

# 16

## PLANT NOMENCLATURE

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**Nomenclature** is the assignment of names utilizing a formal system. The criteria for formally naming organisms “traditionally treated as plants” are based on the rules and recommendations of the **International Code of Botanical Nomenclature** or **ICBN** (McNeill et al. 2006). Botanical names serve as symbols of a group of natural entities for the purpose of communication and data reference.

The ICBN deals with the names of extant or extinct (fossil) organisms encompassed by the field of botany (see Chapter 1 for a definition of *botany*). These include not only the land plants, but also the “blue-green algae (cyanobacteria); fungi, including chytrids, oomycetes, and slime moulds; photosynthetic protists and taxonomically related nonphotosynthetic groups.” As discussed in Chapter 1, it is now known that many of these groups are not closely related phylogenetically. Yet, the ICBN deals with these taxa, as they were historically treated as plants.

Separate nomenclatural codes exist for traditional zoology (International Code of Zoological Nomenclature) and for prokaryotes (International Code of Nomenclature of Bacteria). One difficulty with this is that photosynthetic bacteria are named both under the ICBN and under the Bacteria Code. Similarly, some of the so-called protists (itself a paraphyletic assemblage) are named both under the ICBN and the

Zoological Code. Thus, some organisms have two names, from two different nomenclatural codes. A draft of a future universal code covering all forms of life, termed the BioCode (Greuter et al. 1997), has been prepared, but has not progressed. A separate code using a phylogenetic definition, termed the *PhyloCode* (Cantino and de Queiroz 2007) has also been proposed, recently for the naming of “higher” land plant taxa (see Cantino et al. 2007).

The International Code of Botanical Nomenclature governs the rules both for the names assigned to taxa and for the name endings that denote taxon rank (see below). The ICBN is utilized in two basic activities: (1) naming new taxa, which were previously unnamed and often not described; and (2) determining the correct name for previously named taxa, which may have been divided, united, transferred, or changed in rank (see later discussion). The rules of the ICBN can be somewhat complex, often necessitating careful scrutiny, and a lawyerlike mentality. (Note that a supplementary code is utilized for cultivated plants, the “International Code of Nomenclature for Cultivated Plants.” This Code operates within the framework of the ICBN and its provisions do not override those of the ICBN.)

Any name governed by the ICBN must be **validly published** (see later discussion). **Legitimate names** are those

that are validly published in accordance with the rules of the ICBN. A validly published name that is not in accordance with the rules is an illegitimate name.

Changes to the International Code of Botanical Nomenclature are voted upon at the Nomenclatural Session of the International Botanical Congress, which assembles about every six years in some city around the world. As of this writing, the last Congress was held in Vienna, Austria, in July 2005. The following summary is based on the ICBN resulting from that Congress (McNeill et al. 2006).

## PRINCIPLES OF NOMENCLATURE

The **Principles** of the International Code of Botanical Nomenclature are stated verbatim below from the 2005 Vienna Code. Each of these will be covered in detail.

- I. Botanical nomenclature is independent of zoological and bacteriological nomenclature. The Code applies equally to names of taxonomic groups treated as plants whether or not these groups were originally so treated.
- II. The application of names of taxonomic groups is determined by means of nomenclatural types.
- III. The nomenclature of a taxonomic group is based upon priority of publication.
- IV. Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the Rules, except in specified cases.
- V. Scientific names of taxonomic groups are treated as Latin regardless of their derivation.
- VI. The Rules of nomenclature are retroactive unless expressly limited.

The details of the International Code of Botanical Nomenclature are organized into a number of **Rules**, organized as **Articles** (which are binding), **Recommendations** (which are subsidiary and nonbinding but to be preferred), and explanatory **Notes** and **Examples**.

Currently, the entire International Code of Botanical Nomenclature is available on a web site (see McNeill et al. 2006 in references).

### SCIENTIFIC NAMES

The *fundamental* principle of nomenclature is the fourth principle of the ICBN, stating that every **taxon** (a taxonomic group of any rank), whether species, genus, family, etc., can bear only one correct name (see below for precise definition of *correct* name). This is only common sense. Confusion would reign if taxonomic entities could bear more than one name or if one name could refer to more than one entity. The

names assigned to individual plant groups by the rules of the ICBN are known as **scientific names**. Scientific names are, by convention, treated as Latin (see later discussion).

As reviewed in Chapter 1, the scientific names of species are **binomials** (or **binary combinations**), consisting of two parts, the genus name plus a specific epithet. The binomial convention was first consistently used by Carolus Linnaeus (also known as Carl Linné or Carl von Linné, 1707–1778), a Swedish botanist, who is often referred to as the “father of taxonomy.” Prior to the use of binomials, the designation of species was descriptive in nature; a name commonly utilized many more words than just two, and names often varied from one author to the next.

As an example of a binomial, the species commonly known as “sweetgum” has the scientific name *Liquidambar styraciflua*. Note that botanical names at the rank of genus and below are typically italicized or underlined. The first name of the binomial, *Liquidambar* in this case, is the **genus** (L. for “birth, origin,” i.e., a kind of group) and is always capitalized. The second name of the binomial, *styraciflua* in this example, is the **specific epithet**. The specific epithet may be capitalized if it is a commemorative (named after a person or place), but the ICBN recommends that epithets not be capitalized. Recall from Chapter 1 that a **species** (L. for “appearance”) is always the entire binomial. It is incorrect to say that the species name for sweetgum is *styraciflua*, as this is the specific epithet; the species name is *Liquidambar styraciflua*. The genus name may be abbreviated by its first letter, but only after it is first spelled out in its entirety and if it would not be confused with another genus name starting with that letter; thus, the above may be abbreviated as *L. styraciflua*.

In contrast to scientific names, many taxa also bear **common names** (also called vernacular names), which are generally used by people within a limited geographic region. Common names are not formally published and are not governed by the ICBN. Scientific names are much preferable to common names for several reasons. First, only scientific names are universal, used the same worldwide; common names may vary from region to region, even within a country or within regions of a country. For example, species of the genus *Ipomoea* are known commonly as “morning glory” in the United States, but as “woodbine” in England. Differences in language will, of course, further increase the number of different common names. In addition, a single taxon may bear more than one common name, these often varying in different regions. For example, *Adenostoma fasciculatum* of the Rosaceae is known by at least two common names, “chamise” and “greasewood.” Alternatively, a single common name may refer to more than one taxon. “Hemlock” may refer to two quite different plants, either a species of *Tsuga*, a coniferous tree of the Pinaceae, or *Conium maculatum*, an

herb of the Apiaceae (the extract of which Socrates drank in execution). Second, common names tell nothing about rank and often nothing about classification, whereas scientific names generally indicate rank and yield at least some information about their classification. For example, “pygmy weed” tells nothing about rank; it could be variety, species, genus, or family. However, one immediately knows that *Crassula argentea* is at the rank of species and is a close relative to other species of *Crassula*. Third, many, if not most, organisms have no common name in any language; thus, scientific names alone must be used to refer to them. This is especially true for plants that are not showy, occur in remote areas, or belong to groups whose members are difficult to distinguish from one another.

There is a tendency in some works to arbitrarily convert all scientific species names into common names by translating from the Latin, even when these common names are not used by the native people. For example, *Carex aurea* might be designated “golden carex” or “golden sedge,” even if these names are not in common usage. It is the author’s opinion that this is less than ideal policy and that it is preferable simply to utilize scientific names and refer to common names only if they are, in fact, commonly used. However, the trend seems to be to assign standardized common names, at least for some regional floras.

## RANKS

Recall from Chapter 1 that taxa are classified hierarchically by **rank**, in which a higher rank is inclusive of all lower ranks (Figure 16.1). [Note that there are “principal” ranks, “secondary” ranks, and additional ranks (if needed) that may be used by adding the prefix “sub”; see Figure 16.1.] Each scientific name of a particular rank ends in a certain suffix according to the rules and recommendations of the ICBN (Figure 16.1). For example, Asteridae is a taxon at the rank of subclass, Asterales is at the rank of order, and Asteraceae is at the rank of family, etc. Note that taxa above the rank of genus are not underlined or italicized.

An exception to standard rank endings of taxa is the acceptance of nine traditional family names. These are Compositae (= Asteraceae), Cruciferae (= Brassicaceae), Gramineae (= Poaceae), Guttiferae (= Clusiaceae), Labiatae (= Lamiaceae), Leguminosae or Papilionaceae (= Fabaceae), Palmae (= Arecaceae), and Umbelliferae (= Apiaceae). In addition, within the Fabaceae (= Leguminosae), the subfamily name Papilionoideae is an acceptable alternative to the Faboideae. The trend today is to consistently apply the type principle (see later discussion) by using the standardized family names that end in “-aceae” and to use subfamily names that are based on these (e.g., to use “Faboideae” over “Papilionoideae”). However, plant taxonomists should know

TAXONOMIC RANKS OF LAND PLANTS	ENDING	EXAMPLE TAXON
<b>Kingdom</b>	(various)	<b>Plantae</b>
<b>Phylum = Division</b>	<b>-phyta</b>	<b>Magnoliophyta</b>
Subphylum = Subdivision	-phytina	Magnoliophytina
<b>Class [cl.]</b>	<b>-opsida</b>	<b>Asteropsida</b>
Subclass [subcl.]	-idae	Asteridae
<b>Order [ord.]</b>	<b>-ales</b>	<b>Asterales</b>
Suborder [subord.]	-ineae	Asterineae
<b>Family [fam.]</b>	<b>-aceae</b>	<b>Asteraceae</b>
Subfamily [subfam.]	-oideae	Asteroideae
<u>Tribe [tr.]</u>	-eae	Heliantheae
Subtribe [subtr.]	-inae	Helianthinae
<b>Genus [gen.]</b>	(various)	<b><i>Helianthus</i></b>
Subgenus [subg.]	(various)	<i>Helianthus</i> subg. <i>Helianthus</i>
<u>Section [sect.]</u>	(various)	<i>Helianthus</i> sect. <i>Helianthus</i>
<u>Series [ser.]</u>	(various)	<i>Helianthus</i> ser. <i>Helianthus</i>
<b>Species [sp.]</b>	(various)	<b><i>Helianthus annuus</i></b>
Subspecies [subsp.]	(various)	<i>Helianthus annuus</i> subsp. <i>annuus</i>
<u>Variety [var.]</u>	<b>(various)</b>	<i>Helianthus annuus</i> var. <i>annuus</i>
<u>Form [f.]</u>	<b>(various)</b>	<i>Helianthus annuus</i> f. <i>annuus</i>

FIGURE 16.1 Some of the taxonomic ranks and endings recognized by the International Code of Botanical Nomenclature. “Principal” ranks are in bold. “Secondary” ranks are underlined. “Sub” ranks may be used as needed, some of the possibilities indicated. Phylum, subphylum, class, and subclass may utilize different endings for Fungi or “Algae.” Standard endings above the rank of genus are required or recommended and indicate the rank of that name. “Division” may be used interchangeably with “Phylum.” Standard abbreviations are in brackets.

these classical names, as they are often used in older, as well as some current floras and other taxonomic works.

**Position** is the placement of a taxon as a member of another taxon of the next higher rank. For example, the position of the genus *Aster* is as a member of the family Asteraceae. Taxa may be the same in rank but differ in position. *Rosa* and *Aster* are both at the rank of genus but differ in position, the former in the Rosaceae, the latter in the Asteraceae.

As mentioned earlier, the prefix *sub-* can be used formally in a rank name in more categories are needed, such as *subgenus* or *subspecies*. The term *infraspecific* taxon can be used to denote a taxon below the rank of species, including, among others, subspecies and varieties.

A subspecies or variety name is a **ternary name** and consists of three parts, e.g., *Toxicodendron radicans* subsp. *diversilobum* or *Brickellia arguta* var. *odontolepis*. In these examples, the **subspecific epithet** is *diversilobum*; the **varietal epithet** is *odontolepis*. Note that, technically, the rank of subspecies is above that of variety (Figure 16.1). However, in practice, subspecies and variety are used interchangeably (Hamilton and Reichard 1992).

#### AUTHORSHIP

Scientific names are associated with one or more **authors**, the person(s) who validly published the name (see later discussion). For example, the family Rosaceae can be cited as “Rosaceae Jussieu” because de Jussieu validly published the family name. In other examples, the name of the tribe Conostylideae with authorship is “Conostylideae Lindley”; that of the genus *Mohavea* is “*Mohavea* A. Gray”; that of the species *Mohavea confertiflora* is “*Mohavea confertiflora* (Bentham) Heller”; and that of the subspecies *Monardella linoides* subsp. *viminea* is “*Monardella linoides* A. Gray subsp. *viminea* (Greene) Abrams.” Author names are often abbreviated, such as Haemodoraceae R. Br. (for Robert Brown) or *Liquidambar styraciflua* L. (“L.” being the standardized abbreviation for Linnaeus). See Brummitt and Powell 1992 and the web sites, International Plant Names Index and Index Fungorum for standardized author abbreviations.

Authorship should be cited in all scientific publications at least once, in order to clarify the name’s origin (valid publication). In practice the author is not typically memorized or recited as part of a scientific name. The authors of higher taxa are sometimes omitted in print even in scientific publications, except in detailed monographic treatments in which the nomenclatural history of the taxa under study is described. In many floras and journal publications, only species and infraspecific taxa may be listed with full authorship.

#### LEARNING SCIENTIFIC NAMES

As argued earlier, it is important to learn the scientific names of plants, correctly spelled. The serious plant taxonomist will learn many hundreds of scientific names in his/her lifetime, still just a tiny fraction of the more than 270,000 described land plant species. Beginners may at first have difficulty learning scientific names. Some suggestions for mastering them are as follows.

First, learn to divide into syllables and accent scientific names (see Botanical Names, page 620). It is often easier to recite and spell a scientific name if it is consciously broken down into syllables, each of which is separately pronounced.

Second, use mnemonic devices. Select one distinctive feature about the plant. Then find a common word that *sounds* somewhat similar to the scientific name. Link the distinctive plant feature with the similar sounding word in an active, vivid mental image, the weirder and more active the better. Thus, when you see the plant, you associate it with the mental image, which sounds like (and reminds you of) the scientific name. For example, visualizing “liquid amber” flowing from the distinctive, ball-shaped fruits of sweetgum may help you remember the genus name, *Liquidambar*.

Third, learn the etymology (meaning) of scientific names. Scientific names often are descriptive about the morphology of the plant. Once you know, for example, that the Latin word *alba* means “white” or that *leptophylla* means “narrow-leaved,” you can better associate the name with the organism. Other scientific names may be named after a person or place of significance; learning the history of these commemorative names may be helpful in memorizing them.

Finally, there is no substitute for continual practice and review. Use a combination of both oral and (for correct spelling) written recitation, with the live plant, plant specimen, photograph, or mental image in view.

#### NOMENCLATURAL TYPES

The second principle of the ICBN states that scientific names must be associated with an “element,” known as a **nomenclatural type** or simply **type**. A nomenclatural type is almost always a single specimen, e.g., a standard herbarium “sheet” for vascular plants, but it may also be an illustration. The type serves the purpose of acting as a reference for the name. If there is ever any doubt as to whether a name is correct or not, the type must be consulted.

There are different “types of types.” A **holotype** is the one specimen or illustration upon which a name is based, originally used or designated at the time of valid publication. It serves as the definitive reference source for any questions of identity or nomenclature. It is recommended that a holo-

type be deposited in a public herbarium (see Chapter 18) or other public collection, so that it is available for study by systematists. Indication of the holotype is one of the criteria for the valid publication of a name (see later discussion). Holotypes constitute the most valuable of specimens and are kept under safe keeping, usually in a large herbarium. An **isotype** is a duplicate specimen of the holotype, collected at the same time by the same person from the same population. Isotypes are valuable in that they are reliable duplicates of the same taxon and may be distributed to numerous other herbaria to make it easier for taxonomists of various regions to obtain a specimen of the new taxon. A **lectotype** is a specimen that is selected from the original material to serve as the type when no holotype was designated at the time of publication, if the holotype is missing, or if the original type consisted of more than one specimen or taxon. Lectotypes must be selected from among isotypes, syntypes, or isosyntypes (below), if these are available. A **neotype** is a specimen derived from a nonoriginal collection that is selected to serve as the type as long as all of the material on which the name was originally based is missing. Other types of types include **syntype**, which is any specimen that was cited in the original work when a holotype was not designated; alternatively, a syntype can be one of two or more specimens that were all designated as types; a duplicate of a syntype is an “isosyntype”; **paratype**, a specimen cited in the valid publication (see later discussion), but that is not a holotype, isotype, or syntype; and **epitype**, a specimen (or illustration) that is selected to serve as an “interpretive” type if the holotype, lectotype, or neotype is ambiguous with respect to the identification and diagnosis of the taxon.

Normally, we think of types as referring to genera, species, or infraspecific taxa. However, type specimens may serve as references for higher taxonomic ranks as well. For example, the type for the family Poaceae Barnhart. is the genus *Poa* L., which has as its type *Poa annua* L.

#### VALID PUBLICATION

According to the ICBN, in order for a scientific name to be formally recognized, it must be **validly published**. There are four general criteria for valid publication of a name. First, the name must be effectively published, which means that it must be published in a journal commonly available to botanists (not, say, in the local newspaper or *National Enquirer* magazine). Second, the name must be published in the correct form, i.e., properly Latinized (see later discussion), with the rank indicated (e.g., as “sp. nov.” or “gen. nov.”; see Latin Terms and Abbreviations, page 619). Such a name in correct form is known as an *admissible name*. Third, the name must be published with a Latin description or diagnosis

or with a reference to such. The Latin diagnosis may be brief, e.g., listing how the new taxon is different from a similar, related taxon. (In addition, a more detailed description in some vernacular language, or, with a new combination, a reference to a previous description, is usually included but not required.) Fourth, a nomenclatural type must be indicated. For species and ranks below species, the type refers to a specimen, the location of which is also indicated (using the acronyms of Index Herbariorum; Holmgren et al. 1990; Chapter 18). For genera and above, the type is a reference to a species; e.g., the type for the genus *Stebbinsoseris* is the species *S. heterocarpa* (Nutt.) Chamb. An example of a valid publication, illustrating these criteria, is seen in Figure 16.2. The term **protologue** is “everything associated with a name at its valid publication, i.e., description or diagnosis, illustrations, references, synonymy, geographical data, citation of specimens, discussion, and comments” (McNeil et al. 2006).

A full citation of a scientific name may include the authorship and the journal, volume, page numbers, and date of publication. For example, a complete citation for the species cited in Figure 16.2 is “*Perityle vigilans* Spellb. & A. Powell, Syst. Bot. 15: 252. 1990.” Full citations are listed in the International Plant Names Index (see References for Further Study, Web Sites, page 626).

#### PRIORITY OF PUBLICATION

The third principle of the ICBN is priority of publication, which generally states that of two or more competing possibilities for a correct name, the one published *first* is the correct one, with some exceptions. Priority of publication only applies to taxa at the rank of family and below, and priority does not apply outside a particular rank (e.g., with the change of a name in rank; see later discussion). For example, of two competing names (both legitimate and validly published)—*Mimulus* (published in 1753) and *Diplacus* (published in 1838)—*Mimulus* has priority and is the correct name when the two genera are combined into one. The principle of priority for vascular plants starts 1 May 1753 with the publication of *Species Plantarum* by Linnaeus; names published prior to that are not considered for priority. (Different groups covered by the ICBN have various starting dates.)

#### CONSERVATION OF NAMES

One adverse effect of the principle of priority is that scientific names that are well-known and frequently used may be replaced by some other name if the latter was discovered to have been published earlier. This lends a degree of instability to nomenclature. However, in such a case, a petition may be presented and voted upon at the International Botanical Congress to conserve one name over another that actually has

Effective publication, in a journal commonly available to botanists

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**A New Species of *Perityle* (Asteraceae) from Southwestern Chihuahua, Mexico**

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**ABSTRACT.** *Perityle vigilans* is described from the Sierra Madre Occidental of southwestern Chihuahua. It differs from other *Perityle* by the combination of its white ligules, sparsely setose-hispid achenes, finely grayish villosulous tomentum, and absence of pappus bristles. The new species is believed to be most closely related to *P. rosei* and *P. trichodonta*, which occur about 800 km to the south. A key is presented that distinguishes the 12 known taxa of *Perityle* occurring in the northern Sierra Madre Occidental, an area of high diversity in the genus.

In a series of three papers Powell (1969, 1973, 1974) revised the genus *Perityle*, recognizing 53 species. Except for one amphitropical disjunct, *P. emoryi* Torrey, the genus is restricted to southwestern North America. The treatment by Niles (1970) is in concurrence with regard to the circumscription of species. In his series of papers Powell proposed that speciation in *Perityle* occurs primarily by geographic isolation, that the populations of species, many of which inhabit nearly barren rock cliffs, were derived from more widespread ancestral species whose ranges were divided by geologic uplift, igneous intrusion, and subsequent erosion. Powell explained that this isolation on island-like habitats of exposed rock has resulted in a high degree of endemism, and he noted (1974) that the diversity in the genus is highest in the Sierra Madre Occidental of northwestern Mexico. He postulated that this may be the center of origin for the genus. Since that revision, seven narrowly endemic species have been added to the genus as remote areas have been explored: *P. ajoensis* Todsén (1974), *P. batopilensis* Powell (1983), *P. carmenensis* Powell (1976), *P. fosteri* Powell (1983), *P. huecoensis* Powell (1983), *P. specuicola* Welsh and Neese (1983), and *P. vandevenderi* B. Turner (1989). A few varieties also have been described. This article adds an eighth species, this from the isolated mid-elevations of the west slope of the Sierra Madre Occidental.

to 3 mi. NE along road, just below oak zone and in lower edge of zone, elev. 1700 m, 27°52'30"N, 107°59'30"W, 25 Apr 1985, Spellenberg, Soreng, Corral, Todsén 8104 (holotype: NMC; isotypes: ENCB, NY, MEXU, SRSC, TEX, UC. Escuela Superior Agricultura "Hermanos Escobar" [Cd. Juárez].

Plantae perennes suffrutescens subpulvinatae, caulibus 2.5-8.5 cm longis. Indumentum densum, griseum, minute villosulum. Folia opposita, periolata, laminae ovatae rhombeae-ovatae, 2.5-5.5 mm longae, 1.7-4 mm latae, dentibus 0-3 brevibus obtusis in uterque marginibus. Capitula terminales solitaria radiata; corollae radii 6-8, ligulis 2.5-3.0 mm longis, 1.5-2.5 mm latis, in tubis extus et laminis subtus glandulis aureis sparsis obsitis; corollae disci ca. 35-40, ca. 2.0 mm longae. Achaenia anguste obdeltata nigra 2.2-2.5 mm longa modice pilosa-hispida. Pappus obsolete constans ex corona dentibus tenuibus triangularibus minoribus quam 0.1 mm longis. Fig. 1.

Plants suffruticose, more or less cushion-like, the stem tips ascending. Stems 2.5-8.5 cm long, densely and finely grayish-villosulous, the fine kinked hairs over-topping yellowish spherical glands. Leaves opposite, pubescent as the stem, the upper leaves slightly more densely so than the lower; petioles slender, expanding into the cuneate leaf base, 2-3 mm long; blades ovate to rhombic-ovate, broadly cuneate at the base, 2.5-5.5 mm long, 1.7-4.0 mm wide, with 0-3 low blunt teeth on each margin, when only 1 tooth the blade then subhastate. Capitulescence of a

**Name in Latin** — *Perityle vigilans* Spellenb. & A. Powell, sp. nov. (fig. 1). — TYPE: Mexico, Chihuahua, Municipio Maguarichi, on igneous rocks at Maguarichi and

**Rank indicated**

**Type specimen indicated**

**Latin description**

**Vernacular description**

FIGURE 16.2 Example of a new species description, illustrating the components of valid publication. Note the abbreviation "sp. nov." after the scientific name, meaning *species nova*, Latin for "new species." Rewritten from *Systematic Botany*, by permission.

priority. Such a procedure is outlined as three Amendments to the ICBN: *Nomina familiarum conservanda*, *Nomina generica conservanda et rejicienda*, and *Nomina specifica conservanda et rejicienda* (L. “conservanda,” conserving; “rejicienda,” rejecting). The rationale for the conservation of names is to provide greater stability in nomenclature by permitting names that are well-known and widely used to persist, even upon the discovery of an earlier, but more obscure, name.

### NAME CHANGES

Occasionally, the name of a taxon will change. Name changes can occur for only two reasons: (1) because of the recognition that one name is illegitimate (contrary to the rules), and, thus, another name must take its place; or (2) because additional taxonomic study or research (for example, a cladistic analysis) has resulted in a change of the definition and delimitation of a taxon; this process is known as a **taxonomic revision**.

There are four basic types of nomenclatural activities that can result in a name change. First, a single taxon may be **divided** into two or more taxa, often called “segregate” taxa because they are segregated from one another relative to the original classification. This is done generally via the recognition of features that clearly distinguish two or more groups from one another. For example, the genus *Langloisia* has been split into two genera, *Langloisia* and *Loeseliastrum*, based on a number of morphological, anatomical, and palynological (pollen) features that distinguish them. Ideally, the segregate groups should be monophyletic, as based upon a rigorous cladistic analysis (see Chapter 2). Other examples of taxa being divided are:

1. The genus *Carduus* of the family Asteraceae is often split into two genera: *Carduus*, having barbellate pappus bristles, and *Cirsium*, having plumose pappus bristles
2. The genus *Rhus* of the Anacardiaceae has been split into several segregate genera, such as *Malosma*, *Rhus*, and *Toxicodendron*, the last including poison-oak and poison-ivy
3. The classical family Liliaceae has been split into numerous families, such as the Liliaceae s.s., Melanthiaceae, Philesiaceae, and Smilacaceae
4. The large genus *Haplopappus* of the Asteraceae has been split into several genera, including *Anisocoma*, *Ericameria*, *Hazardia*, *Haplopappus*, and *Isocoma*

Note that when a larger taxon is divided into two or more smaller taxa of the same rank, the terms **sensu lato** (abbreviated **s.l.**) and **sensu stricto** (abbreviated **s.str.** or **s.s.**) may be used to distinguish the more inclusive and less inclusive treatments, respectively. For example, *Haplopappus* s.l. contains many more species than *Haplopappus* s.s., the latter of which is what remains after *Haplopappus* s.l. is split into many segregate genera.

A second, major name change occurs when two or more separate taxa are **united** into one. One reason for uniting taxa is the recognition that features previously used to distinguish them are, upon more detailed study, not supportive of their being different; i.e., there is no clear character state discontinuity. Another reason to unite taxa may be based on cladistic studies, in which of two or more separate taxa, one (or more) is demonstrated to be paraphyletic; thus, one way to eliminate a paraphyletic taxon is to unite it with other taxa such that the new inclusive group is now monophyletic (see Chapter 1). In cases of taxa being united, the final name used is the one that was *published earliest*, according to the principle of priority. Examples of taxa being united are:

1. The species *Bebbia juncea* and *Bebbia aspera*, which were considered indistinct and were united into one species, *B. juncea*
2. The genera *Diplacus* and *Mimulus*, which were united into one genus, *Mimulus*
3. The families Apocynaceae and Asclepiadaceae, which have been united into one family, the Apocynaceae (which could be designated Apocynaceae s.l. to distinguish it from the earlier circumscribed less inclusive family)

Third, a taxon may be **transferred in position**, i.e., from one taxon to another of the *same rank*. Examples of this are:

1. The species *Rhus laurina* was transferred in position as a member of the genus *Malosma*, the new species name being *Malosma laurina*
2. The species *Sedum variegata* was transferred to the genus *Dudleya*, the new species name being *Dudleya variegata*

Note that a transfer in position may be an automatic result of uniting or dividing taxa of higher rank. For example, if the genera *Diplacus* and *Mimulus* are united into the genus *Mimulus*, then all of the *species* of *Diplacus* must be transferred in position.

Fourth, a taxon may be **changed in rank**. Examples include:

1. The species *Eruca sativa* was changed to the rank of subspecies (of the species *E. vesicaria*), the new combination being *Eruca vesicaria* subsp. *sativa*
2. The variety *Viguiera deltoidea* var. *parishii* was changed to the rank of species, the new name being *Viguiera parishii* (*V. deltoidea* persisting as a separate species)

Note in the two rank change examples just given that the original names for the epithets are retained. A name that is changed in rank may be retained, but only if an earlier name

for the same taxon had not already been published at that rank (and also, only if the *same* name had not already been used for another taxon; see **homonym**, page 619). The principle of priority does not apply outside the rank of a taxon, however; this means that if a name is changed in rank, the date of publication of the original name (before being changed in rank) cannot be considered in evaluating priority of publication with respect to the change.

In some cases a taxonomic study results in the **remodeling** of a taxon, i.e., a change in diagnostic characteristics, those that distinguish the taxon from other taxa. In these cases, a name change is not warranted and the rules of the ICBN need not apply.

A **basionym** is the “name-bringing or epithet-bringing synonym,” i.e., the original (but now not accepted) name, part of which has been used in a new combination. As seen earlier, if a species or infraspecific name is transferred in position or rank, the specific or infraspecific epithet of the unaccepted basionym may be retained (unless violating another rule of the code, such as priority of publication, e.g., if the taxon had already been named, or if the name had already been used for another taxon at that rank). The name of the author(s) who originally named the basionym is also retained and placed in parentheses ahead of the author who made the change. Thus, botanical names may have two sets of authors: the author(s) set in parentheses who originally named the basionym, and the author(s) who made the name change. (This is true only for names at and below the rank of genus; for suprageneric names, such as family, these “parenthetical” authors are not cited.) From some of the examples cited previously:

1. When *Sedum variegata* Wats. was transferred to the genus *Dudleya* by Moran, the new species name became *Dudleya variegata* (Wats.) Moran. The original epithet, *variegata*, is retained, and the author associated with that epithet, Watson in this case, is also retained, but is placed in parentheses preceding the new author. The basionym in this case is *Sedum variegata* Wats., the original name.
2. When *Dilatris caroliniana* Lam. was transferred to the genus *Lachnanthes* by Dandy, the new species name became *Lachnanthes caroliniana* (Lam.) Dandy. The basionym in this case is *Dilatris caroliniana* Lam.
3. When *Fumaria bulbosa* L. var. *solida* L. was elevated to the rank of species by Miller, the new name became *Fumaria solida* (L.) Miller. The basionym in this case is *Fumaria bulbosa* L. var. *solida* L. Subsequent to this change, *Fumaria solida* (L.) Miller was transferred in position by Clairv to the genus *Corydalis*, the new name

becoming *Corydalis solida* (L.) Clairv [*not Corydalis solida* (Mill.) Clairv]. Note that it is the author of the retained name of the basionym, *Fumaria bulbosa* L. var. *solida* L., that is retained in parentheses.

An **autonym** is an automatically created name for infrafamilial, infrageneric, and infraspecific taxa. Autonyms are automatically created whenever a family is divided into subfamilies, tribes, or subtribes; a genus is divided into subgenera or sections; or a species is divided into subspecies or varieties. Of the two or more subtaxa formed, the autonym is used for the one that corresponds to the original type specimen. Autonyms have no authors; only the higher taxa upon which they are based and the other subtaxa have formal authorship. For example, Isely split *Lotus stipularis* (Benth.) E. Greene into two varieties: *L. stipularis* (Benth.) E. Greene var. *ottleyi* Isely and *L. stipularis* (Benth.) E. Greene var. *stipularis*; note that the latter variety, containing the autonym, lacks authorship because its type is the same as that for the originally described species.

For infrafamilial taxa, the autonym has the same root name as the family but a different ending that corresponds to the infrafamilial rank. For example, the family Euphorbiaceae is usually divided into subfamilies, one of which, the Euphorbioideae, is the autonym; this subfamily, of course, contains the genus *Euphorbia*, the type for the family. For infrageneric taxa, the autonym is identical to the genus name and should be preceded by the name of the rank to avoid confusion. For example, *Ceanothus* (a genus) consists of two subgenera, subgenus *Ceanothus* and subgenus *Cerastes*; subgenus *Ceanothus* is the one that includes the type for the genus itself. For infraspecific taxa, autonyms are identical to the specific epithet. For example, *Eriogonum fasciculatum* is divided into several varieties, one of which, *Eriogonum fasciculatum* var. *fasciculatum*, is the autonym, based on the original type specimen for the species.

#### SYNONYMS

A **synonym** is an unaccepted name, *by a particular author or authors*, applying to the same taxon as the accepted name. Synonyms are unaccepted for either of two reasons: (1) because they are illegitimate, i.e., contrary to the rules of the ICBN; or (2) because of taxonomic judgment, i.e., a particular author rejects the classification represented by the synonym.

A **homotypic** (or **nomenclatural**) **synonym** is an unaccepted name that is based on the same type as that of the accepted name. For example, *Krynitzkia decipiens* M. E. Jones is a homotypic synonym of *Cryptantha decipiens* (M. E. Jones) A. Heller because both names are based on the same type specimen. A **heterotypic** (or **taxonomic**) **synonym** is an



unaccepted name based on a type different from that of the correct name. For example, *Pavia* Mill. (1754) is a heterotypic synonym of *Aesculus* L. (1753) if the two taxa are combined into one genus; this is because they have different holotypes. Synonyms are typically indicated in brackets following the correct name, such as *Malosma laurina* (Nutt.) Abrams [*Rhus laurina* Nutt.] or *Machaeranthera juncea* (Greene) Hartman [*Haplopappus juncea* Greene].

A **correct name** is a validly published, legitimate name that is adopted by a particular author or authors. Recall that the fundamental principle of the ICBN states that each taxon can have only one correct name. Thus, if there are two or more competing names for the same taxon, e.g., *Malosma laurina* (Nutt.) Abrams and *Rhus laurina* Nutt., only one of them can be correct. However, which name is correct may depend on the author(s) of a given reference book or journal. For example, according to one author, *Rhus laurina* Nutt. is the correct name and *Malosma laurina* (Nutt.) Abrams is the synonym. According to other authors, *Malosma laurina* (Nutt.) Abrams is the correct name and *Rhus laurina* Nutt. is the synonym.

A **homonym** is one of two (or more) identical names (not including authorship) that are based on different type specimens. The **later homonym**, based on publication date, is illegitimate (unless it is conserved; see earlier discussion). For example, *Cryptantha foliosa* Reiche and *Cryptantha foliosa* Greene are homonyms. *Cryptantha foliosa* Reiche is a later homonym and illegitimate because its publication date (Anales Univ. Chile 121: 827. 1907.) was after that of *Cryptantha foliosa* Greene (Pittonia 1: 113. 1887.). The two names in this case refer to different taxa.

A **tautonym** is a binomial in which the genus name and specific epithet are identical in spelling. Tautonyms are not permitted in botanical nomenclature. For example, the name *Helianthus helianthus* is a tautonym and not validly published, whereas *Helianthus helianthoides* is not a tautonym and would be permitted. (Note that zoological nomenclature does permit tautonyms, as in *Gorilla gorilla*.)

#### LATIN TERMS AND ABBREVIATIONS

Certain Latin terms and abbreviations are often used in scientific names. For example, the word **ex** essentially means “validly published by.” For example, *Microseris elegans* Greene ex A. Gray means that Asa Gray validly published the name *Microseris elegans* that was originally proposed (but not validly published) by Greene. The “ex” plus the author(s) preceding it may be omitted, as in *Microseris elegans* A. Gray.

The word **in** means “in the publication of;” referring to a name published within a larger work authored by the person(s) following the “in.” For example, *Arabis sparsiflora* Nutt. in T. & G. means that Nuttall validly published the name *Arabis*

*sparsiflora* in another work authored by Torrey & Gray. The “in” plus the author(s) following it may be omitted for brevity, as in *Arabis sparsiflora* Nutt. (The use of “in” is not recommended by the ICBN.)

An  $\times$  indicates a hybrid. For example, *Salvia*  $\times$  *palmeri* (A. Gray) E. Greene is a named (validly published) taxon representing a hybrid between two species: *S. apiana* Jepson and *S. clevelandii* (A. Gray) E. Greene. Alternatively, this hybrid could be represented as *S. apiana* Jepson  $\times$  *S. clevelandii* (A. Gray) E. Greene. Hybrids may also be indicated by placing the prefix *notho-* prior to the rank name, as in *Polypodium vulgare* nothosubsp. *mantoniae* (Rothm.) Schidley, indicating that the named subspecies is of hybrid origin.

The abbreviation **sp. nov.** following a binomial (e.g., “*Eryngium pendletonense*, sp. nov.”) refers to the Latin *species nova* and means that the species is new to science. Similarly, **gen. nov.** (*genus novum*) cites a new genus name. The abbreviation **comb. nov.** following a name refers to the Latin *combinatio nova* and means that the taxon has recently been transferred to a new position or rank. An example of such a change is:

***Lithospermum album*** (G. L. Nesom) J. Cohen, **comb. nov.** Basionym: *Macromeria alba* G. L. Nesom, Madroño 36: 28. 1989. Type: Mexico. Tamaulipas, Mpio. Gomez Farias, 5–7 km, NW of Gomez Farias, just S of Agua del Indio, 30 May 1969, A. Richardson 1763 (holotype: TEX)."

Note that to be validly published, a comb. nov. only requires reference to the basionym and to the protologue.

The abbreviations “aff.” and “cf.” are used to describe plant specimens whose identity is uncertain. The distinction between the two abbreviations is unclear, as different taxonomists have used them with slightly different meanings. The abbreviation **aff.** preceding a taxon name literally means “related to” (Latin *affinis*, “related, connected”), as in “*Calyptridium* aff. *monandrum*” or “aff. *Calyptridium monandrum*.” This abbreviation implies some type of close relationship, presumably an evolutionary relationship, but also that the specimen differs from the cited taxon in some way, e.g., beyond the described range of variation for one or more characters; the cited specimen might, in fact, be indicative of a new taxon. The abbreviation “**cf.**” (Latin *confer*, “compare”) preceding a taxon name, as in “*Calyptridium* cf. *monandrum*” or “cf. *Calyptridium monandrum*,” indicates that the identity of a specimen is more questionable or uncertain (perhaps because references or comparative specimens are not available), and should be compared with specimens of the taxon indicated (i.e., the name following “cf.”) for more detailed study.

**Circumscription** refers to the boundaries of a taxon, i.e., what is included within it and how it is delimited from other

taxa. As alluded to earlier, **s.l.** (*sensu lato*) means “in the broad sense,” referring to a broad, inclusive taxon circumscription, and **s.str.** or **s.s.** (*sensu stricto*) means “in the strict sense,” referring to a narrow, exclusive circumscription.

A list of some standard terms, abbreviations, and symbols, including the preceding, are as follows:

1. **aff.** (*affine*) means “related to”
2. **auct. non** (*auctorum non*) means “not of these authors,” referring to a “misapplied” name, such that the type specimen of the name does not fall within the circumscription of the taxon being referred to by that name
3. **cf.** (*confer*) means “compare to”
4. **comb. nov.** (*combinatio nova*) means a new nomenclatural combination
5. **emend.** (*emendatio*) means a correction or amendment
6. **et** is Latin for “and”
7. **ex** is Latin for “from,” meaning validly published by
8. **gen. nov.** (*genus novum*) means a new genus
9. **in** is Latin for “in,” meaning in the publication of
10. **ined.** (*ineditus*) means not validly published
11. **nom. cons.** (*nomen conservandum*) means a conserved name
12. **nom. nov.** (*nomen novum*) means a new name, e.g., proposed as a substitute for an older name (e.g., an illegitimate homonym, in which case the older name serves as the type for the new one)
13. **nom. nud.** (*nomen nudum*) means published without a description or diagnosis, making the name invalid
14. **non** is Latin for “not”
15. **n. v.** (*non visus*) is Latin for “not seen,” typically meaning that authors did not see a specimen, such as a type.
16. **orth. cons.** (*orthographia conservanda*) means a conserved spelling
17. **s.l.** (*sensu lato*) means “in the broad sense”
18. **s.s.** or **s.str.** (*sensu stricto*) means “in the narrow sense”
19. **sp. nov.** (*species nova*) means a new species
20. **stat. nov.** (*status novus*) means a change in rank, e.g., elevating a varietal name to specific status
21. **typ. cons.** (*typus conservandus*) means a conserved type specimen
22. **typ. des.** (*typus designatus*) means the designation of a type specimen
23. **vide** (*video*) means to cite a reference
24. × indicates a hybrid
25. ! (symbol for *vidi*, “I have seen it”) can mean a) a confirmation of a name, as on an annotation label agreeing with the name on the original herbarium label; or b) indication that a specimen (usually a type) has been seen by the author in a publication
26. = a heterotypic synonym, based on a different type

27. ≡ a homotypic synonym, based on the same type

#### INDEPENDENCE OF BOTANICAL NOMENCLATURE

The International Code of Botanical Nomenclature is independent of the International Code of Zoological Nomenclature. Thus, there may be some names of plants, algae, or fungi that are identical to those of some animals (and “Protista”). For example, the genus *Morus* refers both to a flowering plant, the mulberry, and to a bird, the gannet; *Ficus* is the genus name of the figs and of a group of gastropods. A separate code is also used for the “Prokaryotes” (including the bacteria) and viruses.

#### RETROACTIVITY OF THE ICBN

The Rules of the International Code of Botanical Nomenclature are retroactive, except in specified cases.

### BOTANICAL NAMES

“Those who wish to remain ignorant of the Latin language, have no business with the study of botany,” (J. Berkenhout, 1789, cited in Stern, 1992).

“Botanical Latin is best described as a modern Romance language of special technical application,” (Stern 1992).

The fourth principle of the ICBN is that botanical names are treated as Latin, a language chosen because of its classical history (in the past being the language of scholars) and perhaps because it is no longer in active use (minimizing international rivalries). No matter what the language of the person who published a name, the name itself must consist of direct Latin words or be “Latinized,” i.e., converted from the vernacular to the Latin. Thus, the Latin alphabet (which is almost identical to the English alphabet) and grammatical rules must be used.

#### GENDER

All Latin words have a gender: masculine, feminine, or neuter. Gender is a grammatical term, to be distinguished from male and female sex. It is usually only of concern for names at the rank of genus or below. The standardized gender endings are:

Masculine	Feminine	Neuter
-us	-a	-um
-er	-ra	-rum
-is	-is	-e
-r	-ris	-re

The first row of endings (-us, -a, and -um) are those most commonly used. For example, the gender of the genus *Amaranthus* is masculine, *Crassula* is feminine, and *Polygonum* is neuter. Specific or infraspecific epithets are usually adjectives, the endings of which must agree in gender with that of

the genus name, as in *Amaranthus albus*, *Crassula connata*, and *Eriogonum fasciculatum* subsp. *polifolium*. However, in rare cases the specific or infraspecific epithet is a noun (in apposition), in which case it retains its original gender. For example, in *Cypripedium calceolus*, *calceolus* is a noun and retains the masculine gender despite the neuter gender of the genus name.

One exception to the standardized gender endings is that many tree genera are typically treated as *feminine*, regardless of ending. For example, the genera *Quercus*, *Pinus*, and *Liquidambar* are feminine in gender, even though they have masculine endings. Thus, specific or infraspecific adjectival epithets of these genera names must be feminine (to agree in gender), as in *Quercus alba*, *Pinus ponderosa*, and *Liquidambar styraciflua*.

Note that a **name change** (divided, united, transferred in position, or changed in rank) can necessitate a *change in the gender ending of a specific epithet*. For example, for species *Haplopappus squarrosus*, the ending (-us) is masculine. When this species is transferred to the genus *Hazardia*, the new name becomes *Hazardia squarrosa*. Although the root of the specific epithet does not change, its ending may, in order to agree in gender with the new genus name.

#### NUMBER

Names of genera, infrageneric names (such as subgenera or sections), and species or infraspecific combinations are all treated as the singular case in Latin. However, all taxon names above the rank of genus are treated as Latin plural nouns. Thus, it is correct to say, e.g., “The Orchidaceae are a large family of monocotyledons” and “The Rosales consist of many species.”

#### COMMEMORATIVES

Commemorative names are those named after a person or place. Specific or infraspecific commemorative names are usually treated as the genitive case (denoting possession) and must have genitive endings. For male commemoratives, the ending is *-ii*, if the name ends in a consonant, as in *Isoetes orcuttii* (unless the terminal consonant is *-r* or *-y*, in which case a single *-i* is used, as in *Erigeron breweri*) or *-i*, if the name ends in a vowel other than *a*, as in *Arctostaphylos pringlei*. The ending *-orum* or *-iorum* can be used for plural commemorative epithets, e.g., *Ambrosia johnstoniorum* (named for I.M. and M.C. Johnston). For commemorative names that end in *-a* (regardless of sex) an *-e* is added, as in *Baccharis vanessae* (female) or *Aphelandra trianae* (male). For female commemoratives, regardless of the last letter of the name, the ending is always *-ae* or *-iae*, e.g., *Hippeastrum wilsoniae* or *Carex barbarae*.

In some cases a commemorative name is treated as an adjective, in which case the endings *-ianus*, *-iana*, or *-ianum* may be used. These endings agree in gender with the

genus name, as in *Lotus nuttallianus* (named after Thomas Nuttall), *Prunus caroliniana* (named after the Carolinas), or *Antirrhinum coulterianum* (named after John M. Coulter). Another suffix ending used for place commemoratives is *-ensis*, etc., as in *virginensis* (“of Virginia”) or *capensis* (“of the Cape”).

Finally, if the personal name is already converted to Latin, e.g., Linnaeus or Xantus, then the commemoratives are given appropriate Latin genitive endings, e.g., *linnaei* (not *linnaeusii*) or *xanti* (not *xantii*).

#### PRONUNCIATION OF NAMES

Although scientific names are universal, their pronunciation may vary from region to region, especially between different countries. For example, European pronunciations are often different from those of most American botanists. There are no international agreements as to how scientific names should be pronounced. Very often, pronunciations are influenced by one’s native language. One should be flexible and adaptive with regard to pronunciations, as the overriding goal is communication.

The rules cited in Figures 16.3 and 16.4 are recommended here. These generally use traditional English for pronunciation of diphthongs, vowels (long and short), and consonants and “reformed” academic pronunciation (based on classical Latin) for converting to syllables and for accenting. (See Stern, 1992; however, see also Weber, 1986.)

#### DIPHTHONGS

Diphthongs are two vowels that are combined together and treated as the equivalent of a single vowel. The Latin diphthongs and their “traditional” English pronunciations are:

Diphthong	English Pronunciation	Example
ae	long “e”	<i>Tropaeolum</i>
oe	long “e”	<i>Kallstroemia</i>
au	“aw”	<i>Daucus</i>
ei	long “i”	<i>Eichhornia</i>
eu	long “u”	<i>Teucrium</i>
ui	as in “quick”	<i>Equisetum</i>

Note that “ie” is not a Latin diphthong, but two separate vowels, each of which would be pronounced separately, as in the genus *Parietaria* (Pa-ri-e-ta-ri-a). Also note that “oi” is not a Latin diphthong. Technically, each vowel should be pronounced separately, as in *Langloisia* (Lan-glo-i-si-a). However, by convention “oi” is often pronounced like the English language diphthong, as in “oil.” Thus, the genus *Langloisia* is often heard as Lan-gloi-si-a.

Rule	Example	Syllables
A single consonant between two vowels or diphthongs goes with the second one Exception: an “x” between two vowels or diphthongs goes with the preceding one	<i>Tridens</i> <i>exaltataus</i>	Tri-dens ex-al-ta-tus
Two adjacent consonants between vowels or diphthongs are split evenly Exceptions: the combinations bl, cl, dl, gl, kl, pl, tl; br, cr, dr, gr, kr, pr, tr; and ch, ph, th go together with the following vowel	<i>guttatus</i> <i>scabra</i> <i>leptocladus</i> <i>Ephedra</i> <i>agrifolia</i> <i>brachypoda</i> <i>ereomophila</i> <i>Notholaena</i>	gut-ta-tus sca-bra lep-to-cla-dus E-phe-dra a-gri-fo-li-a bra-chy-po-da e-re-mo-phi-la No-tho-lae-na
Of three or more consonants between two vowels or diphthongs, all but the first go with the second vowel or diphthong	<i>absconditus</i>	ab-scon-di-tus

FIGURE 16.3 Rules for converting Latinized scientific names into syllables.

Occasionally, adjacent vowels will resemble a diphthong, but are actually separate vowels. In “ligatured” typesetting, the two letters of a diphthong are connected together, such as “æ,” to distinguish the diphthong from two adjacent vowels. However, in cases where the diphthong is not specially indicated (most print these days), a diaeresis (¨) is permitted to indicate that the vowel combination is not a diphthong. For example, in the genera *Aloë*, *Kalanchoë*, and *Monanthochloë*, there is no diphthong; the diaeresis shows that the “o” and “e” are separate vowels and are pronounced separately. (Sometimes these are ignored in practice; for example *Aloë* is usually pronounced as if the ë were absent, as in Ah-loh.)

#### SYLLABLES

Latin words have as many syllables as there are vowels and diphthongs. Every syllable of a Latin word is pronounced. Thus, it is often valuable to convert scientific names to syllables in order to pronounce them properly and better memorize them. Some of the rules for this are enumerated in Figure 16.3. Special rules for the pronunciation of consonants and vowels are cited in Figure 16.4.

#### ACCENTING

A standard format for denoting accent is ` for a (grave) accent denoting a long vowel, ´ for an (acute) accent denoting a short vowel. Determining the accent of a scientific name may be difficult without actually looking up the word in a flora or other reference. However, if these are not available, the following general rules may be used to determine which syllable is accented and whether the vowel of that syllable is long or short.

Determining whether a vowel is long or short generally requires consulting a Latin dictionary.

The last syllable of a word is *never accented* unless the word has only one syllable; e.g., “*max*” of *Glycine máx*.

If a word has two syllables, the accent always goes with the next to the last (called the penult); e.g., *Àcer*.

If a word has three or more syllables, the accent always goes either with the next to the last (penult) or the third from the last (called the antepenult). The next to the last (penult) is accented if it ends in a consonant (in which case the vowel is short) as in *perennis* pe-rén-nis; it ends in a diphthong (which is treated as long), as in *amoenus* a-moè-nus; or it ends in a long vowel, e.g., *alsine* al-sì-ne. If none of these conditions is met, then the accent goes with the third from the last syllable (antepenult); e.g., *dracontium* dra-cón-ti-um.

#### COMMEMORATIVES

Although commemoratives are preferably divided into syllables and accented according to the rules of Latin, they also may be pronounced as the person or place would be pronounced in the native language. For example, the specific epithet of *Hesperoyucca whipplei* may be pronounced “wíp-pull-i” (as the person’s name is pronounced plus the letter “i”) as opposed to the Latinized pronunciation “wíp-pleh-i.” The general pronunciation rule is to simply pronounce the commemorative as it would be pronounced in the language of that person, then add the ending. However, in practice the commemorative pronunciation is usually converted to the language of the speaker, as pronunciation in the original language of that person may be unknown or unwieldy. (Remember, the overriding goal is communication!)

Pronunciation Rule	Example	Syllabizing and Accenting	Sounds Like
“C” or “g” is hard (pronounced like “k” or a hard “g,” respectively)  Exceptions: “c” or “g” is soft (pronounced like “s” or “j,” respectively) when followed by the letters/diphthongs e, i, y, ae, or oe	<i>Cakile</i> <i>Garcinia</i>  <i>Cedrus</i> <i>cinerea</i> <i>coccinea</i> <i>cyaneus</i> <i>caerulea</i> <i>Geranium</i> <i>Gibasis</i> <i>Gypsophila</i>	Ca-kì-le Gar-cí-ni-a  Cè-drus ci-nè-re-a coc-cí-ne-a cy-à-ne-us cae-rù-le-a Ge-rà-ni-um Gi-bà-sis Gyp-só-phi-la	Kah-kì-lee Gar-cfh-nee-ah  Seè-druhs sigh-nèè-ree-ah kahk-síh-nee-ah sigh-à-nee-us see-rù-lee-ah Jeh-rà-nee-uhm Jih-bà-sis Jip-só-fi-lah
When a word or root begins with cn, ct, gn, mn, pn, ps, pt, or tm, the first letter is silent; only the second letter is pronounced.	<i>Cneoridium</i> <i>Ctenium</i> <i>Gnetales</i> <i>Mniodes</i> <i>Pneumatopteris</i> <i>Psilotum</i> <i>Pteridium</i> <i>Tmesipteris</i>	Cne-o-rí-di-um Ctè-ni-um Gne-tà-les Mni-ò-des Pneu-ma-to-pté-ris Psi-lò-tum Pte-rí-di-um Tme-sí-pte-ris	Nee-oh-rí-di-um Teè-nih-um Nee-tày-lees Ni-ò-des Noo-ma-to-té-ris Sigh-lò-tum Teh-rí-di-um Meh-sí-te-ris
“Ch” is hard, pronounced like “k”	<i>Chilopsis</i>	Chi-lóp-sis	Ki-lóp-sis
“X” at the beginning of word or root is pronounced like a “z”	<i>Xylococcus</i> <i>Xanthium</i>	Xy-lo-cóc-cus Xán-thi-um	Zy-lo-cóc-cus Zán-thi-um
An “x” within a word is pronounced like “ks”	<i>Zanthoxylum</i>	Zan-thóx-y-lum	Zan-thóks-i-lum
A final “e” or “es” is long	<i>Anemone</i> Rosales	A-né-mo-ne Ro-sà-les	A-né-mo-nee Ro-sày-lees
A final “a” is short	<i>Nicotiana</i>	Ni-co-ti-à-na	Ni-co-ti-à-nah
A “y” is pronounced like a short “i”	<i>argophyllus</i>	ar-go-phy <sup>l</sup> -lus	ar-go-fí <sup>l</sup> -lus
For “uu,” both “u”s are pronounced, the first long, the second short	<i>Carduus</i>	Cár-du-us	Cár-doo-us
An “i” at the end of a syllable is short	<i>crassifolius</i>	cras-si-fò-li-us	cras-si-fòh-li-us
An “e” is long if it is derived from the Greek diphthong “ei”	<i>Achillea</i>	A-chil-lè-a	A-kil-leè-a

FIGURE 16.4 Rules for pronunciation of Latinized scientific names, ` representing a grave accent denoting a long vowel, ´ representing an acute accent denoting a short vowel.

## REVIEW QUESTIONS

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### NOMENCLATURE

1. What is nomenclature?
2. What is the name (and abbreviation) of the work that provides the rules and recommendations for plant nomenclature?
3. What groups of organisms are covered by this reference? What organisms are not?
4. What are the two basic activities governed by nomenclature (and the ICBN)?
5. What are legitimate and illegitimate names?
6. How are changes to the ICBN made?
7. Name the six principles of botanical nomenclature. Which of these is considered the fundamental principle?
8. What is the difference between the rules and the recommendations of the ICBN?
9. What is meant by a scientific name? Give three examples.
10. Which scientific names (i.e., at which rank) are always binomials (binary combinations)? Give an example of a binomial.
11. Who first consistently used the binomial and is called the “father of taxonomy”?
12. What is the correct form of a binomial?
13. For *Quercus dumosa* Nuttall, what is (a) *Quercus*; (b) *dumosa*; (c) *Quercus dumosa*; (d) Nuttall?
14. What are common names?
15. Name the reasons scientific names are advantageous over common names.
16. What is the difference between rank and position?
17. Name the standardized or recommended endings for scientific names at the ranks of phylum, class, subclass, superorder, order, family, subfamily, tribe.
18. What is the rank of the following: (a) Conostyloideae; (b) Flacourtiaceae; (c) Haemodorea; (d) Asteridae; (e) *Linnaea borealis* var. *longiflora*; (f) Liliopsida; (g) Magnoliophyta; (h) Rosales; (i) *Tribonanthes*; (j) *Tribonanthes variegata*; (k) *Phlebocarya ciliata* subsp. *pilosissima*?
19. What is the additional, validly published name for the Apiaceae; Arecaceae; Asteraceae; Brassicaceae; Fabaceae; Faboideae; Clusiaceae; Lamiaceae; Poaceae?
20. What is a ternary name? What are two infraspecific ranks and which is “higher”?
21. What does the author of a scientific name refer to?
22. Name four suggestions for memorizing scientific names.
23. What is meant by a nomenclatural “type”?
24. What is the difference between a holotype, isotype, lectotype, and neotype?
25. What is the nomenclatural type of a family name?
26. What is meant by “priority of publication”?
27. When and with what publication does priority of publication officially begin?
28. What is an adverse consequence of priority of publication?
29. What is conservation of names and how is this accomplished?
30. What are the two basic reasons for changing a scientific name?
31. Give the four major ways that names are changed and give an example of each.
32. What is remodeling? Does it require a name change?
33. What is a basionym?
34. What does it mean if an author’s name is in parentheses, e.g., *Machaeranthera juncea* (Greene) Hartman?
35. You decide that the taxon *Xiphidium coeruleum* Aublet should be transferred in position to the genus *Schiekia*. What is the *required* new name (including authorship)? What if the new name had already been validly published?
36. You decide that the taxon *Quercus albiniana* (C. Jones) G. Smith subsp. *tomentosa* H. Carlisle should be elevated to the rank of species. What is the new name to be called (including authorship)?
37. What is an autonym? Give an example of an autonym at the rank of subfamily, subgenus, or subspecies.
38. What are the main criteria of a validly published name?
39. What is a protologue?
40. What is a synonym?
41. What are the two major reasons a name may be rejected?

42. How can a name be legitimate yet not be correct?
43. What can you infer from: *Malacothrix incana* (Nutt.) T. & G. [*Malacomeris i.* Nutt.] ?
44. What can you infer from: *Porophyllum gracile* Benth. [*P. caesium* Greene; *P. vaseyi* Greene] ?
45. What can you infer from: *Gilia diegensis* (Munz) A. & V. Grant [*G. inconspicua* (Sm.) Sweet var. *diegensis* Munz] ?
46. What is a homonym? Is a later homonym legitimate or illegitimate?
47. What is a tautonym? Are tautonyms acceptable in (a) botanical nomenclature; (b) zoological nomenclature?
48. What is meant by “in” in authorship designations? How may such a designation be simplified?
49. What is meant by “ex” in authorship designations? How may such a designation be simplified?
50. What is the meaning of an × in a scientific name, as in *Quercus ×morehus*?
51. What is the meaning of auct. non, emend., ined., nom. nov., nom. nud., s.l., s.s., and vide (!)?
52. How does the fact that a plant and a bird have the same scientific name *not* violate the principles of the ICBN?

#### BOTANICAL NAMES

53. In what language are scientific names treated?
54. Name the three Latin genders and give the standardized genus endings.
55. What is one prominent exception to these gender endings?
56. Names at which taxonomic ranks are always Latin plurals?
57. What is a commemorative name?
58. What endings may commemorative names have?
59. Are there universal rules for the pronunciation of scientific names?
60. What are the Latin diphthongs and how are they pronounced?
61. How is the combination “oi” properly pronounced in Latin?
62. What is the rule determining the number of syllables in a scientific name?
63. Name some of the specific rules for converting scientific names to syllables (refer to Figure 16.3).
64. Name some of the specific rules for pronouncing scientific names (refer to Figure 16.4).
65. Name the basic rules for accenting scientific names.
66. Convert to syllables and pronounce the following names: *Cleistes*, *Eucalyptus*, *microcarpa*, *Oenothera*, *Pyrus*.
67. A commemorative (named after a person or place) may be pronounced in what two basic ways?

#### EXERCISES

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1. Using a manual or flora of local, native plants, record 12 scientific names plus the listed synonymy for these names. Trace the nomenclatural history of these taxa names as best you can from the data given, especially noting author names in parentheses.
2. Look up these 12 scientific names using the International Plant Names Index (<http://www.ipni.org>). Record the date and journal/book of publication of these names. Also record the synonymy indicated. Does this added information elucidate the nomenclatural history of the taxa?
3. Divide into syllables, accent, and pronounce these 12 scientific names, using any available references.

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