

THE ORCHID FAMILY, ORCHIDACEAE

THE WORLD'S LARGEST FLOWERING
PLANT FAMILY AND MASTER OF
POLLINATION

The orchid family is arguably the world's largest family, with some estimates of 30,000 species.

- Although most of the species are tropical or subtropical, other species live all the way from Alaska south, with around 30+ species native to California
- The family is mostly used for gorgeous ornamentals, but the genus *Vanilla* is also the source of the flavoring from the seed pods
- Orchids have three kinds of basic life styles: epiphytes, terrestrial, and semi to wholly parasitic.
- Most temperate-climate orchids, including those in California, are terrestrial, with some counting as full-fledged fungus parasites.

The dendrobiums are basically epiphytic, growing in the wild on tree crotches where some organic material accumulates. These “perched” orchids receive more sun by living in tree crowns than on the ground.



By contrast, the lady slippers like this *Cypripedium californicum*, live directly in the ground.



Although the ghost orchid, *Cephalanthera austinae*, lives in the ground, it lacks chlorophyll and thus is parasitic on special fungi in the soil.



Vegetatively, orchids display many interesting features.

- Most terrestrial orchids have tubers or corms underground rather than ordinary roots (the exception is the parasitic ones, whose branched roots hook up to fungi)
- The leaves of terrestrial orchids are either basal or on stems and most of them...
- Are ovate to linear with parallel veins, and are simple, untoothed, and never lobed or compound
- Often these terrestrial orchid leaves are mistaken for members of the lily family

The rattlesnake orchid, *Goodyera oblongifolia*, shows basal leaves. Note the conspicuous network of white veins



Here are the leafy stems of the native brook orchid, *Epipactis gigantea*, whose leaves look similar to false Solomon's seal, *Maianthemum stellatum*



In comparison, epiphytic orchids often do things differently.

- Most epiphytic orchids produce aerial roots, each white spongy root ending in a green tip that actually contains chlorophyll
- These roots anchor the plant to its tree, absorb water and nutrients from the rain, and carry on limited photosynthesis, but a few of these orchids have fully green roots and lack leaves altogether, the only flowering plants to do so
- Epiphytic orchids either produce straight, upright stems with leaves, or...
- Have creeping horizontal stems that produce *pseudobulbs*, short upright stems that store water during times of little rain

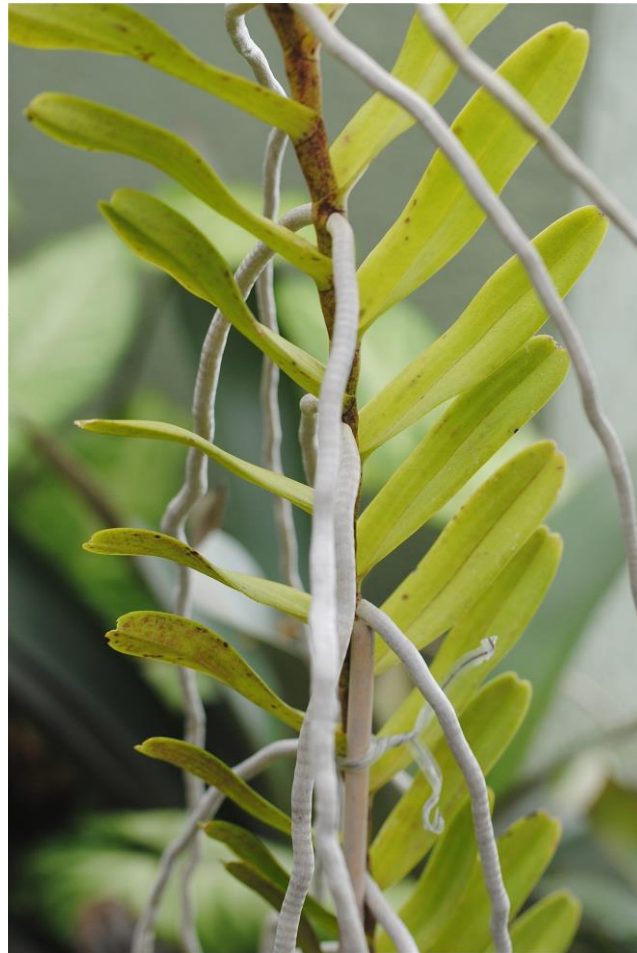
Here is an example of an orchid with green roots and no leaves.



Many epidendrums feature upright stems with leaves, a pattern called *monopodial* (=one foot)



Here's another example of a monopodial orchid. Note the long, white aerial roots



This orchid displays sympodial growth with pseudobulbs to store water



The most distinctive thing about orchids are their wonderfully intricate and varied flowers, which range from tiny to a foot or more across and come in every possible color of the rainbow

- An overview of a typical orchid flower shows 3 colorful sepals that usually resemble the two lateral petals, but the lower middle petal differs by...
- Forming a lip or *labellum* of a different shape and sometimes color pattern.
- The labellum usually provides landing platform for pollinators and is provided with various nectar guide patterns
- The form of the labellum varies widely from genus to genus

On the labellum of the moth orchid, *Phaelanopsis*, the color is deep red with appendages on the upper two sides



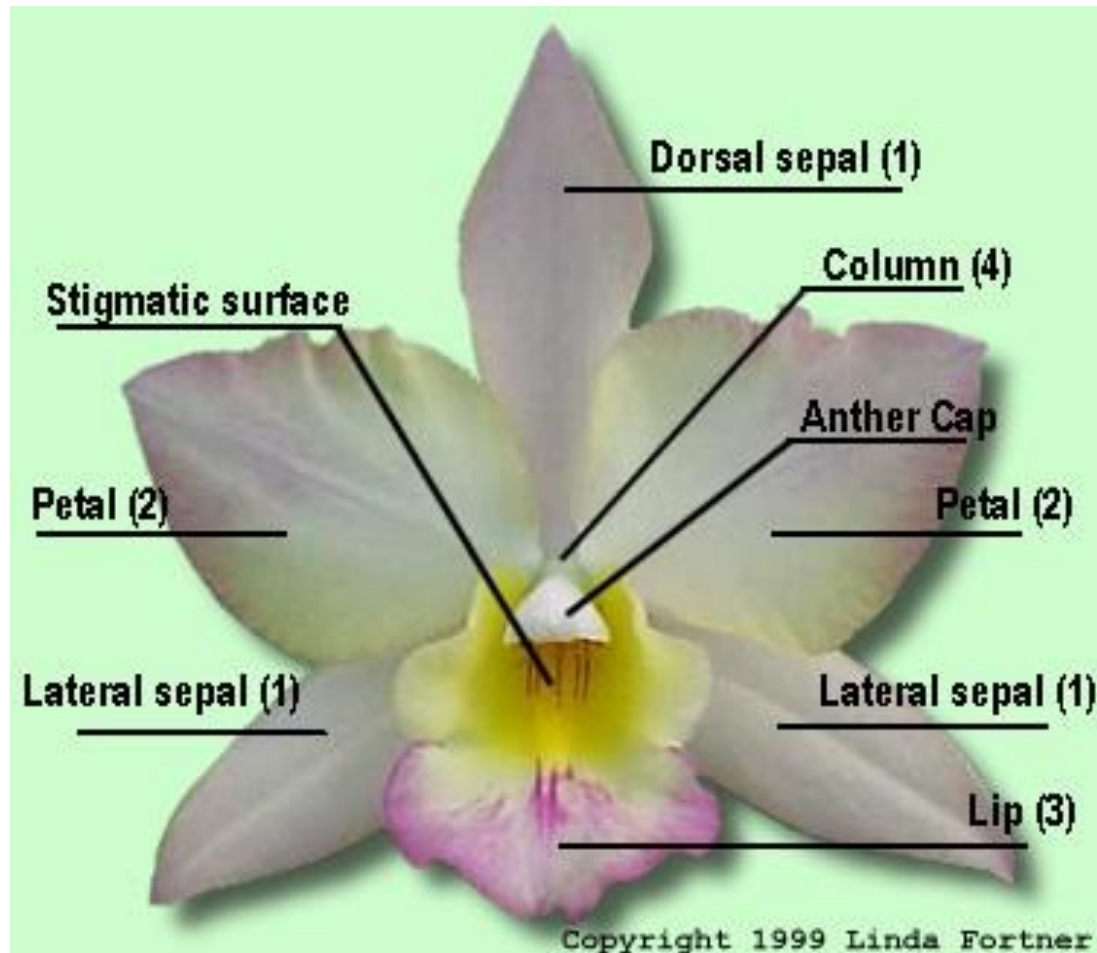
The labellum of the tropical lady slipper, *Paphiopedilum*, forms a deep brown pouch



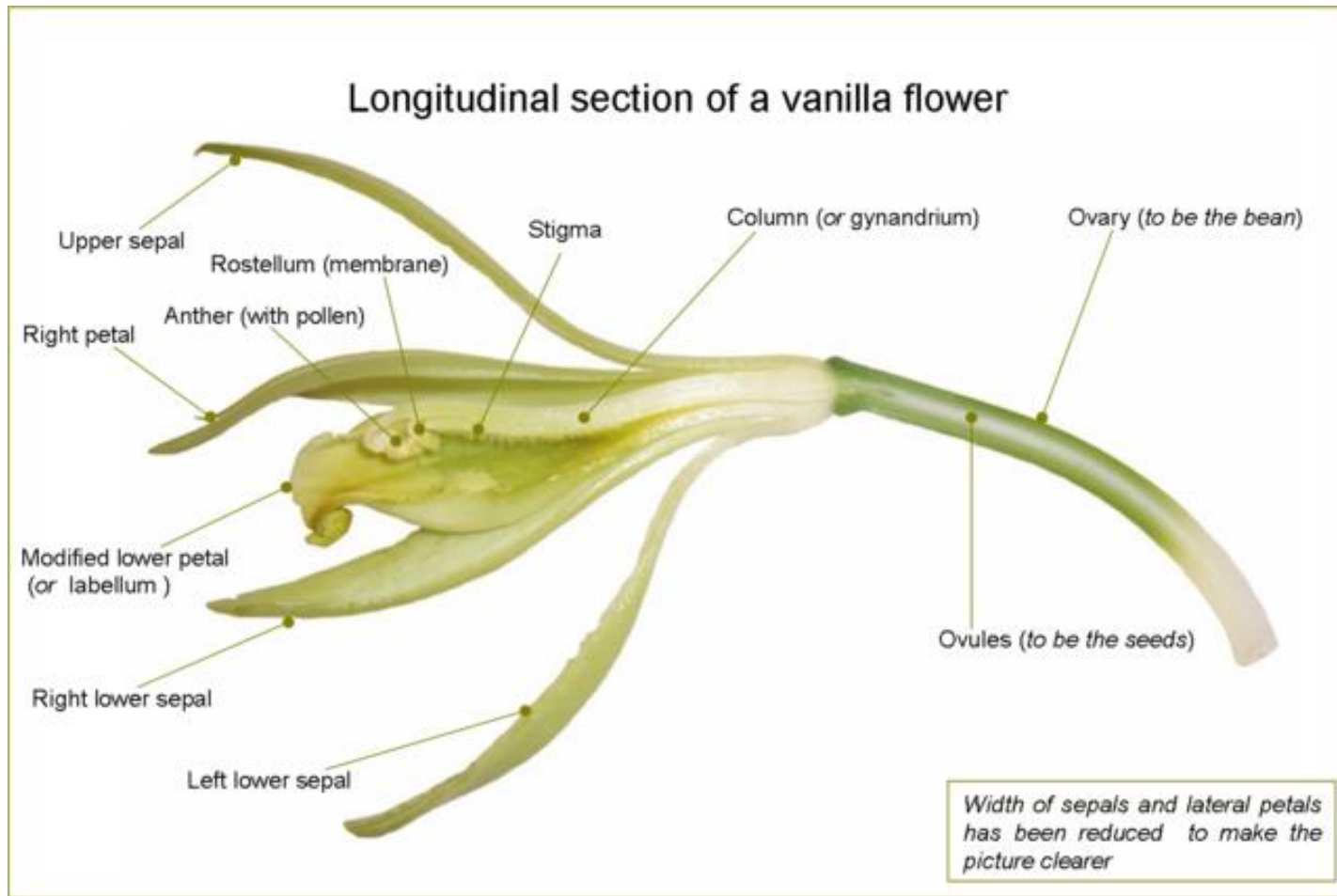
The labellum of the butterfly orchid, *Oncidium*, forms a flared yellow skirt with a red-brown blotch at the top



Even more distinctive than the orchid flower's labellum is the *column*, a fusion of stamen, style, and stigma. This photo with labeled parts shows the column which lies just above the labellum



In this cut-away side view of a vanilla flower, you can see the stigma sits below the terminal stamen. Most orchids have a single terminal stamen



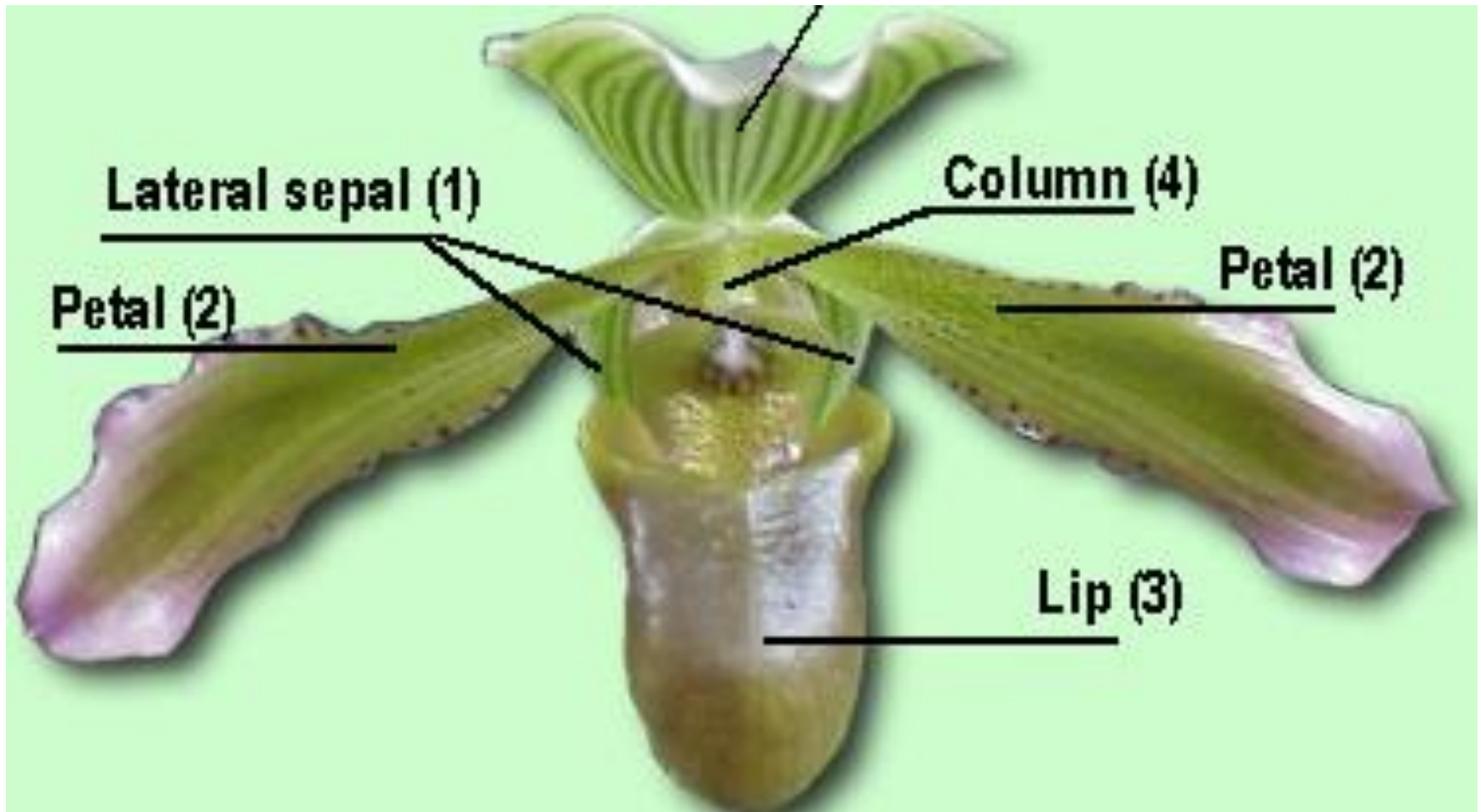
Besides the single stamen at the end of the column, which is covered with a cap, the pollen inside is unusual because the thousands of pollen grains are melded together to form a *pollinium*

- This pollinium assures that when a pollinator comes in contact with the stamen, it carries off a whole wad of pollen to make the chances better of pollination when the pollinium adheres to the stigma of a different flower
- In some orchids like the genus *Catasetum*, sensitive trigger hairs on the column when brushed against, cause the pollinia to be hurled towards the back of the pollinator, where they stick to hitch a ride to the next flower

Here you see a *Catasetum* flower



In the subfamily of orchids the lady slippers belong to, the flower design is tweaked a bit. Instead of 3 sepals, there is a top sepal and two side sepals that are fused together, and the stigma of the column sits at the end with two stamens behind it.



All orchids have an inferior ovary, which is often long and narrow. The fruit is a capsule containing from thousands to nearly a million seeds each, each seed light and small like a grain of dust.



Orchid seeds are so light weight, the wind carries them away, but the chances of any one seed succeeding are vanishingly small.

- Not only are orchid seeds tiny, but the embryo inside is not well developed and there is no nourishing endosperm to feed the embryo until it germinates.
- Orchids, therefore, depend on the seed finding the right fungal partner—most fungi would destroy the seed but..
- Certain fungi form a close association with the seed, providing food and water to allow it to germinate. These fungi are also saprophytic, feeding on decaying leaf litter for their sustenance.
- This relationship was discovered mostly by accident and for years, propagators were at a loss to grow orchid seeds

In order to grow orchids commercially from seed, the propagators need to replace the food provided by the fungal partner under sterile conditions

- The standard technique is to sow orchid seeds in sterile flasks which are covered at the bottom with an *agar* substance (gell derived from algae) to which various nutrients have been added.
- Different kinds of orchids need different nutrient mixes, but common ingredients include coconut milk, mashed banana, pineapple, and tomato juice
- Once the seed germinate, they're gradually hardened off but the process of getting a mature flowering plant may take 7 or more years, making propagation from seed expensive

Here you see orchid seedlings on agar inside a sterile bottle



Also the numerous orchid hybrids in cultivation seldom come true from seed, so vegetative means are mostly used

- Initially, vegetative propagation was from divisions of stems and rhizomes, a process that yielded only a few plants at a time from the mother plant
- Today, the process is changed by *mericlone*, that is, removing the tiny growing tip or meristem, mashing it up into tiny bits, and rotating those tiny bits in a nutrient solution
- Each meristem can potentially produce dozens to hundreds of new plants
- When rotation stops, the propagules develop roots, stems, and leaves and can be planted as baby orchid plants
- This process has revolutionized orchid propagation, allowing choice cultivars to be produced on a large scale and at cheaper prices

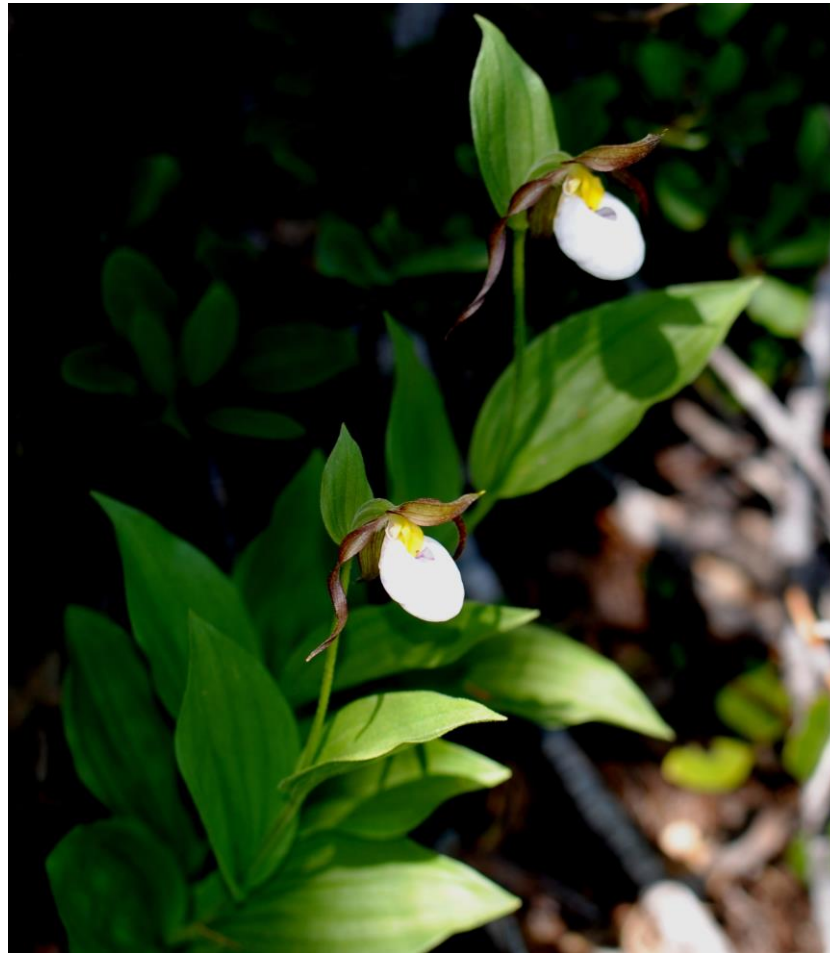
We'll start our survey of the family with California native orchids, which are terrestrial or parasitic. The showiest genus of terrestrials are the lady slippers, *Cypripedium* spp.

- *Cypripedium*s are distinctive for their labellum, which forms a pouch.
- Pollinators are attracted by nectar along the edge of the pouch, slip down inside, and have to crawl back out through a narrow tunnel where they contact the stigma or the pollinia.
- Lady slippers' lateral petals are often different from the sepals behind
- Most lady slippers are rare and often difficult to find in the wild, and are also difficult to grow in gardens

Here is the California lady slipper, *C. californicum*, with its pale yellow lateral petals and white pouch. It is confined to seeps and creeks on serpentine outcrops in Northern California, especially the Klamath Mountains



With a much less predictable habitat, mostly in mountain conifer forests, the mountain ladyslipper, *C. montanum*, has broader leaves and very large flowers with twisted lateral petals and a white pouch.



A close view of mountain lady'slipper. Although historical to the Bay Area, it is most often encountered in the northern Sierra and Klamath Mountains.



The rarest of ladyslippers is *C. fasciculatum*, the brownies lady slipper, which features a pair of broad leaves and a few small, brownish-purple flowers.



Other species of ladyslipper occur across North America and Eastern Asia. Here is the queen ladyslipper, *C. reginae*, from hardwood forests of eastern North America.



An equally showy native orchid is the fairy slipper, *Calypso bulbosa*, a circumboreal species that favors old logs and other humusy soils in conifer forests. It blooms in early spring and in California is most abundant in the North Coast Ranges.



The stream or brook orchid (aka chatterbox), *Epipactis gigantea*, often forms large colonies along shaded watercourses, although it is relatively uncommon in the Bay Area. Ironically, it also occurs in desert oases.



Brook orchid features combinations of unusual colors such as brown, dull red, green, and pale yellow. The labellum is movable, giving rise to the name chatterbox



Often confused with the native brook orchid is the introduced orchid known as helleborine, *Epipactis helleborine*, from Europe. Its flowers are smaller and it grows in dry woods rather than along creeks.



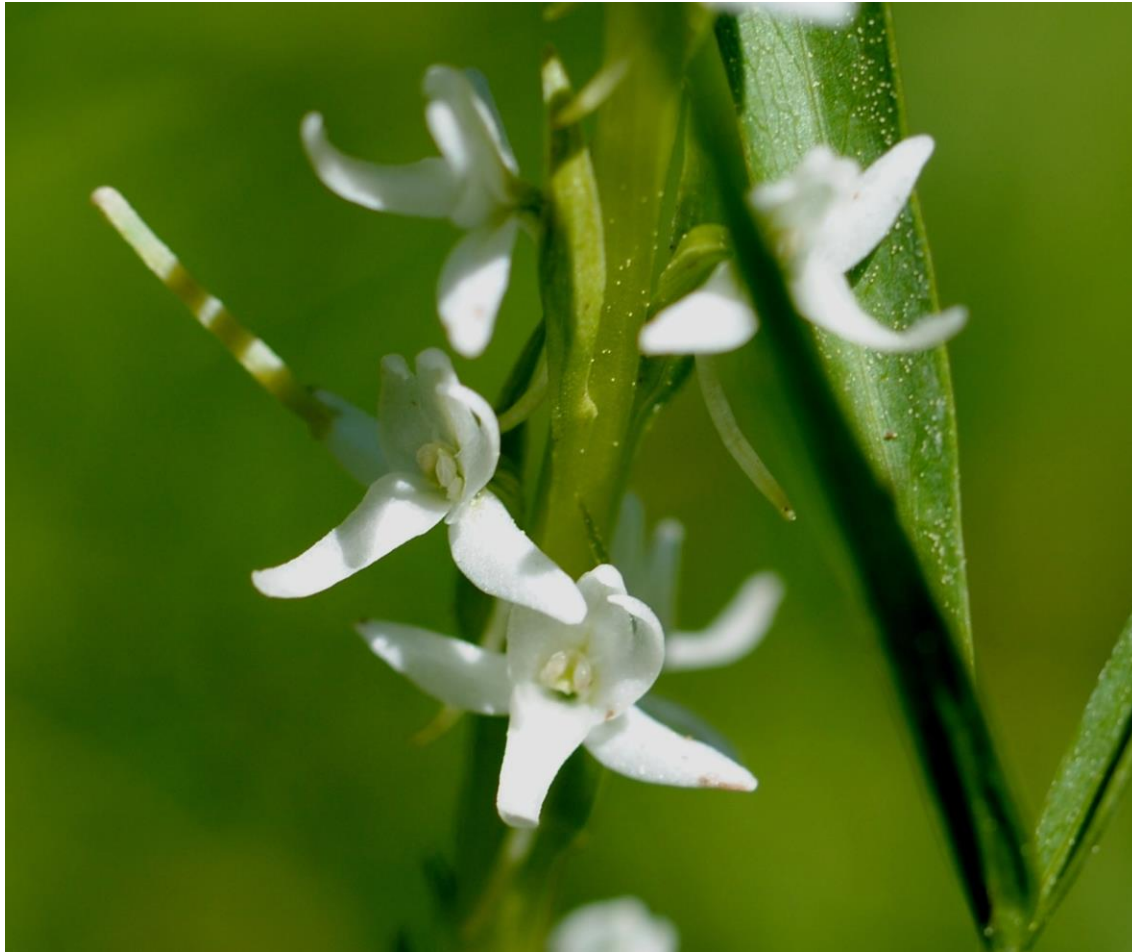
The remainder of our native terrestrial orchids have small flowers, which only at close inspection, reveal their membership in the Orchidaceae.

- Two closely related genera are both referred to as rein orchids: *Platanthera* from wet mountain meadows, and *Piperia* from dry conifer woods
- Another distinctive genus is ladies' tresses, *Spiranthes*, with two species that live in temporary wetlands or mountain meadows and bloom late in the year
- One other noteworthy genus is *Listera* or twayblade, with pairs of broad, rounded leaves, and tiny green flowers, found in wet conifer woods

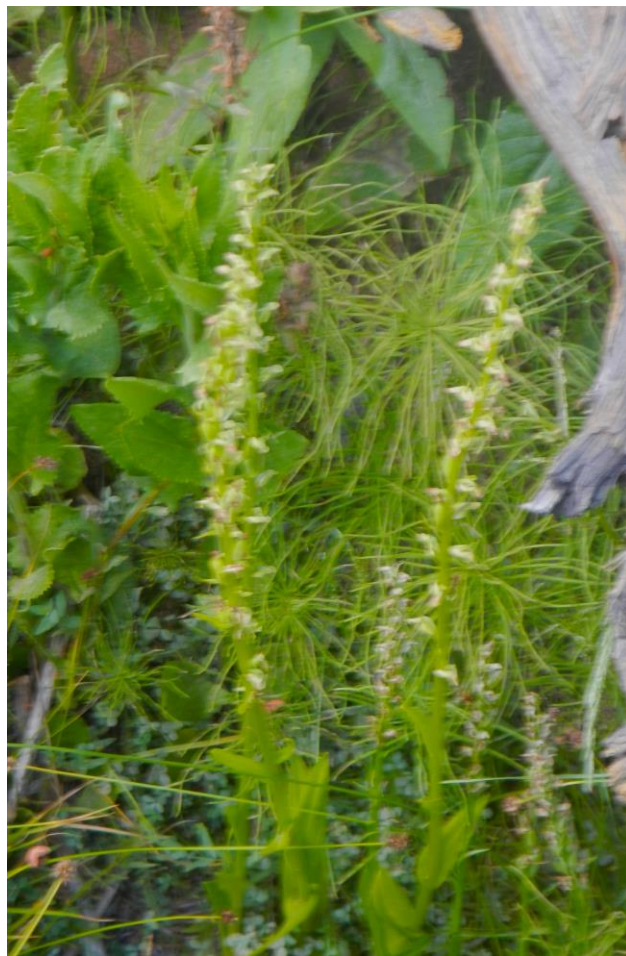
Although there are several species of *Platanthera*, two really stand out and are common. Both have green leaves at flowering time. Here you see the snowy rein orchid, *P. leucostachys*



Both platantheras and piperias feature long, tapered nectar spurs as you see here



Our second common platanthera is *P. sparsiflora* or green rein orchid. It often grows in the same wet meadows as the snowy kind.



The piperias, in contrast to the platantheras, grow in dry woods, often at lower elevations, and lose their leaves by the time the flower spikes open.



The several species of piperia have tiny white to greenish flowers; the only truly showy one is the elegant rein orchid, *P. elegans*, which blooms in June in coastal prairies.



The two native ladies' tresses look similar. These are short plants with white to creamy flowers that lack spurs. The salient feature is the spiral arrangement of the flowers on their peduncle.



Listera or tway blade has a pair of broad leaves and spike of tiny green flowers with a broad, forked labellum. It lives in moist woods in the north and mountains.



The rattlesnake orchid, *Goodyera oblongifolia*, is half way between a regular terrestrial orchid and a parasitic kind as seen with the large white areas of the leaves. It lives in moist conifer forests in Northern California



Rattlesnake orchid blooms in summer with a spike of tiny flowers featuring a white labellum and a hooded green upper sepal



Two of our native orchid genera are fully parasitic, lacking any chlorophyll or well developed leaves. They both live in thick leaf duff where the requisite fungal partner grows, and they are characteristic of deep shade where little sunlight is available.

- The coralroots, *Coralorrhiza* spp., have branched coral-like roots and purple-, brown- or red-tinted flowers in spikes. They are most common in Northern California in thick conifer forests, with occasional appearances in the Bay Area
- The ghost or phantom orchid, *Cephalanthera austinae*, sends up single, pure white stems with a spike of waxy white flowers in summer. Although rare in the Bay Area, it is common in the northern conifer forests.

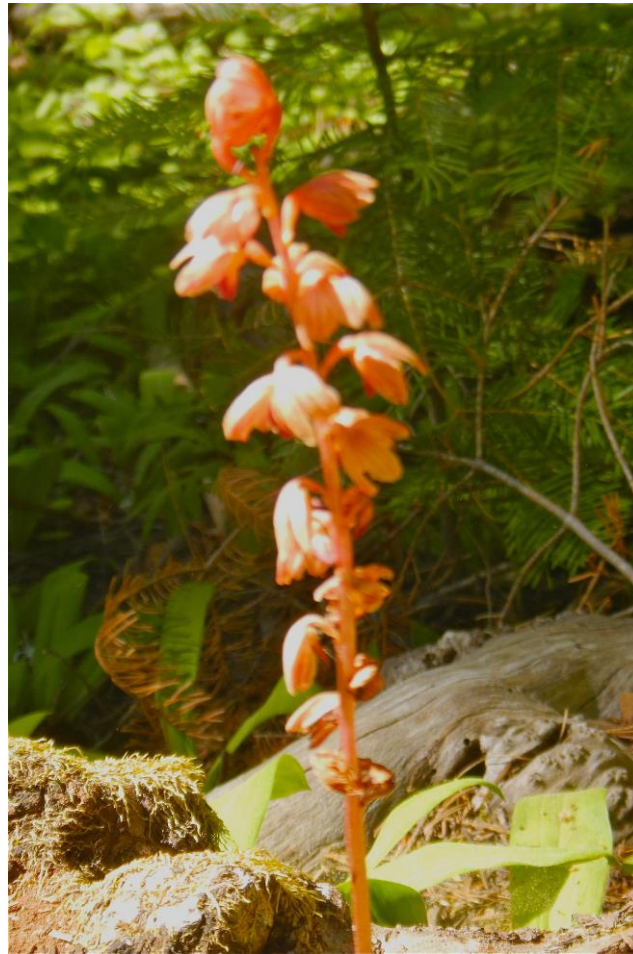
The most common coral root is *C. maculata* or spotted coralroot, with a white labellum dotted with purple spots



Merten's coralroot, *C. mertensiana*, from Northern California has a pink-purple labellum



A third coralroot is *C. striata* or striped coralroot with red-brown striped flowers



Here is a close view of the ghost orchid, *Cephalanthera austinae*, with conspicuous white bracts below the flowers and a labellum with a central yellow patch



Little known outside their native homeland, are the numerous species of Australian terrestrial orchids, most of which are very difficult to grow. Here you see the donkey orchid, *Diuris*, whose lateral petals look like donkey ears



The enamel orchid, *Elythranthera marginata*, looks like the flower has been enameled. Note the labellum is smaller than the sepals and lateral petals



The diminutive greenhood orchids, *Pterostylis* spp., grow on rotting logs and humus-rich soils with a hooded labellum.



Thelymitra has usually blue flowers where the labellum is similar in shape to the lateral petals and sepals



The widespread genus *Caladenia* has highly varied flower designs although all feature a small labellum. Here you see the cowslip orchid, *C. flava*.



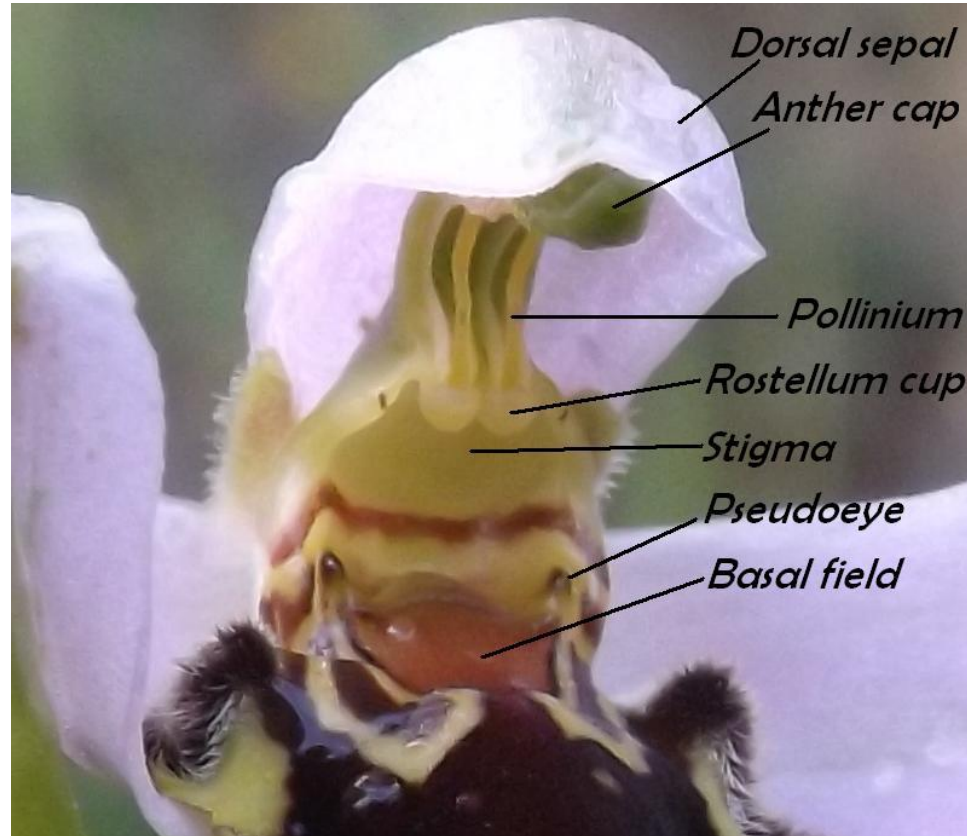
At close range, many of the caladenias have strange colors and shapes that may mimic insects. On the left, the labellum is broad and lurid purple; on the right pale and frilled.



Another area for numerous terrestrial orchids is the mountains of Europe, where meadows feature many beautiful species. The type genus *Orchis* is common here. The name comes from the swollen underground tubers that look like male genitals.



One of the most curious groups of all terrestrial orchids is *Ophrys*, whose flowers resemble female insects with the result that when the male insects emerge, they attempt to mate with the orchid flower in a process called pseudocopulation



On this species, *O. bombeliferum*, the labellum resembles a bumblebee, and is pollinated by them



By contrast, this species, *O. apifera*, is favored by honey bees.



Let's move on now to the semiepiphytic and epiphytic tropical orchids, the ones most popular in cultivation.

- Because epiphytic orchids live in loose humus and leaf mold on trees, the roots need strong aeration, so to best mimic the natural conditions, they're grown in chopped fir bark, roots of the osmunda ferns, and other similar media
- Most epiphytic orchids like indirect sunlight and should be watered periodically just as they would receive periodic rain in their homelands
- Epiphytic orchids vary widely in how cold or cool they can thrive in; some are cool growers that can live in protected outdoor places, while others require a minimal low temperature and are best in glass houses or inside homes

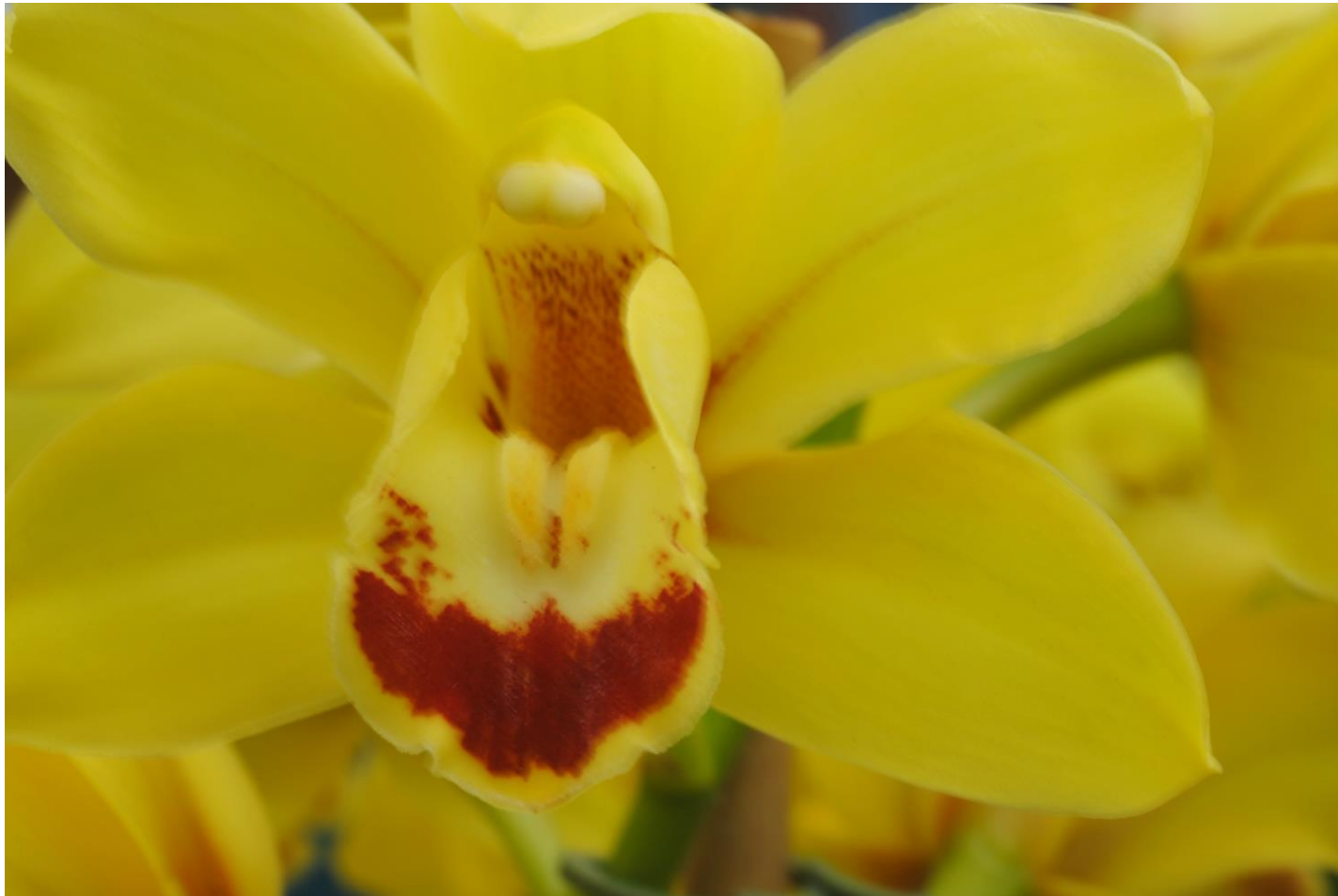
The cattleyas from tropical America are among the most popular epiphytes and often grown for their large, corsage-worthy flowers. They are sympodial and feature a large labellum. The flowers are often strongly fragrant



Best known of the semihardy orchids are the cymbidiums from Southeast Asia and Australia. They mostly live in deep humus, sometimes near the ground and other times as epiphytes. Most have been hybridized and selected for specific color forms.



Here is a typical cymbidium flower; the prominent labellum marked with dark spots and blotches. Note the conspicuous stamen at the end of the column.



Angraceum sesquipedale, Darwin's predicted orchid from Madagascar, has a nectar spur around a foot long, which fits exactly the long tongue of a moth as Darwin predicted from the flower structure.



The dendrobiums from Southeast Asia and Pacific islands including Australia, feature white, pale yellow, purple, or pink flowers and are monopodial.



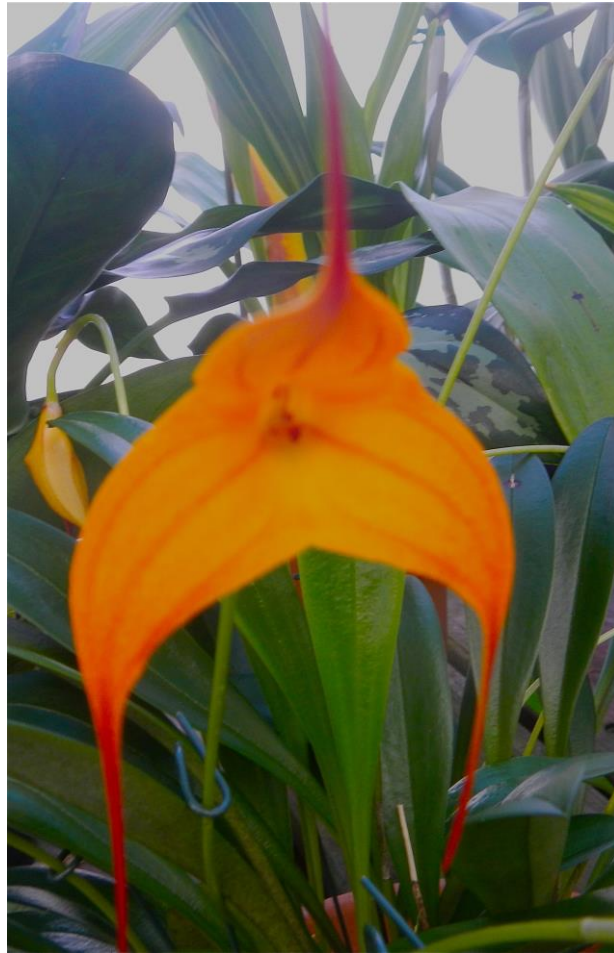
Dendrobiums feature a short nectar spur at the back of the flower.



The epidendrums, a large a varied genus from the Americas, vary from monopodial and semiterrestrial to sympodial and fully epiphytic. The hardiest is *E. o'brienanum* with red, pink, or yellow flowers, and can be grown outside.



The highly distinctive masevalias from tropical America, have three very prominent sepals and tiny petals. They're mostly brightly colored and often hummingbird pollinated.



The pansy orchids, *Miltonia*, are sympodial with pseudobulbs and feature highly fragrant flowers with intricately decorated labellums.



Here is a close view of a miltonia labellum, showing the pansylike markings and the prominent column



The sympodial, pseudobulbous oncidiums or butterfly orchids often grow in seasonal tropical forests and produce large numbers of yellow to orangish flowers that look like butterflies in flight.



The related *Odontoglossum* genus has a similar flower color pattern to the oncidiums.



The moth orchids of *Phalaenopsis* from tropical Asia are popular house plants. Here the small labellum is surrounded by large lateral petals and sepals. Although epiphytic, it lacks a pseudobulb



The bucket orchid, *Stanhopea*, from tropical America features hanging clusters of flowers with a bucket-shaped labellum that fills with liquid.



Closely related to the temperate ladyslippers, the tropical ladyslippers belong to the American genus *Phragmipedium* and the tropical Asian genus *Paphiopedilum*. Here you see the latter. These are seldom fully epiphytic, most often living in leaf mold at the base of trees.



Most of the “paphs” in cultivation are cultivars and/or hybrids. Note the wild color pattern on the upper sepal here. Most paphs can grown outdoors in protected areas and prefer cool conditions.



This is but a small sampling of this fascinating family. Many can be easily grown, especially the epiphytic kinds, but many are virtually unknown in the general trade.

- Native terrestrial orchids are seldom found in gardens, even botanic gardens, because they're fussy about growing conditions
- The only usually available species is *Epipactis gigantea*, the brook orchid, which is easily grown as long as it has summer water and shade.
- The most difficult orchid are, ironically, the showiest. Most ladyslippers and the fairy slipper, *Calypso bulbosa*, should not be attempted. Many are already endangered in the wild.