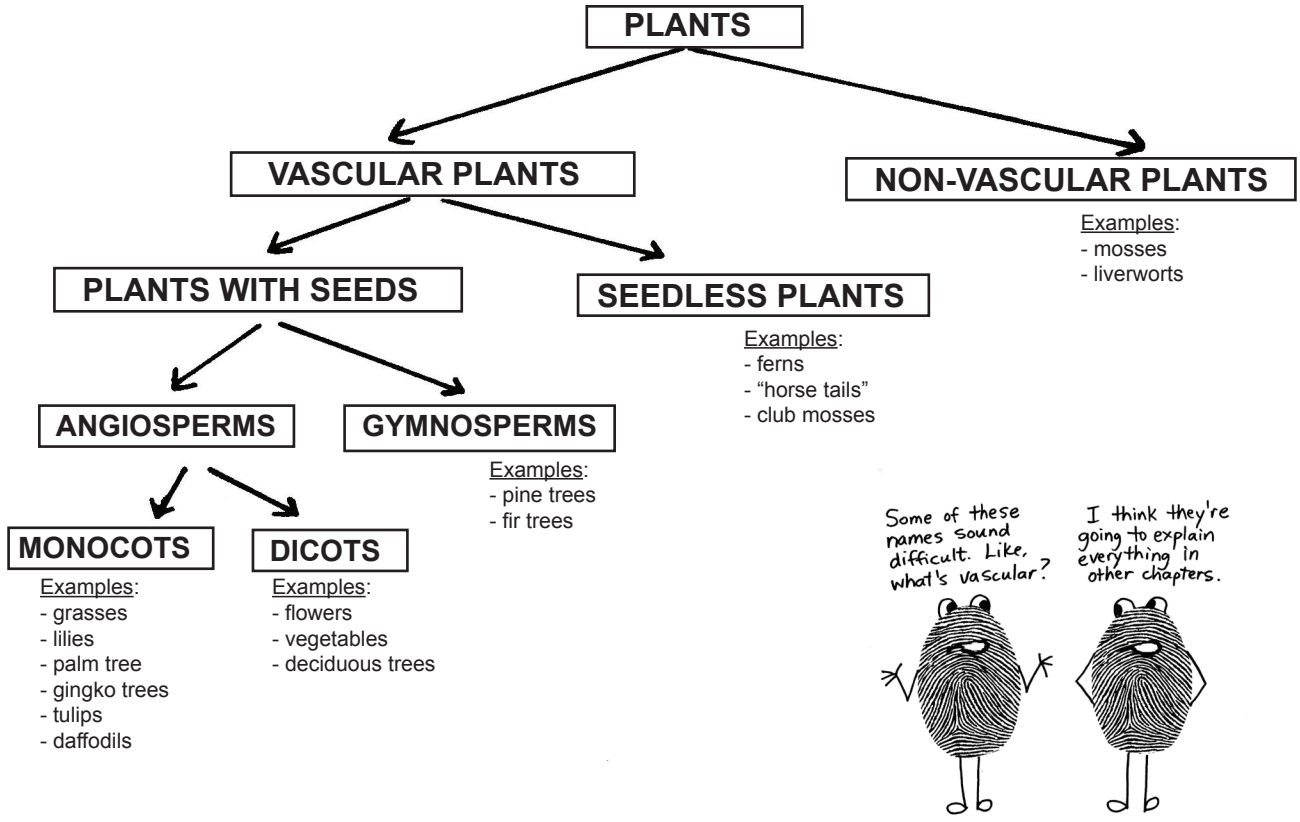
LESSON 2: PLANT CLASSIFICATION

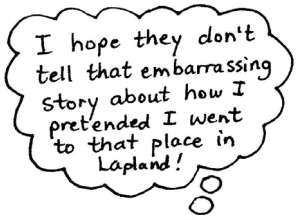
LEVEL ONE

Now you have it firmly in your mind that a plant is an organism that uses the process of photosynthesis. However, there's one more little technicality about qualifying as a plant. You have to have more than one cell. That may sound obvious, but did you know that there are lots of one-celled organisms that use photosynthesis? For example, some kinds of bacteria use photosynthesis. There are also some types of one-celled protozoa that use photosynthesis, such as the euglena and the volvox. So to be a plant, you can't be a bacteria or a protozoa. You must be made of many cells.

The plant "kingdom" is huge. There are millions of different types of plants. Scientists who study plants (***botanists***) like to sort them into categories (classify them). Without a way to put plants into categories, botanists would feel like their field of science was incredibly disorganized. They'd feel the way you'd feel if you woke up one morning to discover that someone had gathered up all the items in your house, then randomly distributed them into storage areas. If you opened a dresser drawer you'd find a random assortment of objects—a flashlight, a spoon, a marble, a couple of toys, a pencil, a book, a battery, a plate, a toothbrush and maybe a sock. Open a closet and you'd find a tennis racket, a stack of books, a pair of jeans, a radio, a flower pot, a guitar, a toy car, a stuffed animal... you get the idea. Now if you wanted to get dressed and needed a shirt and a pair of pants, where would you look for them? How long would it take to find a particular toy or book? Way too long! That's why we organize our houses, putting all the similar objects together. If you want a frying pan, you know to go to the kitchen. If you want to play tennis, you know your racket will be in the garage with the sports gear. Botanists feel the same way about organizing plants into categories. (Okay, so they're science geeks.) Here is the way botanists organize the plant kingdom.

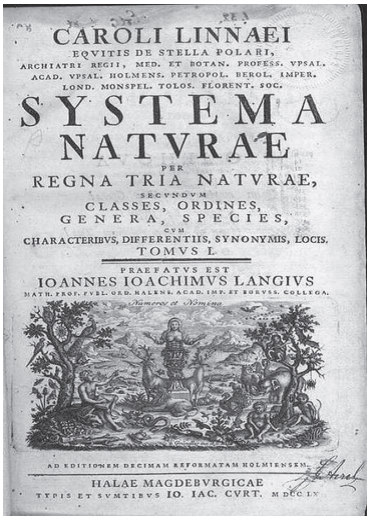


You can look back at this chart whenever you get confused by terms like "vascular" or "gymnosperm."



One of the first scientists to tackle the problem of classification was a man named Carl Linnaeus. Carl grew up in Sweden in the early 1700s and had loved plants since he was a small child. When he was learning to talk he wanted to know all the names of the plants in his father's garden. Carl's father loved plants, too. In fact, he changed the family's last name from Ingermarrson, which means "farmer's son," to Linnaeus, in honor of a large linden tree which grew near their house. When Carl was seventeen, he left home to begin his university studies. Back in those days, university students often had people called "patrons" who gave them money while they were in school. Carl was very good at getting patrons who were interested in supporting his studies. Unfortunately, however, as soon as he found a better patron he dropped the previous one. He made many friends and many enemies this way. Both the friends and the enemies will come back into the story later on.

Even with patrons, Carl never had a lot of money and was always worrying about how to make ends meet. His fretting about money came out in a humorous way one day when he said this: "My hair stands on end and lice bite at its roots when I look at the prices in this catalog!"


CAROLI LINNAEI
EQVITIS DE STELLA POLARI,
ARCHIATRI REGII, MED. ET BOTAN. PROFESS. VPSAL.
ACAD. VPSAL. HOLMENS. PETROPOL. BEROL. IMPER.
LOND. MONSPEL. TOLOS. FLORENT. SOC.

SYSTEMA NATVRAE

PER
REGNA TRIA NATVRAE,
SECVNDVM
CLASSES, ORDINES,
GENERA, SPECIES,
CVM
CHARACTERIBVS, DIFFERENTIIS, SYNONYMIS, LOCIS.
TOMVS I.

PRAEFATVS EST
IOANNES IOACHIMVS LANGIVS

AD EDITIONEM DECIMAM REFORMATAM HOLMIENSEM.

HALAE MAGDEBVRGICAE
TYPIS ET SVMTIBVS IO. IAC. CVRT. MDCCLX

The title page from a 1760 edition of Carl's book *Systema Naturae*.

Carl was a very good scientist, though. He made many discoveries about the life cycles of plants, especially the importance of flowers. Until then, no one knew that flowers have male and female parts. Even before he had graduated from the university, Carl was being asked to give lectures on plants. Before he was 30 years old, he had published several books on plants.

Back in Carl's time, botanists and naturalists were expected to go on long journeys to collect specimens for their studies. Carl went to Lapland (Finland) and hated every bit of the trip. He complained about bad weather, bad food, bad travel conditions and (worst of all)... bugs! He hated bugs. During this trip someone told Carl about a very interesting place in Lapland that he really should see. Carl agreed it would be a fantastic addition to his itinerary (list of places he went). The only problem was that this area was 300 miles inland, which meant several more weeks of bad weather, bad food, bad travel conditions, and bugs. So Carl just imagined what it would have been like to go there and wrote about it in his journal, faking the details!

At some point in his studies, Carl realized that botanists needed a system of naming plants, a system that would be recognized all over the world. Carl noticed that some plants had very simple, common names like "white oak," and other plants were known by complicated Latin names such as (just try to say this in one breath) *physakis amno ramosissime ramis angulosis glabris foliss dentoserratis*. Carl suggested that each plant should have a two-word Latin name, just like people have first and last names. Latin was best for this because it was already used by scientists all over the world, and because it was a "dead" language (no one actually spoke it as their real language) so it wouldn't change over time. This method of naming plants (and animals) would be called ***binomial nomenclature***, which is a fancy way of saying "the two-name naming system" (bi=two, nom=name, nomen=name, clature=call).

Carl would think up a name for a group of plants (what we now call the ***genus***), then make up a name for each specific member of that group (what we now call ***species***). For example, the group of trees we know as oaks have the genus name *Quercus (kwer-kus)*. The white oak is *Quercus alba*, the gray oak is *Quercus grisea,* and the leather oak is *Quercus durata*. The group of plants we call

the honeysuckles are the *Lonicera (lon-i-sare-uh)*. The yellow honeysuckle is the *Lonicera implexa* and the sweet honeysuckle is the *Lonicera japonica*. (Notice that the names are written in italics and only the genus is capitalized.)

Now those friends and enemies come back into the story. Carl had to come up with a lot of new plant names, and often he would use the names of people he knew. Someone once said that you could make a list of Carl's friends and enemies by looking at a list of plants he had named. Plants that were attractive or useful bore the names of people Carl admired. Plants that were prickly or ugly were used as a way to get just a tiny bit of revenge on folks he hadn't gotten along with. For instance, Carl named a species of unpleasant weeds *Siegesbeckia,* after Johann Siegesbeck, the director of a Russian botanical garden who had given Carl a hard time about his books—he thought Carl had talked too much about the "love life" of flowers. The "black-eyed Susan" (a flower with a dark center and yellow petals) was named after a real person named Susan, a woman Carl admired. The sheep laurel, with its beautiful bunches of red or purple flowers, was named *Kalmia augustifolia*, after Peter Kalm, one of Carl's botanical students. The *Lonicera* (honeysuckle) was named after Adam Lonicer, a German doctor of the 1500s who studied plants and used herbal medicines.

Eventually, Carl's naming system was adopted by all scientists everywhere in the world. It became more and more complex as more people started adding their ideas to it. Today, there are seven basic levels in the naming system: ***kingdom, phylum, class, order, family, genus, species***. However, often extra subdivisions and sub-categories are added. And, as we warned you, not all scientists use the same divisions. For example, here are two ways to list the full classification of the white oak. You could use either one and be correct:

Kingdom: Plants (or "Plantae")
Division: Angiosperms
Sub-division: Dicots
Sub-division: Rosids
Order: Fagales
Family: Fagaceae
Genus: *Quercus*
Species: *alba*

Kingdom: Plants
Subkingdom: Tracheobionta (vascular plants)
Superdivision: Spermatophyta (seed plants)
Division: Magnoliophyta (flowering plants)
Class: Magnoliopsida (dicots)
Order: Fagales
Family: Fagaceae
Genus: *Quercus*
Species: *alba*

As if these difficult words weren't enough, other reference sites add the categories "Euphyllophyta" and "Fabids" to these lists! As we said, there isn't a single "correct" way to classify plants. You'll get a slightly different list from each book or website you consult. However, it is still a good idea to know the basic seven categories: kingdom, phylum, class, order, family, genus, species. These words come up often in many branches of science and it's good to be familiar with them.

<u>ACTIVITY 1</u>: LEARN THE CLASSIFICATION SONG

The sound track for this song can be accessed by going to **www.ellenjmchenry.com** and then clicking on the MUSIC tab.

Kingdom, phylum, *(clap, clap*), **class, order,** *(clap, clap),* **family,** *(clap, clap)*, **genus, species,** *(clap, clap).*
Kingdom, phylum, *(clap, clap*), **class, order,** *(clap, clap),* **family,** *(clap, clap)*, **genus, species,** *(clap, clap).*
Kingdom, phylum, class, order, family, genus, species!
Kingdom, phylum, class, order, family, genus, species!
REPEAT

ACTIVITY 2: PLANTS NAMED AFTER PEOPLE

Some plants were named after people—either the scientist who discovered the plant, or a friend or family member of the scientist. See if you can guess the last name of the person for whom these oak were named. (We'll only do a few of these because they're pretty much no-brainers!)

1) *Quercus muehlenbergii* _____
2) *Quercus engelmannii* _____
3) *Quercus michauxii* _____
4) *Quercus kelloggii* _____

ACTIVITY 3: USE YOUR "WORD DETECTIVE" SKILLS

See if you can match the scientific names with the common names. All you need to do is use "word detective" skills. Think of words you know that look or sound like the scientific names. Start with the matches that are easiest.

1) *Daucus carota* _____
2) *Solanum tuberosum* _____
3) *Pinus cembra* _____
4) *Acer saccharum* _____
5) *Juglans nigra* _____
6) *Citrus sinensis* _____
7) *Sophara japonica* _____
8) *Primula vulgaris* _____
9) *Papaver orientale* _____
10) *Paulownia imperialis* _____

A) Oriental poppy
B) Cembrian pine
C) Carrot
D) Empress tree
E) Primrose
F) Orange
G) Potato
H) Sugar maple
I) Black walnut
J) Pagoda tree

ACTIVITY 4: HAVE SOME FUN WITH SCIENTIFIC LATIN

What? Fun with Latin?! Sure, why not?
Use some made-up Latin words to classify yourself. Use this guide:

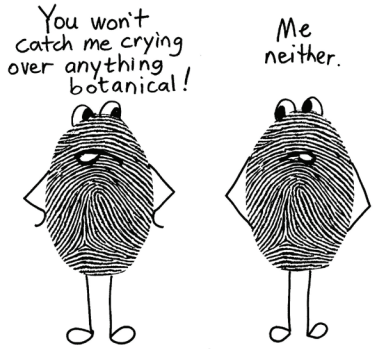
Kingdom: country
Phylum: state
Class: county
Order: city/town
Family: neighborhood or street
Genus: last name
Species: first name

Use some classic Latin endings such as *-us -um -ae -ica -ii -ius*
Example: *Americanus Pennsylvanicus Alleghenus Pittsburghae Avalonica Smithus Jamesii*
(We know him as Jim Smith from Pittsburgh, PA.)

Your (silly) Latin scientific name: _____
_____

Now make up one for someone else: _____
_____

LEVEL TWO



Not everyone immediately adopted Linnaeus' new naming system. Some botanists resisted change, even if it was for the better. That's just how some people are. A botanist named Johann Dillenius accused Linnaeus of "throwing all botany into confusion." However, when Dillenius went to see Linnaeus and let Linnaeus explain the advantages of this new system, Dillenius realized how ingenious this system was. In fact, he got so emotional over it that he almost cried (or so the story goes). One by one, botanists came to see how superior this new system was and eventually they all began using it.

The work of Carl Linnaeus was only the beginning. Since Carl's time, many organized minds have added to the classification system. As far as we know, all *known* plants and animals on Earth have been named and classified. (However, there are some disagreements among scientists about certain species or sub-species because they don't fit perfectly into this system.) As soon as any new plant or animal is discovered, it is compared to all similar organisms so it can be put into a kingdom, phylum, class, order, family and genus. Then the discoverer gets to choose a species name for it. All these words must be in Latin and must have correct endings, such as "ius," "ium," "ae," or "ii." (The ending "ii" means "of." So *jamesii* would mean "of James.")

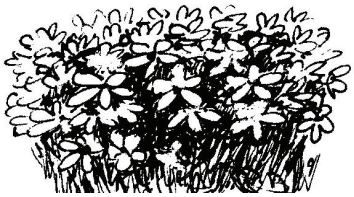
Kingdom is the most general category. There are basically five kingdoms: plants, animals, fungi, monerans (bacteria), and protists (single-celled protozoa). Sometimes scientists like to get all fancy with the names of the kingdoms and use Latin endings, making the animal kingdom *Animalia* and the plant kingdom *Plantae*. Within each kingdom are large groups called ***phyla*** (one phylum, two phyla). Now just to make everyone's life difficult, botanists decided that they'd rather called the phyla ***divisions***. So don't be confused when you see the word "division." Just think "phyla." (That way the classification song will still make sense for the plant kingdom.)

The major plant divisions include ***bryophytes*** (mosses and some algae), ***pteridophytes*** (ferns) (and that initial "p" is silent), ***coniferophytes*** (conifers), and ***anthophytes*** (flowering plants). Now, you may want to know why we showed you that chart on page 15 if it doesn't match up with these divisions. Well... that chart is still valid because science books still use those categories when talking about the plant kingdom. The world of science terminology is sometimes confusing because it has evolved over hundreds of years. And to make things worse, scientists sometimes disagree about terminology or categories. The chart on page 15 is still very helpful, even though it doesn't give Latin names of divisions. It gives you a good overall sense of how botanists think about the plant kingdom.

The classes, orders, and families of plants are the least well-known terms among non-botanists. (You can always look them up on the Internet.) You can probably guess that certain types of plants are grouped together, such as grasses, cacti, squashes, or garden flowers. Hobby gardeners probably know more genus and species names (such as *Quercus alba* for the white oak) than they do classes, orders or families.

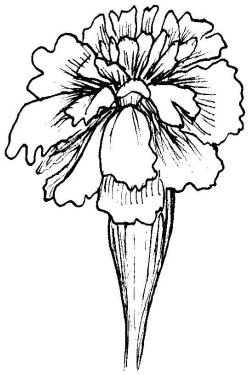
Every scientific name, no matter how boring it sounds, has a story behind how it got its name. Some of these stories are short and not too interesting. Others have quite a bit of history behind them. Here are some of the more interesting stories:

The weeping willow is *Salix babylonica*. All willows are *Salix*, but the weeping willow is *babylonica* as a reference to Psalm 137 in the Bible, where it says, "By the waters of Babylon we sat down and wept. We hung our harps on the willow trees there." The Israelites were taken captive by the Babylonians in 582 B.C. and forced to live out the rest of their lives in Babylon, far from their homeland.

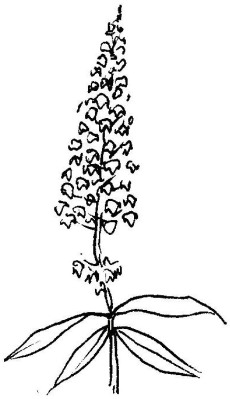


The *Phlox drummondii* was named after Thomas Drummond, a Scottish botanist who came to America in 1831 to study and collect plants. Poor Thomas had a really bad time in America. He tried to survive a northwest winter alone in the wilderness and almost didn't make it. He was attacked by grizzly bears and then almost starved to death, spending weeks chewing on nothing but an old deerskin. Later, he survived a cholera epidemic, lost the use of his arms for two months, and had boils (sores) all over his body that were so severe he couldn't lie down. He went south to Texas and almost starved to death again while stranded on Galveston Island. He finally died during a voyage to Cuba. Whenever he found a new plant, he would send specimens back home to botanists he knew in Britain. The last plant Thomas sent over before he died was a species of white phlox, and his friends decided it should be named in his honor. (The world "phlox" is Greek for "flame," named for its fiery red color.)

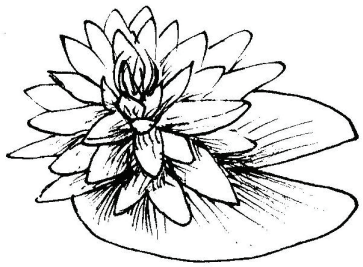
The nasturtium (*na-stur-shum*) comes from the Latin word "nasus" meaning "nose," and "tortus" meaning "twisted." When you smell a nasturtium you wrinkle (twist) your nose because of the strong smell. The scientific name for nasturtium is *Tropaeolum*, from the Greek word "tropaion" meaning "trophy." The leaves of the nasturtium reminded Linnaeus of Greek shields. In ancient Greece, the soldiers would hang the shields and helmets of the defeated enemies on tree trunks. When Linnaeus saw a nasturtium vine growing up the side of a tree, the leaves and flowers reminded him of ancient Greek shields and helmets hung on trees.



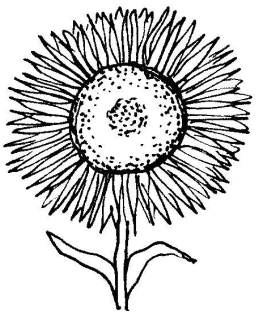
The marigold comes from the phrase "Mary's gold" and was the official flower of the Virgin Mary in medieval times. Church altars were decorated with marigolds almost year-round. Now for the ironic twist--we go from the heavenly to the earthly. The scientific name for the marigold is *Tagetes patula*, and Linnaeus is to blame for this one. Tages was the grandson of the Roman god, Jupiter. Tages was a god of the underworld who came up out of the dirt in a field one day and taught humans the fine art of fortune-telling by examining the intestines of animals. No kidding. The Romans and Greeks would kill an animal and look at its guts before making major decisions. Was this Linneaus' idea of a joke? Or maybe he thought marigolds smelled as bad as animal intestines? No one knows. (*Patula* just means "spreading." Marigolds do spread out quickly and grow to be quite large.)



The scientific name for the butterfly bush is *Buddleia davidii*, named after Rev. Adam Buddle of Essex, England, and Père (Father) Armand David, a French Jesuit missionary to China. Rev. Buddle was just a nice amateur botanist whom Linneaus apparently liked (and who was an expert on mosses, not bushes), but Père David was another one of those crazy, adventuresome botanists who braved countless hardships in order to collect plants. David recorded in his diary that "although it was inconvenient," he was so afraid of the local wolves that he kept his donkey with him in his tent at night. He also said it took great courage to eat the local food. David was lucky, however, and lived long enough to return to France. Some of his Jesuit friends were not so lucky—they were tortured and killed by the natives. Père David managed to send thousands of Chinese plants back to Europe, many of which are common sights now in both Europe and North America.



This spectacular water lily is *Victoria amazonica*, although the name has been changed several times. When it was first brought to England from the Amazon, a flower was presented to Queen Victoria and she was told the flower would be named *Victoria regina* ("Victoria the queen") in her honor. But, oops—a bit later they found out that someone had already discovered it and named it ten years earlier. Now what do you tell the queen? Then they did even more research and discovered that the two plants were not identical, so they could still keep the name of the queen, but by then they thought they really should make some reference to the place the flower came from—the Amazon. However, at that time anything associated with the Amazon was considered to be uncivilized, so putting the queen's name next to the word "amazon" would have been unseemly. So the solution they came up with was to go ahead and change the name of the plant to *Victoria amazonica* but just keep the true name a secret until after the queen died.



The sunflower's botanical name is *Helianthus*, from the Greek words "helios," meaning "sun," and "anthos" meaning "flower." There's a reason for this name: these flowers turn so that they are always facing the sun! The Greek myth associated with this plant is that of Clytie, the mortal who was in love with the Titan god Helios, who had been raised to the sky and turned into the sun. Helios never even noticed poor Clytie. (But don't feel too bad for her; when she found out that Helios loved her sister, she buried her sister alive!) The sunflower is native to America, not Europe, so the ancient Greeks never saw this plant. How this myth became attached to this flower is a mystery.

ACTIVITY 1: MATCH THE PLANT NAME WITH ITS ORIGIN

1) Clematis ____

2) Impatiens ____

3) Chrysanthemum ____

4) Foxglove ____

5) Geranium ____

6) Daisy ____

7) Candytuft ____

8) Gladiolus ____

9) Columbine ___

10) Forsythia ____

A) The seeds of this plant pop out as if they are in a hurry.

B) The leaves of this plant look like a Roman gladiator's sword.

C) The name of this flower comes from the Greek word "geranos," meaning "crane" (the bird) because its seed pod looks like the beak of a crane.

D) This plant produces long, thin flowers that resemble fingers.

E) Named after William Forsyth, a rascal of a botanist who sold the British government a secret plant medicine which turned out to be nothing but cow dung, lime, sand, soapsuds and urine.

F) Centuries ago, this plant was said to be the "day's eye" because its flowers opened in the morning and closed at night.

G) If held upside down, this flower looks a bit like a ring of doves. The Latin word for dove is "columba."

H) This name is from the Greek word "klema" meaning "twig."

I) This name comes from two Greek words: "chrysos" meaning "gold," and "anthos" meaning "flower."

J) This name comes from the place of the plant's origin: Candia (the island of Crete)

ACTIVITY 2: WATCH A VERY NICE BUT VERY SHORT BIOGRAPHY OF LINNAEUS

There's a very nice 4-minute summary of the life and work of Linnaeus posted on the Botany playlist at www.YouTube.com/TheBasementWorkshop.

ACTIVITY 3: PLANTS WITH PLACE NAMES

Some plants are named after places where they grow, or the place where they were first discovered. See if you can identify the place name in each of these plant names.

1) A flower named *Callistephus chinensis:* _____
2) A flower named *Arum italicum:* _____
3) A wildflower named *Tradescantia virginiana:* _____
4) A tree named *Azadirachta indica*: _____
5) A decorative flowering plant named *Dianella tasmanica*: _____
6) A grass named *Raddia brasiliensis*: _____
7) A gray-colored mossy-looking plant named *Raoulia australis*: _____

ACTIVITY 4: "ALL IN THE FAMILY"

Have you ever heard someone talk about plants or animals being "related" to each other? You might have heard something like, "Spiders are related to crabs." What does this mean?

The more classification categories two organisms share, the more they are considered to be "related." For example, look at the classification (taxonomy) of these three plants. Their taxonomy is listed starting with the kingdom and going all the way down to genus and species.

POTATO: Plants, Angiosperms, Dicots, Asterids, Solanes, Solanaceae, *Solanum, tuberosum*
TOMATO: Plants, Angiosperms, Dicots, Asterids, Solanes, Solanaceae, *Solanum, lycopersicum*
SWEET POTATO: Plants, Angiosperms, Dicots, Asterids, Solanes, Convolvulaceae, *Ipomoea, batatas*

Which is more related to a potato—a tomato or a sweet potato? If you look at a potato and a sweet potato they seem very related. But if you look at their classification (taxonomy) you will see that the lists for the potato and the tomato are almost identical except for the species. The sweet potato list is different right after "Solanes." The sweet potato isn't even in the same family with the potato, but the tomato is!

Here are some members of the (very large) Prunus family:

CHERRY: Plants, Angiosperms, Dicots, Rosids, Rosales, Rosaceae, *Prunus, serotina*
PLUM: Plants, Angiosperms, Dicots, Rosids, Rosales, Rosaceae, *Prunus, domestica*
PEACH: Plants, Angiosperms, Dicots, Rosids, Rosales, Rosaceae, *Prunus, persica*
APRICOT: Plants, Angiosperms, Dicots, Rosids, Rosales, Rosaceae, *Prunus, armeniaca*

The members of this family all share a common trait when it comes to forming seeds. Can you think of what it might be? (Hint: Compare their seeds with those of apples, pears or bananas.)

If you have Internet access, try to find the answers to these questions. (Hint: Wikipedia is very helpful.)

1) Which is more "related" to a zucchini--an acorn squash or a cucumber? _____
2) Which is more "related" to a carrot--a tomato or a yam? _____
3) Which is more "related" to an oak tree--a maple tree or a chestnut tree? _____

LESSON 1

Level 1

Activity 5: (Crossword puzzle)
ACROSS: 1) chloroplasts 2) membrane 3) daughters 4) photosynthesis 5) elongation 6) energy 7) water 8) nucleus 9) chlorophyll 10) carbon dioxide
DOWN: 1) light 2) mitosis 3) eat 4) sugar 5) oxygen 6) DNA 7) vacuole 8) respiration 9) wall

Activity 6: Compare your drawing to the one in the chapter

Activity 7: 1)D 2)A 3)B 4)F 5)H 6)C 7)E 8)G

Level 2

Activity 1: 1)J 2)I 3)B 4)F 5)G 6)D 7)A 8)H 9)C 10)E

Activity 2: 1)B 2)F 3)C 4)G 5)A 6)D 7)H 8)E

Activity 3: 1) Answers will vary. 2) ATP 3) no 4) respiration 5) no 6) split water molecules 7) light 8) carbon dioxide and water 9) the P 10) light phase 11) RuDP 12) there would be no photosynthesis 13) no 14) magnesium

LESSON 2

Level 1

Activity 1: 1) Muehlenberg 2) Engelmann 3) Michaux 4) Kellogg

Activity 3: 1)C 2)G 3)B 4)H 5)I 6)F 7)J 8)E 9)A 10)D

Activity 4: Answers will vary.

Level 2

Activity 1: 1) H 2) A 3) I 4) D 5) C 6) F 7) J 8) B 9) G 10) E

Activity 3: 1) China, 2) Italy, 3) Virginia, 4) India, 5) Tasmania, 6) Brazil, 7) Australia

Activity 4: The prunus fruits all have one large seed that we sometimes call a “pit.”
1) acorn squash (same species), 2) tomato (yam is monocot), 3) chestnut (both are Fagales)

LESSON 3

Level 2

Activity 2: 1) zygote 2) osmosis 3) sporophyte 4) bryophyte 5) thallus 6) gametophyte 7) gemma 8) wort 9) vascular 10) alternation of generations

Stupid plant joke missing words: moss, liverwort, argument, a, bryo-phyte (sounds like “fight”)

LESSON 4

Level 1

Activity 3: The monocots are: corn, yucca, grass, orchid, tulip. The dicots are: oak, geranium, nasturtium, mint.

Activity 4: Vascular plants have a system of [pipes/tubes] that deliver water to their cells. They are made of two types of cells: [xylem] and [phloem]. The [xylem] tubes take water up from the roots and into the [leaves]. This process is called [transpiration]. (The reason this process works is because of the electrical attraction between [water] molecules.) The [phloem] tubes carry water that has sugars in it. This sugary water can go either up or [down] depending on where it is needed. In northern climates, sap in maple trees rises from [the roots] up into the leaves. If you put a tube into the tree you can catch some of this sap and make [maple syrup] from it.

Most vascular plants make [seeds] but a few do not, such as the fern. Most vascular plants are either monocots or [dicots]. The monocots have one [seed leaf] when they first sprout, whereas the [dicots] have two. The monocots have [parallel] veins in their leaves. The [dicots] have veins that resemble a palm shape.

The central part of a stem is called the [pith]. The outer cells are the epidermis. Just inside the

LESSON 2

1) LEARN HOW TO PRONOUNCE SCIENTIFIC LATIN

To learn more about how to pronounce Latin plant names, check out this site by the Florida Department of Agriculture: **http://botanicallatin.org/latinhandout.doc**

2) WANT TO HEAR MORE STORIES ABOUT HOW FLOWERS GOT THEIR NAMES?

To learn more about the names of flowers, you might want to read this book: 100 Flowers and How They Got Their Names by Diana Wells. (If your library doesn't have it, you can find inexpensive used copies on Amazon.com.) There's only about a page per flower—just enough info to keep you interested but not enough to bog you down. This book isn't intended for a juvenile audience, but literary-type kids might think it's interesting. Read just one or two flowers per day—maybe even as a short bedtime story!

3) A BOOK ABOUT PLANT FAMILIES

If you've got a future botanist in the family, you might want to consider purchasing this book: Plant Families by Carol Lerner. (My hardback copy is ISBN 0-688-07882-6.) It is intended for a young audience, but has more than enough information to satifsy most adults, even those of us who enjoy science. The left side of each page has information about a popular plant family and the right side has beautiful botanical illustrations. The plant families include: buttercup, mustard, mint, pea, parsley, "pinks," arum, rose, composite, lily, grass and orchid.

3) A GAME ABOUT PLANT FAMILIES

If you like card games and are willing to spend $12.50 plus shipping, I recommend the following: **"Shanleya's Quest; A Botany Game"** by Thomas Elpel. The game is designed to go with a book by the same name, but can be used independently of the book. This book covers basically the same information as the book listed above in (3), though this one goes into a little more depth and is written around the theme of Native North American folklore.

The cards feature photographs of the flowers of members of various plant families. You learn to recognize members of the same plant family while playing games with the cards. The game is usable for students of any age, from elementary to high schoolers. (There is a video advertisement for this game on the Botany playlist. I posted the ad because there is so much information in it that it's worth watching it even if you don't buy the game.)