

# Plant Breeding Introduction

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PLS 006

# Who was Carl Linnaeus?

- Carl Linné var svenska som växte upp i södra Sverige i Småland. Han fick sin utbildning vid Uppsala universitet. De flesta av hans skriftliga kommunikation i vetenskaperna var på latin.
- Swedish botanist – developed the modern scheme for classifying plants. His book ***Systema Naturæ*** published in 1735 was the starting point for this.
- Today every plant has a scientific name that includes **genus** and **species**

# Taxonomy

- The scientific work of defining groups of organisms based on shared characteristics
  - Physical characteristics
    - Shapes of leaves
    - Stature of plant
    - Details of the flowers and other plant organs
  - Ability to sexually propagate
- Taxonomists come up with names for the specific groups

# Taxonomic Classification of plants

## Kingdom – Plants

- Phylum

- Class

- Order

- Family

- » Genus – plural: Genera

- Species

- Horticultural subdivisions:

- Variety

- Cultivar

If you want to learn more about this, then take one of the many courses at UCDavis that involve this:

ENH 6

ENH 105

PLS 131

PLB 102, 105, 108

- In addition to a scientific name, many flowers also have common names
- Pay attention to these names!

# Propagation

- **Asexual propagation**
  - Making **cuttings** and turning those into whole plants
  - On many plants when cells of stems are exposed to certain hormones, roots are formed
  - Note that every **propagule** is a **clone**
  - “**Tissue culture**” – cells or groups of cells are manipulated to grow and form new plant tissue in a vessel that is otherwise sterile
- Is asexual propagation possible with animals?

# Propagation

- **Sexual propagation**

- Uses the organism's male and female parts to grow **Seed**

- Male and female elements combine (process is called "**fertilization**")
    - For most plants the seed can sit for a long time without growing

- Seed germinates when some set of conditions and stimuli are present

- E.g. water, temperature,
    - Different plants have different **germination requirements**

# Terms to learn:

- **Breeding**

- **Hybridization** = Breeders use sexual propagation: manipulating the male and female

- **Hybrid** – the result of sexual propagation

- Once a plant company has a plant that has the desired characteristics, asexual propagation can be used (not always) to multiply the plant

- **Special terms:**

- Crossing

- Backcrossing

# Basic crosses

- Take pollen from one flower on one plant and place that on the stigma of a flower on a different plant of the same species



# Generally in nature

- Parents are the same species
- It is also possible to make hybrids by combining genetic material from parents which are not the same type
  - Animals: think of some strange dogs (mutts)
  - Plants: Lilies – currently we are seeing new hybrids which resulted from crossing different species of lilies.

# Basic Steps

- Pollen from one plant → transfer to stigma of another plant
  - If plants are “incompatible” then nothing happens
  - If plants are of same species: something happens
- That “something”:
  - A sequence of events inside the style that lead to fertilization
    - Many things can go wrong along the way or afterwards
    - If everything goes “right” then a new seed is formed

# Pollen transfer

- Wind – for many plants this does not work; those where it works are called “wind pollinated”
- Insects, other animals (birds, bats, etc)
- In some plants it happens without any other forces
  - E.g. pollen falls from stamen to style,...
  - Term: “Self-pollination” means that the plant can pollinate itself
  - Many plants have mechanisms that prevent this from happening or where when it does happen, that something prevents self-fertilization or prevents the seed from developing.
- Breeders (humans doing it by design)

# First Breeder/Geneticist

- Gregor Mendel (1822 – 1884)
  - Was a German monk in what is now the Czech Republic (was then part of Austria/Germany)
  - Grew up on a farm; became monk; was schooled at University of Vienna; returned to his abbey and started studying the genetics of peas
  - because of what he learned he is known today as the "**father of modern genetics**"
  - Since then we know how to make crosses and what to expect from them; but even today there is more research being done...

# Hybridization

- Note that today we know how to make crosses that would normally not work. Two terms:
  - Interspecific hybridization (generally works)
    - Crossing two different species from within the same genus
  - Note that crossing plants from different genera (plural of genus) generally does not work in nature (except with some orchids)
    - Doing it in ways that overcome natural barriers to pollination and fertilization to obtain offspring that have parents from different species

# Hybrids

- A term that breeders use that comes up a lot is “F1 hybrid” (even for non-breeders)
  - “F1” is jargon that stands for “Filial 1” (first offspring)
  - Generally the result of a cross of two pure-bred lines (what you would find out in nature)

# Genetically Modified Organisms (GMO)

- Organisms which have genetic material that was modified through “genetic engineering” techniques
- Note that despite the name, it does NOT mean organisms whose genetic material was modified through conventional crosses
- Genetic material can end up in a cell through transmission by:
  - Virus, bacterium
  - Some other physical injection (“gene gun”)
- Very powerful method to achieve specific things; many times unachievable by conventional breeding