

Our Garden Today

The systematics garden at Smith College has been reorganized three times, in 1894, 1980s and 2014, reflecting the understanding of plant classification at the time. The current design is an interpretation of a genetics and phylogeny (evolutionary) based organization scheme. Our systematics garden contains angiosperms (flowering plants) and therefore does not show species that evolved earlier, such as the ginkgo, one of which is growing in the midst of the systematics garden, and ferns, which can be seen next to Burton Hall.

The garden is laid out in a visual representation of a phylogenetic tree, which represents the lineages of organisms as they evolve through time. It reflects current concepts put forth by the Angiosperm Phylogeny Group, an international collaborative of systematic botanists. Everything in the ends or the “leaves” of the tree is living today and therefore this arrangement does not show their ancestors but rather how related each group is to another. The sign post represents the base of the angiosperm tree. The common ancestor of all of the angiosperms would be here, if it were alive today. Each dotted line of granite stone represents generations of adaptations and genetic changes that led to the groups at the end of the line. Those beds feature today’s flowering plants, each the result of more than 120 million years of evolution since the rise of angiosperms. In each bed we have planted representatives from a group of families that are closely related to each other. Nearby beds are more closely related to each other than to beds that are farther away from each other.

Angiosperms have been constantly evolving into new species since they first arose. Three significant groups split off over time. Basal groups are those that evolved and split off earlier. The first group is the basal angiosperms, which include the magnoliids. This group broke off from the angiosperm line and continued to evolve in a different direction. Later the monocots broke off and continued to evolve. Lastly the eudicots, or true dicots, broke off from the tree. Today the eudicots are the most diverse group of flowering plants.

Families in the Systematic Beds

Magnoliids

Annonaceae, Custard-Apple | **Calycanthaceae**, Strawberry–shrub
Magnoliaceae, Magnolia | **Saururaceae**, Lizard’s–tail
Aristolochiaceae, Birthwort | **Lauraceae**, Laurel

Basal Monocots

Araceae, Arum | **Acoraceae**, Sweetflag | **Dioscoreaceae**, Yam

Monocots

Smilacaceae, Catbrier | **Amaryllidaceae**, Amaryllis | **Liliaceae**, Lily
Colchicaceae, Autumn Crocus | **Iridaceae**, Iris
Asparagaceae, Asparagus | **Xanthorrhoeaceae**, Kangaroo Paw
Melanthiaceae, Brunchflower | **Alliaceae**, Onion

Monocot Commelinids

Poaceae, Grass | **Commelinaceae**, Spiderwort | **Cyperaceae**, Sedge
Cannaceae, Canna | **Heliconiaceae**, Heliconia
Zingiberaceae, Ginger | **Stereltziaceae**, Bird-of-Paradise

Basal Eudicots

Papaveraceae, Poppy | **Lardizabalaceae**, Lardizabala
Buxaceae, Boxwood | **Trichodendraceae**, Yama-Kuruma
Berberidaceae, Barberry | **Ranunculaceae**, Buttercup

Saxifragales

Saxifragaceae, Saxifrage | **Grossulariaceae**, Currant
Paeoniaceae, Peony | **Crassulaceae**, Stonecrop

Malvids

Anacardiaceae, Sumac | **Malvaceae**, Mallow | **Rutaceae**, Rue
Brassicaceae, Mustard | **Onagraceae**, Evening Primrose

Fabids

Rosaceae, Rose | **Hypericaceae**, St. John’s-wort
Phyllanthaceae, Leaf Flower | **Linaceae**, Flax
Begoniaceae, Begonia | **Violaceae**, Violet
Cucurbitaceae, cucumber | **Fabaceae**, Bean
Euphorbiaceae, Spurge | **Geraniaceae**, Geranium

Caryophyllales

Cactaceae, Cactus | **Portulacaceae**, Purslane
Phytolaccaceae, Pokeweed | **Caryophyllaceae**, Pink
Polygonaceae, Buckwheat | **Plumbaginaceae**, Leadwort
Amaranthaceae, Amaranth

Ericales

Polemoniaceae, Phlox | **Primulaceae**, Primrose
Balsaminaceae, Touch-me-not | **Ericaceae**, Heath

Lamids

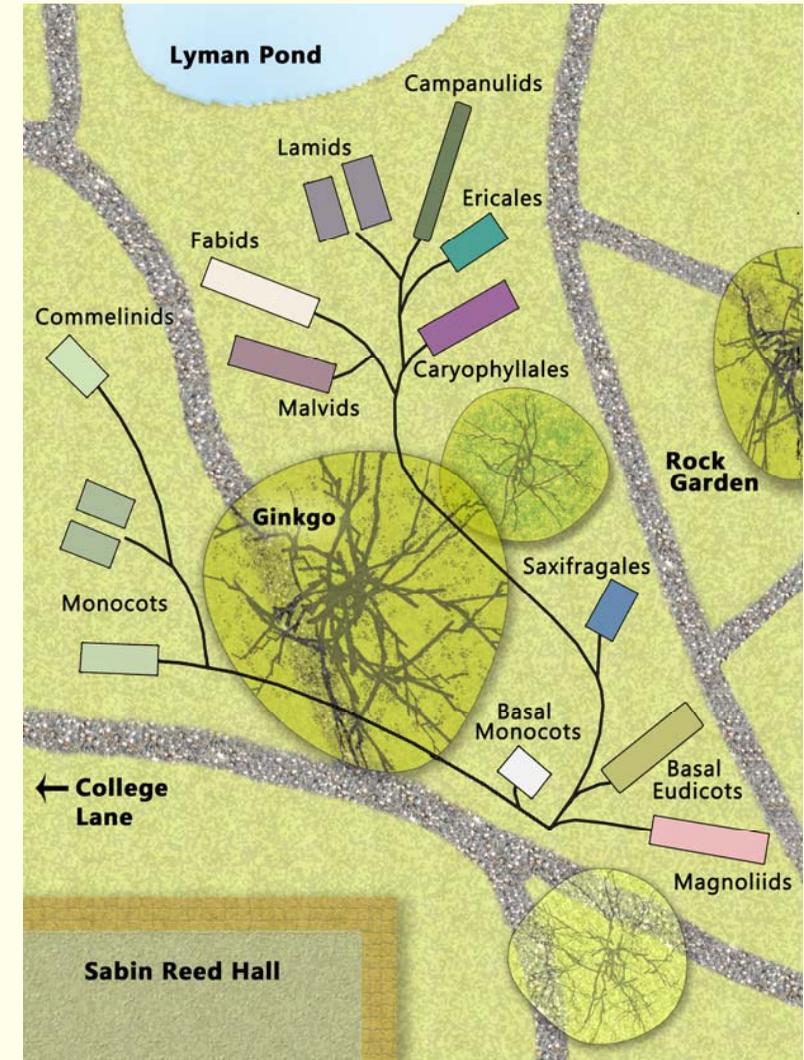
Boraginaceae, Borage | **Plantaginaceae**, Plantain
Apocynaceae, Dogbane | **Verbenaceae**, Verbena
Gentianaceae, Gentian | **Solanaceae**, Potato
Scrophulariaceae, Figwort | **Lamiaceae**, Mint

Campanulids

Caprifoliaceae, Honeysuckle | **Apiaceae**, Carrot
Campanulaceae, Bellflower | **Asteraceae**, Aster

Systematics Garden

THE BOTANIC GARDEN OF SMITH COLLEGE



History of Plant Classification

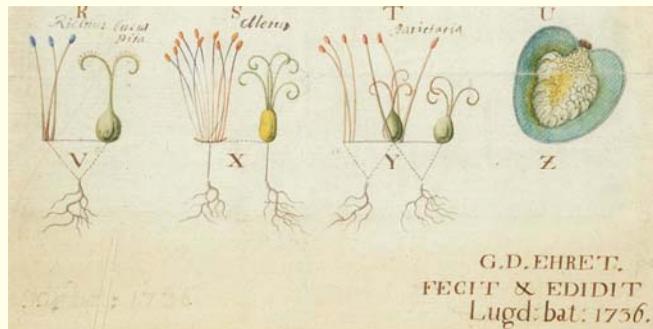
Humans are constantly attempting to understand and explain the natural world. When it comes to living things, we try to impose order by categorizing organisms into groups. There is some artificiality to this, with boundaries drawn when they are actually not so clear. Evolution is a spectrum and all organisms are ultimately related to each other.

Throughout history humans have created a variety of organizational systems, each with a different goal. The initial classification systems were based on functionality: medicinal, edible and poisonous plants were categorized by their purpose. The Greeks transitioned to morphological classification, with plants sorted by physical characteristics. As evolution became better understood, systems changed to reflect how plants are genetically related.

Carl Linnaeus (1707-1778) created the scientific naming system using binomial nomenclature (genus + specific epithet, in Latin), e.g., humans are *Homo sapiens*. This format is still universally accepted, governed by internationally agreed upon rules. Each identified species is given a unique name, enabling scientists to communicate without ambiguity.



Carl Linnaeus



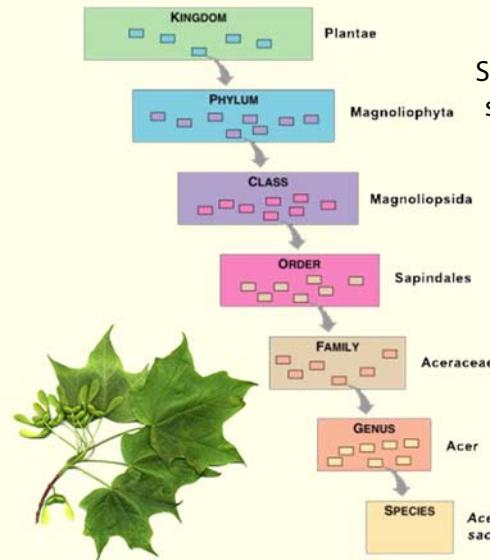
A drawing explaining the Linnaeus system

Classification of Animals

All animals have a scientific name, including your housecat, *Felis catus*. It is in the animal kingdom and in the class Mammalia. Yet there are many different mammals. To distinguish a cat from a lion, wolf, kangaroo, or whale, we divide them further into additional subcategories, each with animals more related to each other. The family Felidae includes all cats including jaguars, tigers, and bobcats, all sharing certain characteristics. Within the cat family the genus *Felis*, includes small cats, including the black-footed cat and Chinese desert cat.

Classification of Plants

Sugar maples, known for the sap that is used to make maple syrup, are in the plant kingdom, placed in the flowering plant division. All maples are in the genus *Acer*, a part of the family Aceraceae. Sugar maples have the specific epithet of *saccharum* while *rubrum* is the specific epithet for red maple. Thus the sugar maple is *Acer saccharum*.



	Seed	Root	Stem	Leaf	Flower
Mono-cots					
		root xylem and phloem in a ring	vascular bundles scattered in stem	leaf veins form a parallel pattern	flower parts in threes and multiples of three
Eudi-cots					
		root phloem between arms of xylem	vascular bundles in a distinct ring	leaf veins form a net pattern	flower parts in fours or fives and their multiples

Differences in structure between Monocots and Eudicots

Biodiversity and Conservation

The field of conservation biology relies heavily on the classification of organisms to make policy decisions. Preservation of biodiversity and the development of bioengineering rely on the understanding of genetic relationships. Plant biodiversity is crucial in combating plant diseases and developing new economically important plants for food, medicine, fiber, etc. We cannot bring back a species once it is extinct. Protecting species required a system for identifying plants and keeping track of those that are threatened.

rare & endangered

A study published recently revealed that the world's plants are as threatened as mammals and the main cause is human-induced habitat loss. Plants are essential to life on earth and their loss would prove catastrophic.

PLANT LIFE IN NUMBERS

- There are **more than 380,000** species of plants known to science with many more yet to be discovered
- One in five** plant species in the world is under threat of extinction
- 63%** of threatened plant species are found in **tropical rainforest**

THREATS TO PLANT LIFE

One of the worst threats facing plants today is the conversion of natural habitats for agriculture or livestock use

81.3% HUMAN IMPACT which includes:

- Commercial agriculture, pollution, mining and transportation
- War and recreational activities

18.7% NATURAL EVENTS which includes:

- Intrinsic factors such as limited dispersal, restricted range and poor reproduction
- Geological events such as volcanic eruptions, earthquakes and tsunamis

STATE OF THE WORLD'S PLANT LIFE

FACTS

- Plants are major pillars of the world's ecosystems and are vital for providing food, clean water and soil, medicine and regulating our climate
- The most threatened habitat is tropical rainforest

References

- Simpson, Michael G. *Plant Systematics*. 2nd ed. New York: Elsevier Inc, 2010. Print.
- Angiosperm Phylogeny Group website
<http://www.mobot.org/MOBOT/research/APweb/>