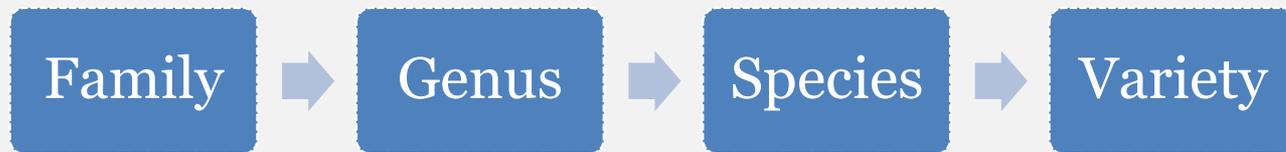
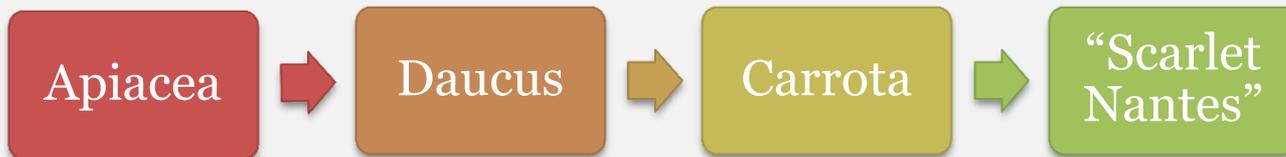


Seeds



Ex. Carrots:



Understand the Basics of Seed Propagation



- The learner will understand the basics of plant:
 - Botany
 - Pollination
 - Breeding
 - Saving



First: Basic Botany



- The kingdom *Plantae* features multicellular organisms that are most often characterized by their ability to *photosynthesize*, or convert solar energy into chemical energy.
 - The most important plants to farmers are the *angiosperms*, or flowering plants. These plants use flowers as their method of reproduction.
 - The flower produces the seed, which contains the genetic material for producing a new separate plant.

Seed Basics: <http://www.youtube.com/watch?v=iv5JjH4kD1k>

Plant Taxonomy



- Plants are divided into species, which are further divided into *varieties*.
- Varieties of a single species will differ from each other in some regard, but can still reproduce and create viable offspring.

• For instance, there are well over 100 varieties of green beans.



What Are Seeds?



- Seeds are the mature, fertilized ovules of plants and the means by which plants reproduce. In essence, a seed is the embryo of a new plant that will grow upon certain conditions.



Life Cycle Length



- Plants produce seeds at different rates; we categorize plants based on the length of their life cycle, and thus seed production.

| TITLE | LIFE CYCLE LENGTH |
|-----------|---------------------|
| Annual | One year |
| Biennial | Two years |
| Perennial | More than two years |

Biennials include:

Annual vs. Biennial seed producers



carrots



beets



parsley



Swiss chard



kale



leeks

AND..

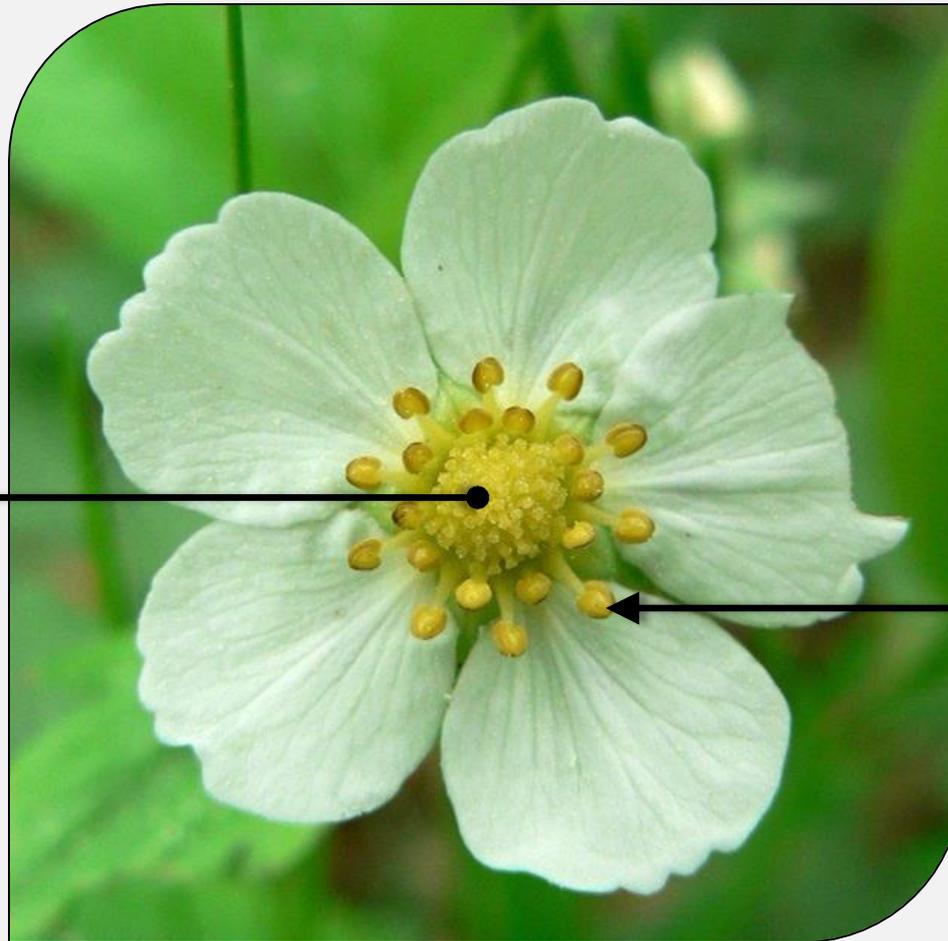
Cabbage family & onions

Plant Reproductive Anatomy



- Plants have sexual organs: the stamen (male) and pistil (female).
 - The stamen has a specific part, the *anther*, that produces *pollen grains* that contain the male germ cells.
 - The ovules of the pistil produce female germ cells.
 - ✦ When the pollen grains unite with the ovules, fertilization occurs and the flower produces seeds.

Stamen and Pistil

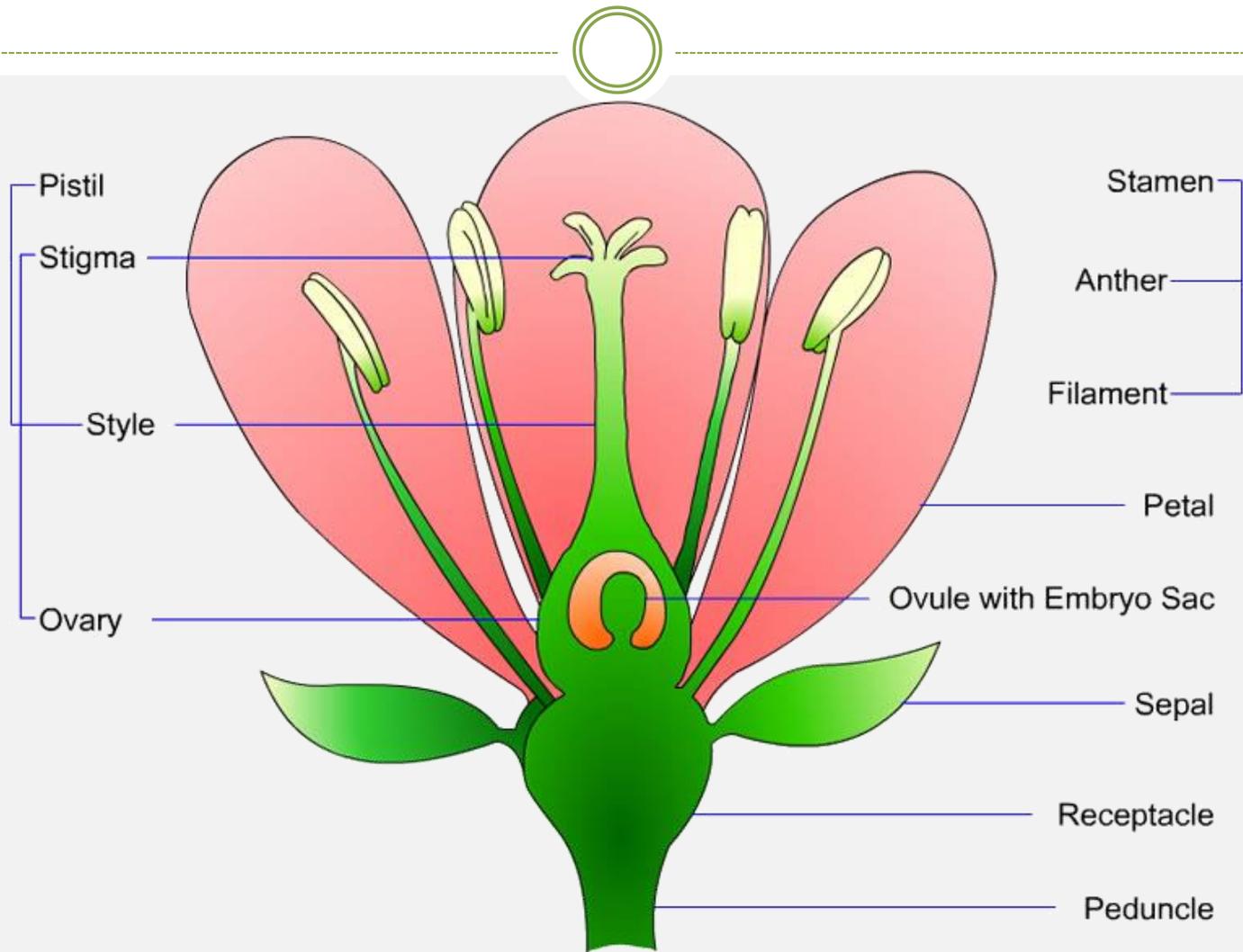


Pistil
(female)

Stamen
(male)

Strawberry flower (*Fragaria x ananassa*)

Flower Parts



Types of Flowers



- Some plants have *perfect flowers*, which contain both sexual organs, whereas other plants have *imperfect flowers*, which have only one sexual organ.

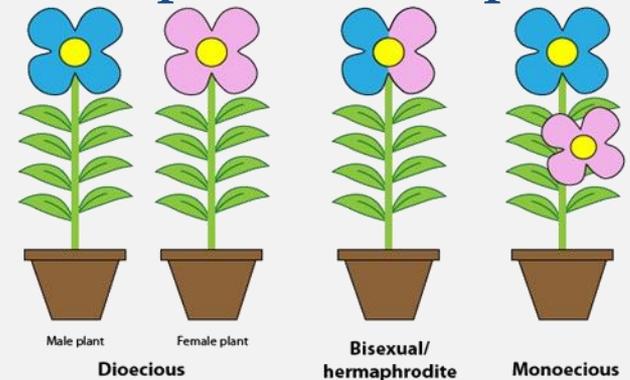


Thus, you know that
this is a *perfect*
flower

Monoecy vs. Dioecy



- Plants with imperfect flowers are divided into categories of *monoecious* and *dioecious*.
 - Monoecious plants have both male and female flowers on each plant.
 - ✦ Most flowering plants are monoecious.
 - Dioecious plants instead have one type of imperfect flower (male or female) on each plant and rely on another plant to complement the sexuality.
 - ✦ These include asparagus and spinach.



Pollination



- Plants either self-pollinate or cross-pollinate.
 - Self-pollination is a form of asexual reproduction; the plant simply pollinates itself, thus creating genetically identical offspring.
 - Cross pollination, in turn, requires two different plants that will create genetically different offspring.

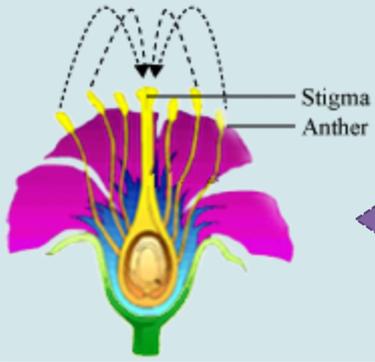
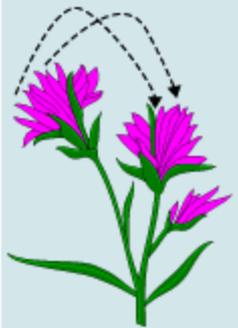
[Louie Schwartzberg – The Hidden Beauty of Pollination-](http://www.youtube.com/watch?v=eqsXc_aefKI)
http://www.youtube.com/watch?v=eqsXc_aefKI

Pollination



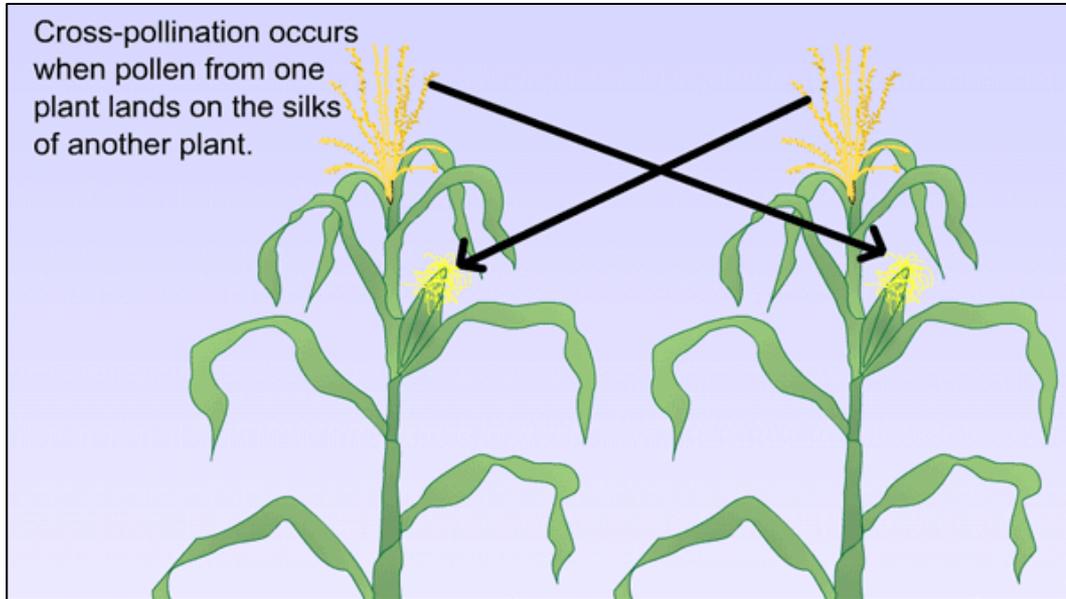
- Plants that *only* self-pollinate include:
 - Bush and pole beans
 - Peas
 - Tomatoes, Peppers, Eggplant
 - Lettuces
- Plants that *only* cross-pollinate include:
 - Cabbages
 - Radishes
- Most other plants can both self- and cross-pollinate.

Self-Pollinated:

| (a) Type I | (b) Type II |
|--|--|
|  |  |
| <p>It occurs within the same flower. Pollen from the anther is transferred to stigma of the same flower.</p> | <p>It occurs between two flowers of the same plant. Pollen from the anther of one flower is transferred to stigma of another flower in the same plant.</p> |



Cross Pollination:



Cross pollinated plants need isolation from one another (usually a minimum of 1/2 mile) when planting more than one variety of the same species in order to keep the breed clean . This can be accomplished by time isolation as well. Planting times are staggered to avoid overlapping flowering and unwanted crossing of pollen(works well with corn).

All Vegetables Require Pollination:

http://newstimes.augusta.com/stories/2011/02/20/new_606469.shtml

Pollination Mechanisms



- Plants pollinate by either *biotic* or *abiotic* mechanisms.

Biotic mechanisms rely upon animals and can be conducted by bees, moths, bats, birds, and many other organisms.

Abiotic mechanisms are wind and water, which can carry the pollen grains to other flowers.



[Britannica – Methods of Pollination](#)

[– Seed Dispersal](#)

Genetics: Inbreeding Depression



- Plants require genetic variability in reproduction on the population level, or the population will undergo *inbreeding depression*, where many individuals will develop undesirable and potentially self-threatening traits.
- Thus, while self-fertilization has obvious benefits to the reproduction of an individual plant, it cannot sustain a whole population.

[Avoiding Inbreeding Depression:](http://www.flexiguru.com/expert/how-do-plants-overcome-inbreedingdepression-8477)

<http://www.flexiguru.com/expert/how-do-plants-overcome-inbreedingdepression-8477>

Hybrid Offspring



- Remember the slide about plant taxonomy? Each species can have multiple *varieties* of plants.
 - Breeding between different varieties results in *hybrid* offspring.



Seedless watermelon is simply an infertile hybrid; it is a triploid offspring produced by crossing one diploid and one tetraploid watermelon.

Genetics: Heterosis



- Opposite of inbreeding depression, a population can experience *heterosis*, or *hybrid vigor*, which is the production of positive traits in offspring due to hybrid crosses.
 - For this reason, over 95% of the corn grown in the U.S. is from hybrid seeds. Corn farmers purchase these seeds each year, rather than growing their own.



Genetic Modification GMO



- Genetically Modified seed is the result of scientifically altering DNA of that seed; usually using genes of a different plant life to alter the characteristics of the plant or fruit of that seed (to make it more profitable).

ie-GMO corn and soybeans have altered DNA to withstand applications of Round Up(herbicide) without dying like all other surrounding plant life(and microbiology).

GMO seed is not allowed in organic production and it threatens the sustainability of seed variety and species.

<http://gmoanswers.com/explore?gclid=CI7ApMbsxLoCFc9AMgodi2gAMw>

Seed Saving



- Selecting plants from which to save seed should be an extended process of observation.
- Plants should be evaluated for their positive characteristics and marked appropriately.
- When that crop goes to seed, the marked plants can serve as parents for future plantings.

[How to Save Seeds:](http://www.youtube.com/watch?feature=player_embedded&v=L_Yncr8rTfc)

http://www.youtube.com/watch?feature=player_embedded&v=L_Yncr8rTfc

Seed Saving: Wet vs. Dry Processing

- Seed saving can be done by either dry or wet processing.
 - Many plants permit their seeds to dry out naturally before a farmer harvests them, such as beans or corn.
 - However, certain plants require *wet processing*, in which the harvester dries the seeds if he or she wishes to store them. These plants include tomatoes, melons, eggplant, squash, cucumbers, and peppers.



Benefits of Saving Seed



- Saving seed has many benefits.
 - Small farms saving seed supports biodiversity among the plants and thus the populations are better adapted for pest and disease resistance.
 - Through natural selection the plants adjust to the soil and microclimates of the individual farm.
 - The practice costs less financially and reduces farmer dependence upon regional and/or national seed companies.

Self Review



1. Name the parts of a flower. How do self pollinating differ from cross pollinating?
2. Talk about the positive and negative effects of hybridization.
3. What is the general life cycle of a self pollinating flower.
4. How are wet seeds saved? Why is seed saving important?
5. Give examples of fruits/vegetables that are self pollinating and cross pollinating?

Books for More Information



- [Suzanne Ashworth and Kent Whealy – Seed to Seed](#)
- [Brian Capon – Botany for Gardeners](#)
- [Eliot Coleman – The New Organic Grower](#)
- [Carol Deppe – Breed Your Own Vegetable Varieties](#)

Photograph Sources



- Slide 3 - beautifulcataya. “Fresh Green Beans.” Photograph. Fotopedia. Web. 12 Aug. 2012.
- Slide 4 - Kratochvil, Petr. “Grain Plant Seed.” Photograph. Public Domain Images. Web. 12 Aug. 2012.
- Slides 7 & 8 - Rosendahl. “Wild Strawberry Flower.” Photograph. Public Domain Images. Web. 12 Aug. 2012.
- Slide 12 - Sullivan, John. “Bee pollinating the basil on my balcony.” Photograph. Public Domain Images. Web. 12 Aug. 2012.
- Slide 13 - Brooks, Leon. “Sunlight over picket fence.” Photograph. Public Domain Images. Web. 12 Aug. 2012.
- Slide 15 - Depolo, Steven. Photograph. Nopsa. Web. 12 Aug. 2012.
- Slide 16 – Culturally Authentic Pictorial Lexicon. Photograph. Web. 12 Aug. 2012.
- Slide 18 - Sullivan, John. “Chillies chillies peppers seeds pods.” Photograph. Public Domain Images. Web. 12 Aug. 2012.