

Species Interactions

I MSc Botany

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Types of Species Interactions

- Predation
- Competition
- Symbiosis
 - Mutualism
 - Commensalism
 - Parasitism

Predation

- **Predation** is an interaction between two organisms in which one organism (the **predator**) consumes all or part of another organism (the **prey**).

Predator-Prey



- Photo Credit: Dr. Kay Holekamp, MSU, <http://hyenas.zoology.msu.edu/hyena/image-gallery.html> (Image 13 from Photo Gallery)

- Predation can involve one animal eating another animal.
- Watch Video : <http://www.youtube.com/watch?v=1tgPoi0hWjk>
- If still available, you can watch the entire episode from David Attenborough's Life of Mammals, the Meat Eaters (50 minutes): <http://www.videosift.com/video/David-Attenborough-The-Life-of-Mammals-5-Meat-Eaters>

A Different Twist on Predator-Prey Interactions

- Watch “Battle at Kruger” taken by an amateur photographer on his lucky day:

Herbivore-Plant Interactions

- An herbivore grazing on a plant is another example of predation.
- Usually, only part of the prey is eaten by the predator.

• Photo Credit: Rhett A. Butler @ mongabay.com



Prey Defenses

- Predation usually results in the evolution of defensive adaptations in prey.
- These can include:
 - Chemical defenses (toxins, poison, acrid sprays)
 - Behavior (living in groups, scouts, alarm calls)
 - Morphological features (spines, color, structures that allow you to run fast or detect predators), and other traits



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Caterpillar with Venomous Spines

- Photo Credit: Rhett A. Butler @ mongabay.com

Behavioral Defense Example

- [Caterpillar Video:](#)

Camouflage



- **Camouflage** is protective coloration in which an animal resembles its background.

- Photo Credit: Rhett A. Butler @ mongabay.com

Camouflage



© WildMadagascar.org

- In addition to matching the background, the animal often uses body position to enhance the illusion.
- Photo Credit: Rhett A. Butler @ mongabay.com

Competition

- **Competition** is an interaction between two organisms that are using the same limited resource.
- Competition can be within the same species (**intraspecific**) or between different species (**interspecific**).

Example: Interspecific Competition

- Two species of barnacles on rocky coasts often compete for space.
- The smaller species (*Chthamalus*) is unable to compete as well as that of the larger species (*Balanus*).
- However, *Chthamalus* can survive dry condition better than *Balanus*, so it can live higher up on the rocks.

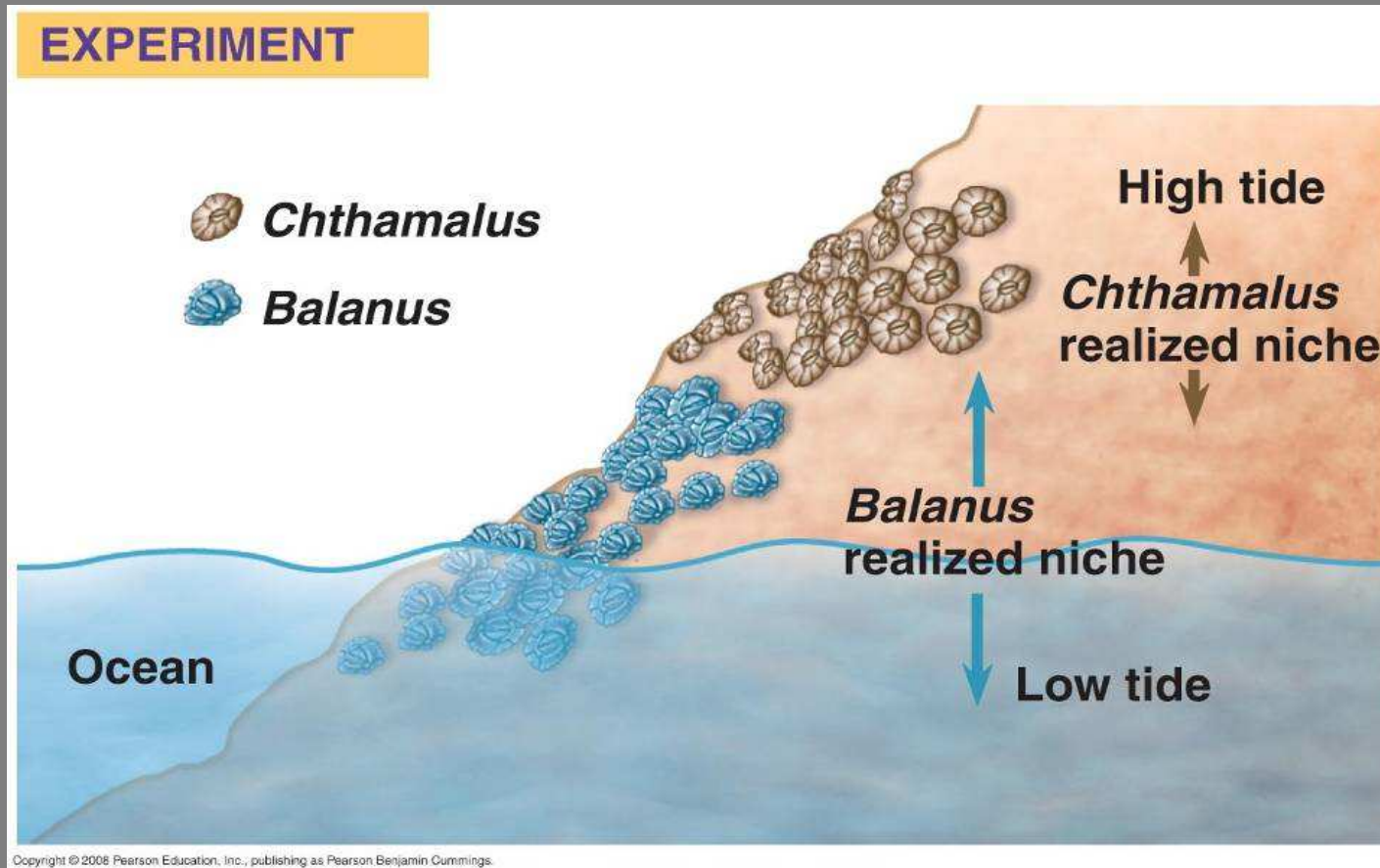
tion



- A small *Chthamalus* barnacle is circled in red.
- A large *Balanus* barnacle is circled in blue.

- Photo Credit: Department of the Interior

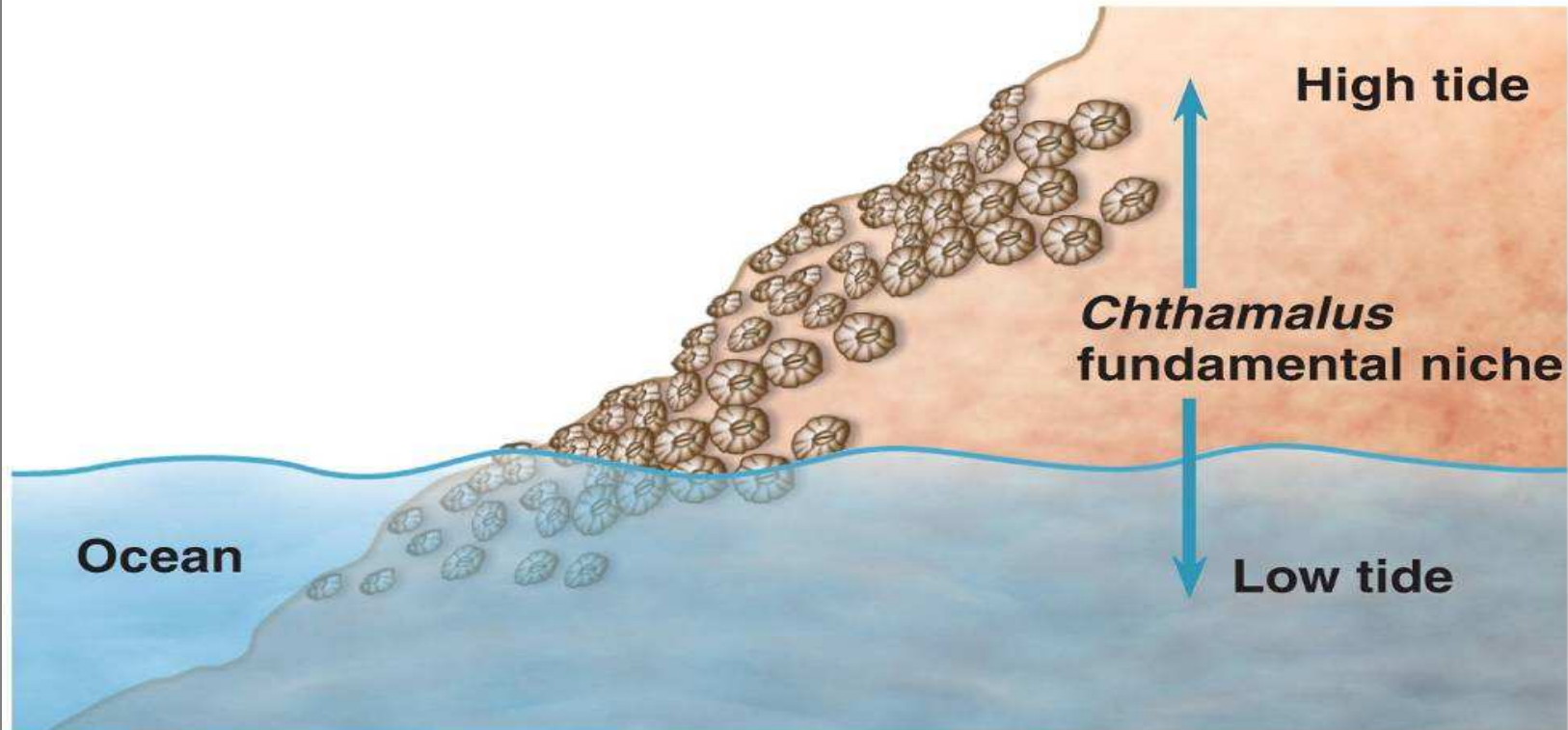
Experiment: Interspecific Competition



- In Scotland, Joseph Connell studied the interspecific competition in these two barnacles.
- In places where both barnacles were present, he removed the *Balanus* barnacles from the rocks.

Experiment: Interspecific Competition

RESULTS



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- When *Balanus* barnacles were removed, the *Chthamalus* barnacles moved down into the vacant area.
- This showed that *Balanus* was outcompeting *Chthamalus* in the lower zone.

Experiment: Interspecific Competition

- At other sites where both barnacles were present, he removed *Chthamalus* barnacles from the rocks.
- The vacant areas remained unoccupied.
- This showed that *Balanus* was not able to survive in the upper zone.

Experiment: Interspecific Competition

- The distribution of these two barnacles is a result of a combination of:
 - Interspecific competition: *Chthamalus* is excluded from the lower zone by *Balanus*
 - Adaptations to dryness and heat: *Balanus* cannot survive in the upper zone but *Chthamalus* can

Symbiosis

- **Symbiosis** is an intimate relationship between different species in which at least one species depends upon the relationship to survive.

Types of Symbiosis

- **Mutualism**: Both partners benefit from the relationship (+, +)
- **Commensalism**: One partner benefits from the relationship; the other partner is not affected (+, 0)
- **Parasitism**: One partner benefits from the relationship; the other partner is harmed (+, -)

Types of Symbiosis

- When one partner is really small and lives inside of the other partner, the other partner is called the **host**.
- The really small partner can be called a **mutualist**, a **commensalist**, or a **parasite** (depending on the type of relationship).
- Sometimes, the really small partner is called the **symbiont**. This is a **general** term and does **not** imply a type of relationship.

Example of Mutualism

- Acacia ants live in acacia trees.
- The tree provides big hollow thorns as a home for the ants.

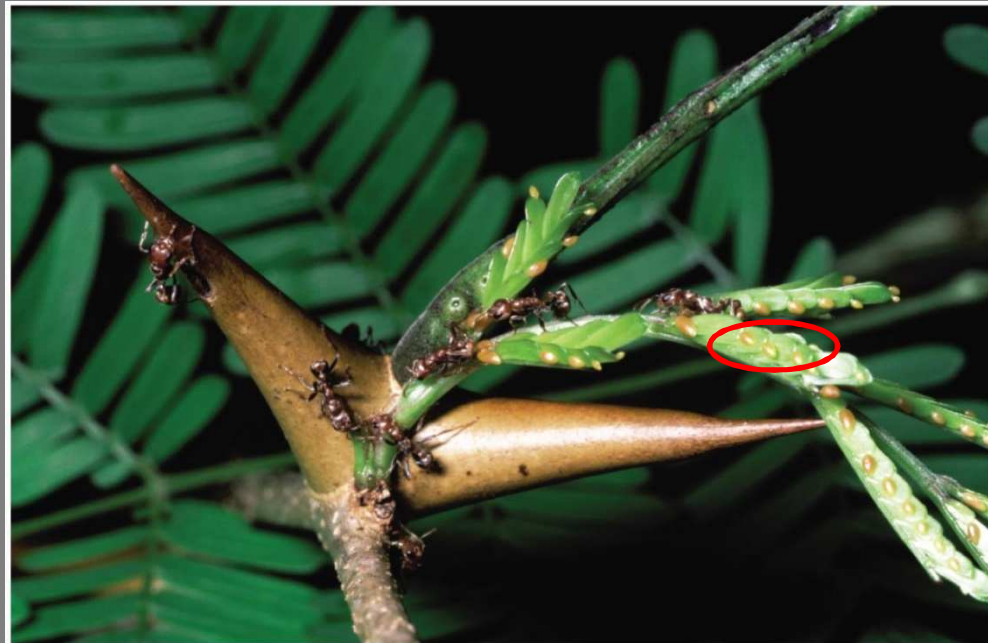


(a) Acacia tree and ants (genus *Pseudomyrmex*)

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Example of Mutualism

- The tree also provides food for the ants in yellow swellings on the leaves (red oval).



(a) Acacia tree and ants (genus *Pseudomyrmex*)

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Example of Mutualism

- The ants defend the tree against herbivores, both large and small.
- They attack insects and large grazing herbivores.



(a) Acacia tree and ants (genus *Pseudomyrmex*)

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Example of Mutualism

- The ants also clear an area around the tree of competing vegetation.
- Without the ants, the acacia tree cannot compete with other trees.



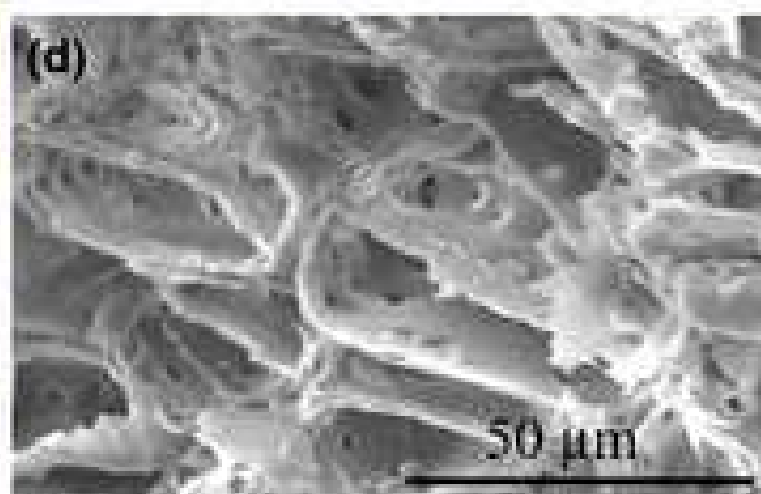
(b) Area cleared by ants at the base of an acacia tree

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Humboldtia brunonis



<http://jlrexplore.com/explore/focus/humboldtia-brunonis-the-perfect-host>







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Example of Commensalism



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- Cattle egrets are often found around grazing herbivores, such as these African buffalo or cattle in Texas fields.

Example of Commensalism

- The cattle egrets eat insects that are flushed as the big herbivores move around.
- The herbivores get no benefit or harm from the egrets.

• Photo Credit: Noodlefish @ flickr.com



Example of Parasitism

- Songbirds are often heavily parasitized by ticks.
- The birds are often anemic, stressed and more vulnerable to predation.
- Female ticks must have a good blood meal in order to lay eggs.

• Photo Credit: Bill Hilton, Jr. @ hiltonpond.org



Example of Parasitism

- Fungal parasites often infect living organisms, such as plants, animals or other fungi.
- This shelf fungus releases enzymes to digest the wood of this tree, which weakens the tree and makes it more vulnerable.

- Photo Credit: BIOL 1407 Student





Coevolution

- Coevolution occurs when two species evolve in response to one another.
- For example, predators evolve in response to prey defenses. Prey evolve in response to predation.



Coevolution

- Mutualists and parasites coevolve with their hosts.
- Pollinators coevolve with the flowering plants they pollinate.



- Photo Credit: Mike Sykes

Coevolution Example: Anemonefish and Sea Anemone



Photo Credit: Mila Zinkova, Wikimedia Commons