Mutualism: Interactions between individuals of different species that benefit both partners

http://www.youtube.com/watch?v=z3bWqlPLpMg
Types of mutualism

- **Facultative Mutualism** occurs when a species can live without its mutualistic partner.
- **Obligate Mutualism** occurs when a species is dependent on a mutualistic relationship.

This wrasse and a barracuda! Why could this be considered obligate mutualism?

Clogged gills for barracuda, food source for wrasse!!
Is mutualism important?

• Without mutualism, there wouldn’t be
  ▶ Coral reefs
  ▶ Animal-pollinated plants
  ▶ No apples
  ▶ No bees or hummingbirds
  ▶ Herbivores that depend on animal-pollinated plants
  ▶ Wind-pollinated plant populations would be reduced – no mycorrhizae
  ▶ No herbivores
  ▶ No eukaryotes!!! No you!!!
Plant Mutualisms

- Many mutualistic relationships
  - Bacteria
  - Animals
  - Fungi - mycorrhizae

http://www.youtube.com/watch?v=bq1bTduTzC0
Mycorrhizae and Plant Water Balance

- Plants with mycorrhizae maintained higher leaf water potentials.
  - mycorrhizal fungi provide more contact with moisture in the soil

Plant gets more access to water and nutrients
Mycorrhizae get photosynthethic product
Plant Mutualisms

- Many mutualistic relationships
  - Bacteria
  - **Animals - Ants and Swollen Thorn Acacia**
  - Fungi

*Can have up to 30,000 ants in the colony!!!*

Ants and Swollen Thorn Acacia

- Acacia gets protection!
- Ants get:
  - Thorns provide living space.
  - Folliar nectaries provide sugar.
  - Beltian bodies are a source of oils and protein.
Competition between Mutualists??!!

- If the ants protect the acacia from other organisms...what happens with potential pollinators (i.e. other mutualistic partners)???
Plant Mutualisms

- Many mutualistic relationships
  - Bacteria – nitrogen fixation
  - Animals
  - Fungi

http://www.youtube.com/watch?v=dOV0E5FaKoQ

Bacteria, fungus, animal mutualism!!!
Coral Mutualisms

• Zooxanthallae and Corals

- Zooxanthallae live within coral tissues.
  - Receive nutrient from coral. In return, coral receives organic compounds synthesized by zooxanthallae during photosynthesis.

http://www.youtube.com/watch?v=YKKbxvqe0T4
http://www.youtube.com/watch?v=RCX1Lobw7lI&feature=related
Coral Protection Mutualism

- *Glynn* found 13 coral species protected by crustacean mutualists.
  - Crustacean mutualists substantially improved chances coral will avoid attack by sea stars.

How do the crustaceans gain???
Coral Protection Mutualism

- *Pocillopora* coral increases production of fat bodies in the presence of crabs.
  - Digestive tract of crabs inhabiting corals contained large quantities of lipids.

The presence of crabs appears to stimulate increased fat body production by *Pocillopora.*
More mutualism examples

- [YouTube Video](http://www.youtube.com/watch?v=8BEKrc-aXF8)
- [YouTube Video](http://www.youtube.com/watch?v=dKuWlBjUFo8&feature=related)
- [YouTube Video](http://www.youtube.com/watch?v=e7mKSOTzqIo)

Home for Nemo, Food, protection, cleaning for Anemnemo
Evolution of Mutualism

- mutualism will evolve where the benefits of mutualism exceed the costs.
  - several types of mutualistic interactions.
    - Successful mutualists
      - Give and receive benefits.
    - Unsuccessful mutualists
      - Give, but do not receive benefit.
    - Non-mutualists
      - Neither give nor receive benefit.
Mutualism and Humans

• For a population to be mutualistic, fitness of successful mutualists must be greater than unsuccessful or non-mutualists.
  ❖ If not, natural selection will eventually eliminate the interaction.

• Do humans have any mutualistic relationships??? Of course we do...here’s a cool one!!!
