

There are two critical stages in the life cycle of a flowering plant:

1. Pollination—the transfer of pollen from anther to stigma, usually most effective on a different plant. As we saw in the lecture on "Breeding Systems", most flowering plants have different types of mechanisms to promote the transfer of pollen from an anther in one flower to a stigma in a different flower, and hopefully this flower will be on a different plant.
2. Dispersal—the movement of seeds away from the parent plant.

Plants often solicit the aid of animals to accomplish both of these.

Sexual reproduction is just as important for plants as it is for animals when it comes to generating genetic variation, but plants have a singular disadvantage compared to animals when it comes to sex: they can't just get up and find themselves a mate.

May R. Berenbaum, *Bugs in the System* (1995)

Much of the flower diversity that you have observed thus far this semester is because of adaptations for pollination by different mechanisms. In this lecture, we will discuss the main types of pollination mechanisms. However, please keep in mind that there are always exceptions; plants and animals that visit flowers have minds of their own!

The vast majority of flowering plant species are pollinated by insects; in fact, it seems that flowering plants and many major groups of insects co-evolved together. Animals other than insects can also be important pollinators: bats, birds (especially hummingbirds), and even a few mammals.

To attract biological pollinators, flowers must:

1. Advertise
  - color and/or nectar guides
  - scent (that humans perceive as wonderful to awful)
2. Offer reward
  - pollen, nectar, other food from special structures, breeding sites, and in a few cases, warmth
3. Provide access
  - place to land or to hover
  - flowers in right position to be found
4. Have correct structure that allows transfer of pollen from plant to pollinator and back

<b>Mode of Pollination</b>	<b>Visitation &amp; Anthesis</b>	<b>Flower Morphology</b>	<b>Color</b>	<b>Odor</b>
<b>Beetles</b>	Day & Night	Actinomorphic, numerous floral parts; large bowl shaped, ovules protected	Dull, white, few visual attractions, no nectar guides	Strong, fruity or aminoid; no nectar, food primarily pollen or food bodies
<b>Carrion &amp; Dung Beetles &amp; Flies</b>	Day & Night	Actinomorphic, deep corolla tube with appendages forming traps	Purple, brown (like meat), no nectar guides or nectar	Strong, like rotting meat, really awful
<b>Flies &amp; Bee Flies</b>	Mostly day	Actinomorphic, little depth	Variable, but often dull or light, nectar guides present	Little to (too) much odor, nectar present or absent, accessible, food often pollen
<b>Bees</b>	Day	Often zygomorphic, shape variable, little depth to tubular	Yellow, blue, or white, usually not red, often with nectar guides	Sweet odor, nectar usually present, often hidden
<b>Butterflies</b>	Day	Actinomorphic, erect anthers on narrow tubular corolla	Yellow, blue, pink and red, often with nectar guides	Strong or weak, nectar present in corolla tubes or spurs
<b>Hawkmoths</b>	Night or dusk	Actinomorphic, narrow tubular corolla, anthers often, versatile, flowers horizontal or hanging down	White or sometimes pale green to yellow, no nectar guides	Heavy, sweet odor at night, abundant nectar

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<b>Fly-gnats</b>	Stay open for several days	Urn or kettle-shaped traps, have structures that mimic fungus gills or pores, close to ground level	Dark purple or brown	Musky like a fungus; intense transpiration during flowering period for humidity
<b>Birds</b>	Day	Actinomorphic, stiff, wide tubular with hanging stamens	Often bright red, no nectar guides	No odor, abundant nectar; ovary protected
<b>Bats</b>	Night	Large, sturdy, wide, somewhat zygomorphic, accessible	White, cream, or drab, no nectar guides	Strong at night, often smelling like fermenting yeast, abundant nectar, food bodies, and/or pollen
<b>Mice, Mouse-Lemurs, &amp; Small Marsupials (S. Africa, Madagascar, Australia)</b>	Night	Sturdy, often "snout" shaped corolla, many stamens or dense heads of flowers, accessible, near the ground	White, cream, dull red, or drab, no nectar guides	Yeasty odor, abundant nectar and/or pollen
<b>Wind</b>	Day	Small, imperfect, produced before leaves unfold or outside crown of plant, inflorescences often hanging	Little color	none