and then with the medium or high-dry objective, depending on the size of the organism in the field of view.
6. Concentrate your observation on a single specimen, keying out the specimen using the Key to Selected Freshwater Inhabitants that follows.
7. In the space provided, write the scientific name of each organism you identify. After each identification, have your instructor verify your conclusion.
8. Clean and reuse your slide and coverslip after each identification.

Key to Selected Freshwater Inhabitants

1a.	Filamentous organism consisting of green, chloroplast-bearing threads	2
1b.	Organism consisting of a single cell or nonfilamentous colony	4
2a.	Filament branched, each cell mostly filled with green chloroplast	*Cladophora*
2b.	Filament unbranched	3
3a.	Each cell of filament containing 1 or 2 spiral-shaped green chloroplasts	*Spirogyra*
3b.	Each cell of filament containing 2 star-shaped green chloroplasts	*Zygnema*
4a.	Organism consisting of a single cell	5
4b.	Organism composed of many cells aggregated into a colony	6
5a.	Motile, teardrop-shaped or spherical organism	*Chlamydomonas*
5b.	Nonmotile, elongate cell on either end; clear, granule-containing regions at ends	*Closterium*
6a.	Colony a hollow round ball of more than 500 cells; new colonies may be present inside larger colony	*Volvox*
6b.	Colony consisting of less than 50 cells	7
7a.	Organism composed of a number of tooth-shaped cells	*Pediastrum*
7b.	Colony a loose square or rectangle of 4–32 spherical cells	*Gonium*

Organism 1 is _____
Organism 2 is _____
Organism 3 is _____
Organism 4 is _____
Organism 5 is _____
Organism 6 is _____
Organism 7 is _____
Organism 8 is _____

Suppose you want to identify the trees growing on your campus or in your yard at home. Without having an expert present, you can now do that, because you know how to use a taxonomic key. But how can you be certain that you have keyed your specimen correctly?

Typically, scientists compare their tentative identifications against *reference specimens*—that is, preserved organisms that have been identified by an expert *taxonomist* (a person who names and classifies organisms). If you are identifying fishes or birds, the reference specimen might be a bottled or mounted specimen with the name on it. In the case of plants, reference specimens most frequently take the form of *herbarium mounts* (Figure 18-1) of the plants. An **herbarium** (plural, *herbaria*) is a repository, a museum of sorts, of preserved plants. The taxonomist flattens freshly collected specimens in a plant press. They are then dried and mounted on sheets of paper. Herbarium labels are affixed to the sheets, indicating the scientific name of the plant, the person who collected it, the location and date of collection, and often pertinent information about the habitat in which the plant was found.

It is likely that your school has an herbarium. If so, your instructor may show you the collection. To some, this endeavor may seem boring, but herbaria serve a critical function. The appearance or disappearance of plants from the landscape often gives a very good indication of environmental change. An herbarium records the diversity of plants in the area, at any point in history since the start of the collection.

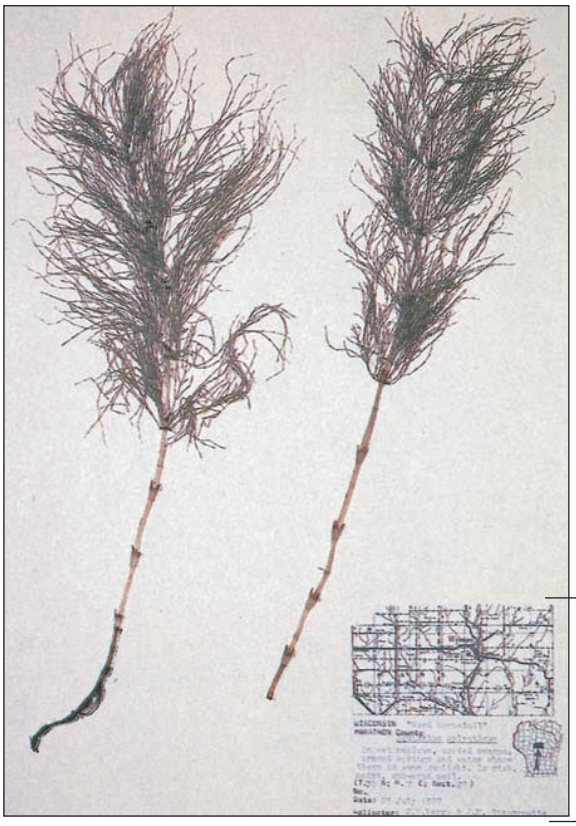


Figure 18-1 A typical herbarium mount.

MATERIALS

Per student group (table):

- set of 8 tree twigs with leaves (fresh or herbarium specimens) *or*
- trees and shrubs in leafy condition (for an outdoor lab)

PROCEDURE

Use the appropriate following key to identify the tree and shrub specimens that have been provided in the lab or that you find on your campus. Refer to the *Glossary to Accompany Tree Key* (pages 256–257) and Figures 18-2 through 18-9 (pages 251–252) when you encounter an unfamiliar term. When you have finished keying a specimen, confirm your identification by checking the herbarium mounts or asking your instructor.

Note: **Some descriptions within the key have more characteristics than your specimen will exhibit. For example, the key may describe a fruit type when the specimen doesn't have a fruit on it. However, other specimen characteristics are described, and these should allow you to identify the specimen.**

Note: **The keys provided are for *selected* trees of your area. In nature, you will find many more genera than can be identified by these keys.**

Common names within parentheses follow the scientific name. A metric ruler is provided on page 252 for use where measurements are required.

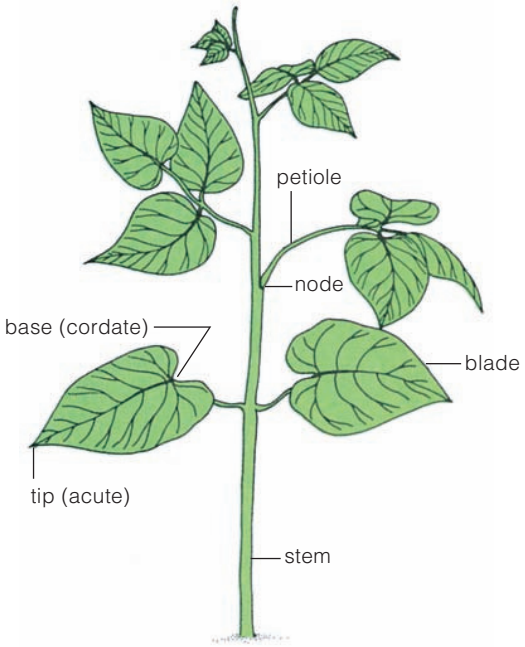


Figure 18-2 Structure of a typical plant (bean).

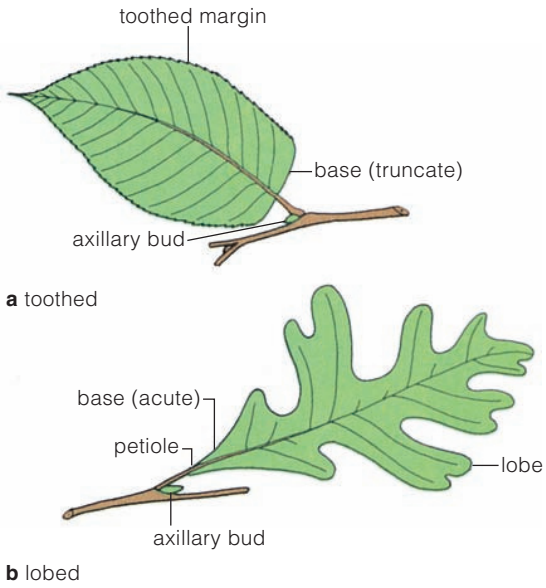


Figure 18-3 Simple leaves.

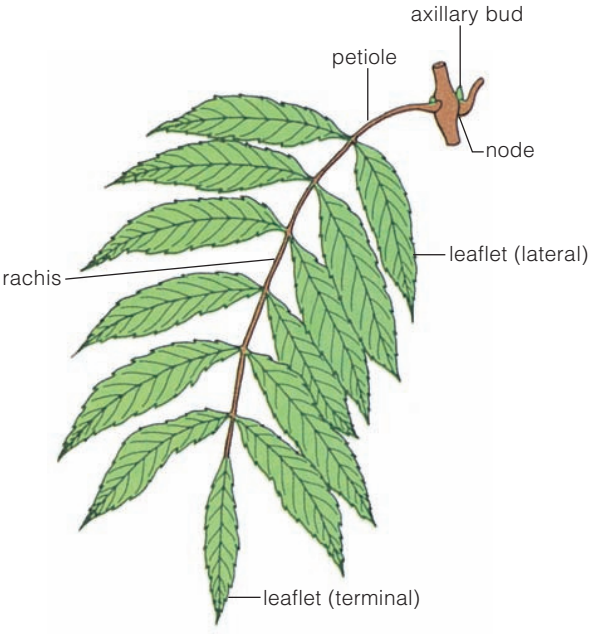


Figure 18-4 Pinnately compound leaf.

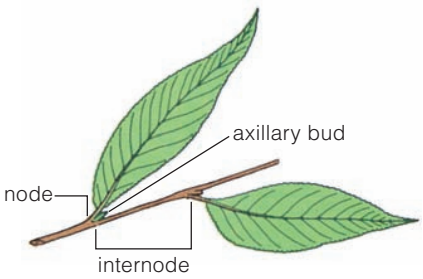


Figure 18-5 Simple leaves—alternating.

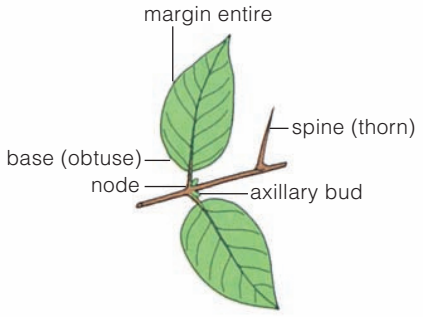


Figure 18-6 Simple leaves—opposite.

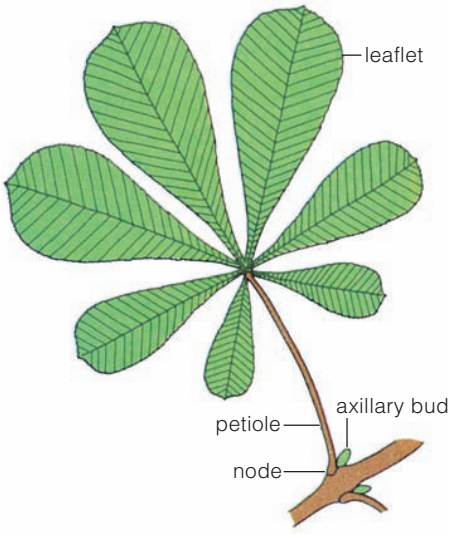
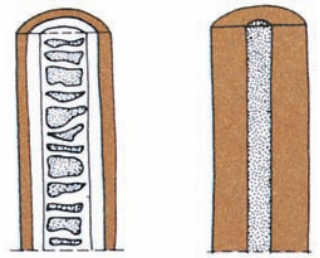
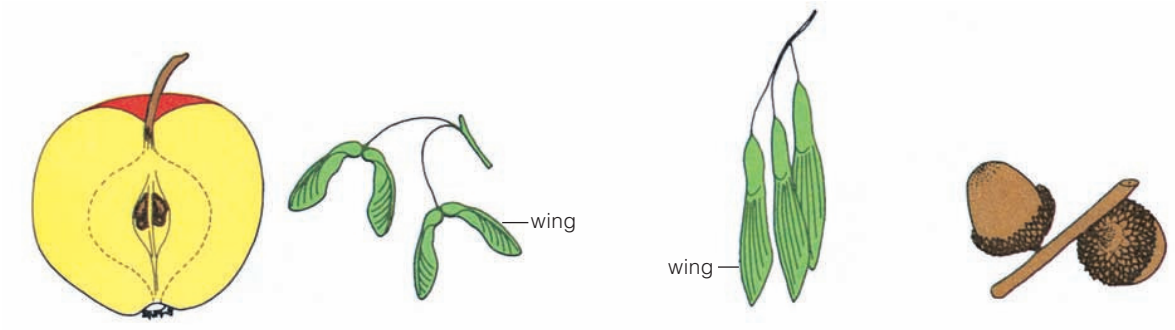


Figure 18-7 Palmately compound leaf.



a pith chambered **b** pith solid

Figure 18-8 Pith types.



a pome (apple, hawthorne) **b** schizocarps (maple) **c** samaras (ash) **d** nuts (oak)

e capsule (buckeye) **f** pods (pea) **g** drupe (cherry)

Figure 18-9 Fruit types.

Key to Some Common Genera of Trees of the Midwestern and Eastern United States and Canada		
1a.	Leaves broad and flat; plants producing flowers and fruits (angiosperms)	2
1b.	Leaves needlelike or scalelike; plants producing cones, but no flowers or fruits (gymnosperms)	22
2a.	Leaves compound	3
2b.	Leaves simple	9
3a.	Leaves alternate	4
3b.	Leaves opposite	7
4a.	Leaflets short and stubby, less than twice as long as broad; branches armed with spines or thorns; fruit a beanlike pod	5
4b.	Leaflets long and narrow, more than twice as long as broad; trunk and branches unarmed; fruit a nut	6
5a.	Leaflet margin without teeth; terminal leaflet present; small deciduous spines at leaf base	*Robinia* (black locust)
5b.	Leaflet margin with fine teeth; terminal leaflet absent; large permanent thorns on trunk and branches	*Gleditsia* (honey locust)
6a.	Leaflets usually numbering less than 11; pith of twigs solid	Carya (hickory)
6b.	Leaflets numbering 1 or more, pith of twigs divided into chambers	*Juglans* (walnut, butternut)
7a.	Leaflets pinnately arranged; fruit a light-winged samara	8
7b.	Leaflets palmately arranged; fruit a heavy leathery spherical capsule	*Aesculus* (buckeye)
8a.	Leaflets numbering mostly 3–5; fruit a schizocarp with curved wings	*Acer* (box elder)
8b.	Leaflets numbering mostly more than 5; samaras borne singly, with straight wings	*Fraxinus* (ash)
9a.	Leaves alternate	10
9b.	Leaves opposite	21
10a.	Leaves very narrow, at least 3 times as long as broad; axillary buds flattened against stem	*Salix* (willow)
10b.	Leaves broader, less than 3 times as long as broad	11
11a.	Leaf margin without small, regular teeth	12
11b.	Leaf margin with small, regular teeth	13
12a.	Fruit a pod with downy seeds; leaf blade obtuse at base; petioles flattened, or if rounded, bark smooth	*Populus* (poplar, popple, aspen)
12b.	Fruit an acorn; leaf blade acute at the base; petioles rounded; bark rough	*Quercus* (oaks)
13a.	Leaves (at least some of them) with lobes or other indentations in addition to small, regular teeth	14
13b.	Leaves without lobes or other indentations except for small, regular teeth	16
14a.	Lobes asymmetrical, leaves often mitten-shaped	*Morus* (mulberry)
14b.	Lobes or other indentations fairly symmetrical	15

15a.	Branches thorny (armed); fruit a small applelike pome	*Crataegus* (hawthorne)
15b.	Branches unarmed	17
16a.	Bark smooth and waxy, often separating into thin layers; leaf base symmetrical	*Betula* (birch)
16b.	Bark rough and furrowed, leaf base asymmetrical	*Ulmus* (elm)
17a.	Leaf base asymmetrical, strongly heart-shaped, at least on one side	*Tilia* (basswood or linden)
17b.	Leaf base acute, truncate, or slightly cordate	18
18a.	Leaf base asymmetrical; bark on older stems (trunk) often warty	*Celtis* (hackberry)
18b.	Leaf base symmetrical	19
19a.	Leaf blade usually about twice as long as broad, generally acute at the base; fruit fleshy	20
19b.	Leaf not much longer than broad, generally truncate at base; fruit a dry pod	*Populus* (poplar, popple, aspen)
20a.	Leaf tapering to a pointed tip, glandular at base	*Prunus* (cherry)
20b.	Leaf spoon-shaped with a rounded tip, no glands at base	*Crataegus* (hawthorne)
21a.	Leaf margins with lobes and points, fruit a schizocarp	*Acer* (maple)
21b.	Leaf margins without lobes or points; fruit a long capsule	*Catalpa* (catalpa)
22a.	Leaves needlelike, with 2 or more needles in a cluster	23
22b.	Leaves needlelike or scalelike, occurring singly	24
23a.	Leaves more than 5 in a cluster, soft, deciduous, borne at the ends of conspicuous stubby branches	*Larix* (larch, tamarack)
23b.	Leaves 2–5 in a cluster	*Pinus* (pines)
24a.	Leaves soft, not sharp to the touch	25
24b.	Leaves stiff or sharp and often unpleasant to touch	27
25a.	Leaves about 0.2 cm and scalelike, overlapping	*Thuja* (white cedar, arbor vitae)
25b.	Leaves needlelike, appear to form two ranks on twig	26
26a.	Leaves with distinct petioles, 0.8–1.5 cm long; twigs rough; female cones drooping from branches	*Tsuga* (hemlock)
26b.	Leaves without distinct petioles, 1–3 cm long; twigs smooth; female cones erect on branches	*Abies* (firs)
27a.	Leaves appear triangular-shaped, about 0.5 cm, and tightly pressed to twig; cone blue, berrylike	*Juniperus* (juniper, Eastern red cedar)
27b.	Leaves elongated and needlelike	28
28a.	Tree; leaves 4-sided, protrude stiffly from twig; female cones droop from branch	*Picea* (spruces)
28b.	Shrub; leaves flattened, pressed close to twig at base; seed partially covered by a fleshy coat, usually red	*Taxus* (yew)

Key to Some Common Genera of Trees of the Pacific Region of the United States and Canada		
1a.	Leaves broad and flat; plants producing flowers and fruits (angiosperms)	2
1b.	Leaves needlelike or scalelike; plants producing cones, but no flowers or fruits (gymnosperms)	15
2a.	Leaves compound	3
2b.	Leaves simple	6
3a.	Leaves pinnately arranged	4
3b.	Leaves palmately arranged	5
4a.	Leaflets number 7, fruit a samara	*Fraxinus* (ash)
4b.	Leaflets 15–17, fruit a nut	*Juglans* (walnut)
5a.	Leaflets numbering 3, lobed; fruit a schizocarp	*Acer* (box elder)
5b.	Leaflets numbering more than 3; fruit a smooth or spiny capsule	*Aesculus* (buckeye)
6a.	Three or more equal-sized veins branching from leaf base	7
6b.	Leaf with single large central vein with other main veins branching from the central vein	9
7a.	Leaves opposite; fruit a schizocarp	*Acer* (maple)
7b.	Leaves alternate	8
8a.	Leaves nearly round in outline; fruit a pod	*Cercis* (redbud)
8b.	Leaves deeply lobed, very hairy beneath; fruit consisting of an aggregation of many 1-seeded nutlets surrounded by long hairs	*Platanus* (sycamore)
9a.	Leaf lobed; fruit a nut	*Quercus* (oak)
9b.	Leaf not lobed	10
10a.	Leaves opposite; fruit a drupe; halves of leaf remain attached by “threads” after blade has been creased and broken	*Cornus* (dogwood)
10b.	Leaves alternate	11
11a.	Upon crushing, blade gives off strong, penetrating odor	*Eucalyptus* (eucalyptus)
11b.	Blade not strongly odiferous upon crushing	12
12a.	Branch bark smooth, conspicuously red-brown; fruit a red ororange berry	*Arbutus* (madrone)
12b.	Branch rough, not colored red-brown	13
13a.	Undersurface of leaves golden-yellow; fruit a spiny, husked nut	*Catanopsis* (golden chinquapin)
13b.	Leaves green beneath	14
14a.	Petiole hairy; leathery blade with a stubby spine at end of each main vein; fruit a nut	*Lithocarpus* (tanoak)
14b.	Petiole and leaf lacking numerous hairs, leaves long and narrow, more than twice as long as wide	*Salix* (willow)

15a.	Leaves needlelike	16
15b.	Leaves scalelike	23
16a.	Leaves needlelike, with 2 or more needles in a cluster	17
16b.	Leaves needlelike, occurring singly	18
17a.	Needles 2–5 in a cluster	*Pinus* (pine)
17b.	Needles 6 or more per cluster, soft, deciduous, borne at the ends of stubby, conspicuous branches	*Larix* (larch)
18a.	Round scars on twigs where old needles have fallen off; twigs smooth; needles soft to the grasp; cones pointing upward with reference to stem	*Abies* (fir)
18b.	Twigs rough, with old needle petioles remaining	19
19a.	Needles angled, stiff, sharp, pointed, unpleasant to grasp; cones hanging downward from branch	*Picea* (spruce)
19b.	Needles soft, not sharp when grasped	20
20a.	Needles round in cross section, can be rolled easily between thumb and index finger; needles less than 1.3 cm long; cones small, less than 1.5 cm	*Tsuga* (hemlock)
20b.	Needles too flat to be rolled easily	21
21a.	Tips of needles blunt or rounded, undersurface with 2 white bands; cones with long, conspicuous, 3-lobed bracts	*Pseudotsuga* (Douglas fir)
21b.	Tips of needles pointed	22
22a.	Tops of needles grooved; woody seed cones broadly oblong in outline	*Sequoia* (redwood)
22b.	Tops of needles with ridges; lacking in cones, instead having a red, fleshy, cuplike seed covering	Taxus (yew)
23a.	Twig ends appear as if jointed	*Calocedrus* (incense cedar)
23b.	Tips of branches flattened, not jointed in appearance	24
24a.	Leaves glossy and fragrant	*Thuja* (Western red cedar)
24b.	Leaves awl-shaped, arranged spirally on twig	*Sequoiadendron* (giant sequoia)

Glossary to Tree Key

- *Acorn*—The fruit of an oak, consisting of a nut and its basally attached cup (Fig. 18-9d)
- *Acute*—Sharp-pointed (Fig. 18-2)
- *Alternate*—Describing the arrangement of leaves or other structures that occur singly at successive nodes or levels; not opposite or whorled (Fig. 18-5)
- *Angiosperm*—A flowering seed plant (e.g., bean plant, maple tree, grass)
- *Armed*—Possessing thorns or spines
- *Asymmetrical*—Not symmetrical
- *Axil*—The upper angle between a branch or leaf and the stem from which it grows
- *Axillary bud*—A bud occurring in the axil of a leaf (Figs. 18-3 through 18-7)
- *Basal*—At the base
- *Blade*—The expanded, more or less flat portion of a leaf (Fig. 18-2)
- *Bract*—A much reduced leaf
- *Capsule*—A dry fruit that splits open at maturity (e.g., buckeye; Fig. 18-9e)

- *Compound leaf*—Blade composed of 2 or more separate parts (leaflets) (Figs. 18-4, 18-7)
- *Cordate*—Heart-shaped (Fig. 18-2)
- *Deciduous*—Falling off at the end of a functional period (such as a growing season)
- *Drupe*—Fleshy fruit containing a single hard stone that encloses the seed (e.g., cherry, peach, or dogwood; Fig. 18-9g)
- *Fruit*—A ripened ovary, in some cases with associated floral parts (Figs. 18-9a–g)
- *Glandular*—Bearing secretory structures (glands)
- *Gymnosperm*—Seed plant lacking flowers and fruits (e.g., pine tree)
- *Lateral*—On or at the side (Fig. 18-4)
- *Leaflet*—One of the divisions of the blade of a compound leaf (Figs. 18-4, 18-7)
- *Lobed*—Separated by indentations (sinuses) into segments (lobes) larger than teeth (Fig. 18-3b)
- *Node*—Region on a stem where leaves or branches arise (Figs. 18-2 through 18-7)
- Nut—A hard, 1-seeded fruit that does not split open at maturity (e.g., acorn; Fig. 18-9d)
- *Obtuse*—Blunt (Fig. 18-6)
- *Opposite*—Describing the arrangement of leaves of other structures that occur 2 at a node, each separated from the other by half the circumference of the axis (Fig. 18-6)
- *Palmately compound*—With leaflets all arising at apex of petiole (Fig. 18-7)
- *Petiole*—Stalk of a leaf (Figs. 18-2, 18-3, 18-4, 18-7)
- *Pinnately compound*—A leaf constructed somewhat like a feather, with the leaflets arranged on both sides of the rachis (Fig. 18-4)
- *Pith*—Internally, the centermost region of a stem (Figs. 18-8a, b)
- *Pod*—A dehiscent, dry fruit; a rather general term sometimes used when no other more specific term is applicable (Fig. 18-9f)
- *Pome*—Fleshy fruit containing several seeds (e.g., apple or pear; Fig. 18-9a)
- *Rachis*—Central axis of a pinnately compound leaf (Fig. 18-4)
- *Samara*—Winged, 1-seeded, dry fruit (e.g., ash fruits; Fig. 18-9c)
- *Schizocarp*—Dry fruit that splits at maturity into two 1-seeded halves (Fig. 18-9b)
- *Simple leaf*—One with a single blade, not divided into leaflets (Figs. 18-3, 18-5, 18-6)
- *Spine*—Strong, stiff, sharp-pointed outgrowth on a stem or other organ (Fig. 18-6)
- *Symmetrical*—Capable of being divided longitudinally into similar halves
- *Terminal*—Last in a series (Fig. 18-4)
- *Thorn*—Sharp, woody, spinelike outgrowth from the wood of a stem; usually a reduced, modified branch
- *Tooth*—Small, sharp-pointed marginal lobe of a leaf (Fig. 18-3a)
- *Truncate*—Cut off squarely at end (Fig. 18-3a)
- *Unarmed*—Without thorns or spines
- *Whorl*—A group of 3 or more leaves or other structures at a node

18.3 What Species Is Your Christmas Tree? *(About 20 min.)*

Each year millions of "evergreen" trees become the center of attraction in human dwellings during the Christmas season. The process of selecting the all-important tree is the same whether you reside in the city where you buy your tree from a commercial grower, or whether you cut one off your "back forty." You ponder and evaluate each specimen until, with the utmost confidence, you bring home that perfect tree. Now that you have it, just what kind of tree stands in your home, looking somewhat like a cross between Old Glory and the Sistine Chapel? This key contains most of the trees that are used as Christmas trees; other gymnosperm trees are included, too. The common "Christmas trees" have an asterisk after their scientific name. Note that this key, unlike those in the preceding sections, indicates actual species designations.

1a.	Tree fragrant, boughs having supported (on clear moonlit nights) masses of glistening snow on their green needles; tree a product of nature	2
1b.	Tree not really a tree but rather a product of a cold and insensitive society; tree never giving life and never having life	17
2a.	Leaves persistent and green throughout the winter, needlelike, awl-shaped, or scalelike	3
2b.	Leaves deciduous; for this reason not a desirable Christmas tree	4
3a.	Leaves in clusters of 2–5, their bases within a sheath	5
3b.	Leaves borne singly, not in clusters	9
4a.	Cones 1.25–1.8 cm long, 12–15 scales making up cone	*Larix laricina* (tamarack)
4b.	Cones 1.8–3.5 cm long, 40–50 scales comprising cone	*Larix decidua* (larch)
5a.	Leaves 5 in a cluster, cones 10–25 cm long	*Pinus strobus** (white pine)
5b.	Leaves 2 in a cluster, cones less than 10 cm long	6
6a.	Leaves 2.5–7.5 cm long	7
6b.	Leaves 7.5–15 cm long	8
7a.	Leaves with a bluish cast; cones with a stout stalk, pointing away from the tip of the branch; bark orange in the upper part of the tree	*Pinus sylvestris** (scotch pine)
7b.	Leaves 1.25–3.75 cm long; cones stalkless, pointing forward toward the tip of branch	*Pinus banksiana* (jack pine)
8a.	Leaves slender, shiny; bark of trunk red-brown; cones 5–7.5 cm long; scales of cones without any spine at tip	*Pinus resinosa** (red pine)
8b.	Leaves thickened, dull; bark of trunk gray to nearly black; cones 5 to 7.5 cm long; scales of cone armed with short spine at tip	*Pinus nigra** (Austrian pine)
9a.	Leaves scalelike or awl-shaped	10
9b.	Leaves needlelike	11
10a.	Twigs flattened, leaves all of one kind, scalelike, extending down the twig below the point of attachment	*Thuja occidentalis* (white cedar, arbor vitae)
10b.	Twigs more or less circular in cross section; leaves of 2 kinds, either scalelike or awl-shaped, often both on same branch, not extending down the twig; coneless but may have a blue berrylike structure	*Juniperus virginiana* (red cedar)
11a.	Leaves with petioles	12
11b.	Leaves lacking petioles, leaf tip notched, needles longer than 1.25 cm	*Abies balsamea** (balsam fir)
12a.	Leaves angular, 4-sided in cross section, harsh to the touch; petiole adheres to twig	13
12b.	Leaves flattened	15
13a.	Leaves 3–10 mm long, blunt-pointed; twigs rusty and hairy	*Picea mariana** (black spruce)
13b.	Leaves 2 cm long, sharp-pointed; twigs smooth	14

14a.	Cones 2.5–5 cm long; leaves ill-scented when bruised or broken; smaller branches mostly horizontal	*Picea glauca** (white spruce)
14b.	Cones 7.5–15 cm long; scales comprising cone with finely toothed markings; leaves not ill-scented when bruised or broken; smaller branches drooping	*Picea abies** (Norway spruce)
15a.	Leaves pointed, over 1.25 cm long; red fleshy, berrylike structures present	16
15b.	Leaves rounded at tip, less than 1.25 cm long, with 2 white lines on underside	*Tsuga canadensis* (hemlock)
16a.	Leaves 2–2.5 cm long, dull dark green on top, with 2 broad yellow bands on undersurface; petiole yellowish	*Taxus cuspidata* (Japanese yew)
16b.	Leaves 1.25–2 cm long, without yellow bands on underside	*Taxus canadensis* (American yew)
17a.	Tree a glittering mass of structural aluminum, sometimes illuminated by multicolored floodlights	*Aluminous ersatzenbaum** (aluminum substitute)
17b.	Tree green, produced with petroleum products, increasing our dependence upon oil; used year after year; exactly like all others of its manufacture	*Plasticus perfectus** (plastic substitute)

PRE-LAB QUESTIONS

_____ **1.** The name "human" is an example of a
(a) common name
(b) scientific name
(c) binomial
(d) polynomial

_____ **2.** Current scientific thought places organisms in one of ___ kingdoms.
(a) two
(b) four
(c) five
(d) six

_____ **3.** The scientific name for the ruffed grouse is *Bonasa umbellus*. *Bonasa* is
(a) the family name
(b) the genus
(c) the specific epithet
(d) all of the above

_____ **4.** A binomial is always a
(a) genus
(b) specific epithet
(c) scientific name
(d) two-part name

_____ **5.** The science of classifying and naming organisms is known as
(a) taxonomy
(b) phylogeny
(c) morphology
(d) physiology

_____ **6.** Which scientific name for the wolf is presented correctly?
(a) Canis lupus
(b) canis lupus
(c) *Canis lupus*
(d) Canis Lupus

_____ **7.** A road that dichotomizes is
(a) an intersection of two crossroads
(b) a road that forks into two roads
(c) a road that has numerous entrances and exits
(d) a road that leads nowhere

_____ **8.** Most scientific names are derived from
(a) English
(b) Latin
(c) Italian
(d) French

_____ **9.** One objection to common names is that
(a) many organisms may have the same common name
(b) many common names may exist for the same organism
(c) the common name may not be familiar to an individual not speaking the language of the common name
(d) all of the above are true

_____ **10.** Phylogeny is the apparent
(a) name of an organism
(b) ancestry of an organism
(c) nomenclature
(d) dichotomy of a system of classification

Name _____ Section Number _____

EXERCISE 18

Taxonomy: Classifying and Naming Organisms

POST-LAB QUESTIONS

Introduction

1. If you were to use a binomial system to identify the members of your family (mother, father, sisters, brothers), how would you write their names so that your system would most closely approximate that used to designate species?

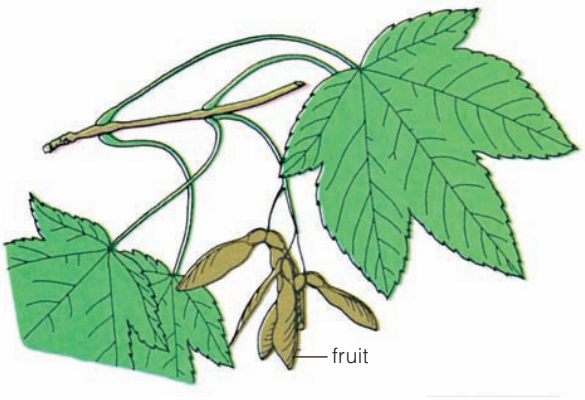
2. Describe several advantages of using scientific names instead of common names.

3. Based on the following classification scheme, which two organisms are most closely phylogenetically related? Why?

	Organism 1	Organism 2	Organism 3	Organism 4
Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Arthopoda	Arthropoda	Arthropoda	Arthropoda
Class	Insecta	Insecta	Insecta	Insecta
Order	Coleoptera	Coleoptera	Coleoptera	Coleoptera
Genus	*Caulophilus*	*Sitophilus*	*Latheticus*	*Sitophilus*
Specific epithet	*oryzae*	*oryzae*	*oryzae*	*zeamaize*
Common name	Broadnosed grain weevil	Rice weevil	Longheaded flour beetle	Maize weevil

18.2 Using a Taxonomic Key

Consider the drawing of plants A and B in answering questions 4–6.



plant A

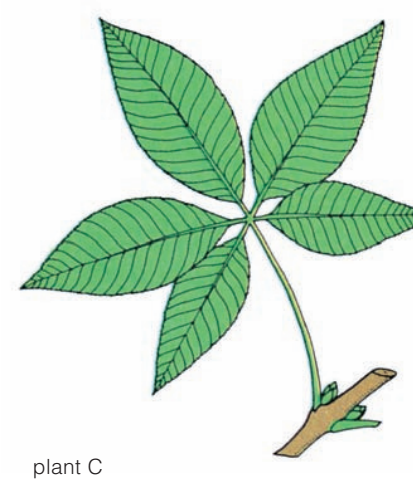
plant B

4. Using the taxonomic key in the exercise, identify the two plants as either angiosperms or gymnosperms.
Plant A is a (an) _____.
Plant B is a (an) _____.

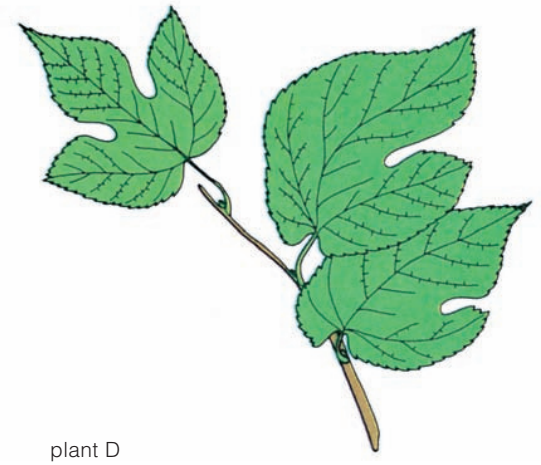
5. To what genus does plant A belong? What is its common name?
genus: _____
common name: _____

6. To what genus does plant B belong? What is its common name?
genus: _____
common name: _____

Consider the drawing of plants C and D in answering questions 7–9.



plant C



plant D

7. As completely as possible, describe the leaf of plant C.

8. To what genus does plant C belong? What is its common name?

genus: _____

common name: _____

9. Using the taxonomic key in the exercise, identify the genus of the organism below.

(Photo by J. W. Perry.)

genus: _____

Food for Thought

10. If you owned a large, varied music collection, how might you devise a key to keep track of all your different kinds of music?