

Lab-wide Learning Outcomes for Species Interactions and Coevolution

Upon completion of *Species Interactions and Coevolution*, students should be able to:

1. List and define the various ways in which two species can interact, including amensalism, commensalism, competition, exploitation, and mutualism.
2. Provide examples of competition, exploitation, and mutualism.
3. Explain how evolution impacts species interactions.
4. Design a hypothetical experiment that can determine whether and how two co-occurring species are interacting.

Species Interactions and Coevolution, Part 1: Natural History of Species Interactions

Upon completion of *Part 1: Natural History of Species Interactions*, students should be able to:

1. Describe the range of possible interactions between two species based on how each is affected (–/0/+).
2. Explain how the interaction compass helps illustrate the dynamic, non-discrete nature of species interactions.
3. Provide detailed examples of exploitative, competitive, and mutualistic interactions, and explain why they are categorized as such.
4. Categorize a competitive interaction based on its mechanism (interference, resource, or apparent), and explain the interaction as direct or indirect.
5. Categorize a well described mutualism based on what materials or services are exchanged, whether the mutualism is obligate or facultative, and the level of physical closeness between the participants.
6. Explain how species interactions could affect the populations' broader ecological community.

Species Interactions and Coevolution, Part 2: Costs and Benefits Drive Species Interactions

Upon completion of *Part 2: Costs and Benefits Drive Species Interactions*, students should be able to:

1. Explain the advantage of experimentation (over simple observation) in understanding the costs and benefits of a species interaction to each participating species.
2. Generate logical predictions for competing hypotheses about a species interaction.
3. Design a simple removal experiment to distinguish between different hypotheses about how two species are interacting.
4. Categorize a species interaction based on experimental results.
5. Provide an example of how a mutualistic interaction affects a broader community.
6. In terms of costs and benefits, explain how trade-offs influence and limit mutualistic interactions.

Species Interactions and Coevolution, Part 3: Coevolution

Upon completion of *Part 3: Coevolution*, students should be able to:

1. Define coevolution.
2. Describe some of the trade-offs associated with alleles that improve the efficiency of predators and/or prey.
3. Provide an example of a study demonstrating a coevolutionary arms race between predators and their prey and/or parasites and their host.
4. Provide an example of a study demonstrating a coevolutionary mutualism.
5. Explain why, according to the Red Queen hypothesis, sexually reproducing species are expected to have an advantage in a coevolutionary arms race, referencing the concept of genetic diversity.
6. Draw reasonable conclusions from the data of an experiment that tests the Red Queen hypothesis among two species.

7. Explain how coevolution can produce highly exaggerated traits, such as extreme toxicity or an awkwardly long body part.
8. Discuss the role of cheating in mutualisms, and provide examples of how mutualists prevent cheating.
9. Describe how mutualisms are believed to have contributed to the evolution of eukaryotic cells.