Plant reproduction
You know about the birds and the bees, why not the birch and the beech?

Alternation of generations
- Multicellular haploid and diploid stages take turns producing each other

Gametophyte-sporophyte variations

Angiosperm life cycle

Flowers: Reproductive shoots
- Four major parts

Complete vs. incomplete flowers
- Four vs. fewer

Perfect vs. imperfect flowers
- Perfect (old) = **bisexual** flower = both stamens and carpels
- Imperfect (old) = **unisexual** flower = missing one set
  - **Monoecious**: both flower types on the same plant
  - **Dioecious**: flower types on different plants

Monoecious flowers

Dioecious flowers

Male gametophyte
- Microspores

Female gametophyte
- Megaspores

Pollination
- Bringing the male and female gametophytes together
- Co-evolution

Self-fertilization?
- Do plants usually self-fertilize?
- Why or why not?
- **Self-incompatibility**—biochemical block is most common
- Structural adaptations

Double fertilization
- Endosperm and zygote formed
- Why double?
- Role of endosperm?

Seed formation
- After fertilization, ovule develops into a seed and ovary develops into a fruit

Seed structure

From flower to fruit

Seed germination

Asexual reproduction
- Many plant species can clone themselves: **asexual** or **vegetative reproduction**
- Partly a result of plants' ability for **indeterminate growth** (vs. most animals)
- Why can this be a good thing?

Humans and plant reproduction
- We've taken advantage of plants ability to reproduce asexually
- **Cuttings** (or **fragments**) from plants are used to produce MANY plants with certain desired characteristics
- At one end of a cutting is a mass of dividing, undifferentiated cells called a **callus**
- A callus forms adventitious roots and eventually differentiates into all parts of a plant

Plant biotechnology
- Using plants in new ways to help people
  - Long history
- Today considered to be using **genetically modified (GM) organisms** in agriculture and industry
  - Very contentious

Modern biotechnology
- Today we've moved beyond artificial selection of closely related species or varieties of a single species
- Now we can transfer genes among very distantly related species through genetic engineering
- **Transgenic organisms** have been genetically engineered to express a foreign gene

Bt corn
- Genes from the bacterium *Bacillus thuringiensis* are inserted into corn plants
- The genes code for a protein (*Bt* toxin) that kills insect pests (especially the European corn borer)
- Using these transgenic corn plants reduces the need for pesticides, which saves money and reduces the environmental impacts associated with chemicals

Bt corn vs. monarch butterflies
- A 1999 study in *Nature* found high doses of pollen from *Bt* corn could negatively impact (including kill) monarch larvae feeding on milkweed that had been dusted with the pollen
- Later published studies have found that the concentrations in the study were unrealistically high, and that there is likely little threat to monarchs at normal levels of pollen

What's the big deal?
- We've been modifying species through selective breeding for thousands of years
- What's the problem with modifying species directly through their genes?