Week 7
BIO-1306 - Biology 2 – ICB textbook

Hello and Welcome to the weekly resources for BIO-1306 - Biology 2 – ICB textbook!

This week is Week 7 of class, and typically in this week of the semester. your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

Keywords: *Coevolution, Selective agent, Pairwise coevolution, Diffuse coevolution, Mutualism, Pupate*

TOPIC OF THE WEEK: Coevolution

This week we will be looking at the two types of coevolution along with how mutualism displays coevolution

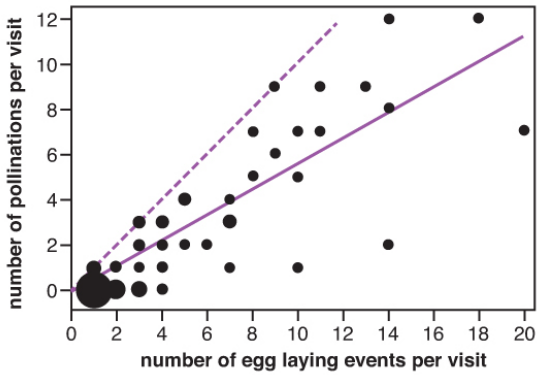
- Coevolution → Closely associated species influencing one another throughout their evolution
- Selective agent → The environmental factor acting on the population
- Pairwise coevolution → Particular adaptations evolve due to specific interactions between two species.
- Diffuse coevolution → The species' behaviors act as selective agents for each other which help them evolve different traits together

- Mutualism → Relationship when two organisms of different species "work together" and both benefit from the relationship. Can lead to either pairwise or diffuse coevolution.

HIGHLIGHT #1: Mutualism

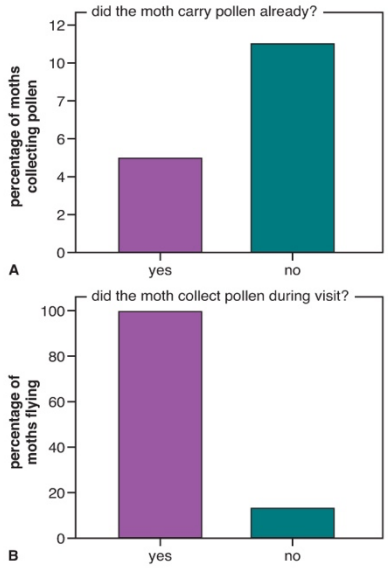
Yuca moths have a **mutualistic** relationship with yucca flowers. They collect pollen from the flowers while the flowers provide a location for the moths to lay their eggs. After the eggs hatch, larvae crawl towards developing seeds and start feeding on them. Following feeding, larva come out of the developing fruit and **pupate** (go from larva to pupa) in the soil. The adults that result from the pupa along with the pupation state itself coincides with next flowering season so that the new adults can mate and collect pollen.

Researchers Addicott and Tyre observed moth behavior on yuccas (pollination, egg-laying) and under what conditions they pollinate flowers. They observed the moths visiting the yucca flowers and recorded whether the moth possessed pollen and whether the flowers that were visited had been visited previous.



What did they find? The slope of number of egg laying events to number of pollinations per visit was smaller than one showing that there were more egg laying events that occurred per pollination events. This indicated that laying eggs is a priority for the moths and pollination come second to that.

They also saw that pollination was affected by TWO factors. The moths were more likely to collect pollen during a flower visit if they did not already carry pollen. It's likely that the females deposit a chemical on a flower when laying



eggs/pollinating to signal that the flower has been pollinated. It was also likely for them to fly away from the flower if they had just collected pollen. Through more observation, they also saw that the more eggs that a female moth laid, the more likely she would pollinate the flower.

If a moth lays its eggs but fails to pollinate, then that incurs costs for both the plant and for the larvae. The seeds will not develop, meaning that there would be no food for the larvae growing in the flower. The researchers saw that most of the moths that did not possess pollen flew to flowers that had been visited possibly because of the signal alerting the moths that the flowers had been pollinated. This way, **there is assurance** that seeds will develop and therefore the larvae will have something to feed on. At the same time, the moths will not need to waste energy into pollinating a plant that they know has already been pollinated.

Additionally, laying an egg first ensures that at least some reproduction will occur which is why moths have evolved to lay eggs first before pollination. This has little benefit to the plant but great benefit to the moth population. Following their egg-laying, however, the moths then pollinate the flower. While this has little benefit for them, this has large benefits for the flower and its seeds. **Both of these actions benefit both species involved, which is why it's a prime example of mutualism.**

HIGHLIGHT #2: Predator and Prey Coevolution

Coevolutionary interactions can also occur between predators and their prey or between pathogens and their hosts. For example, cheetahs are the fastest land animal, but this could've been developed because their prey, gazelles, are also extremely fast creatures. This speed could've been selected for since the fastest cheetahs were the ones that could feed, survive, and therefore reproduce. The gazelles that are faster, however, are also able to survive more attacks and reproduce. **In both populations, speed could be a factor being selected for.**

Another example of this is the garter snake and newts, a type of salamander. Rough-skinned newts contain **tetrodotoxin**, which is a neurotoxin that could kill

predators in small doses if they have no resistance to the toxin. Some garter snakes that prey on these newts have resistance, but this resistance is variable, along with the strength of the tetrodotoxin in newts. Research Williams and her colleagues measured the resistance that garter snakes had to tetrodotoxin, along with whether the snakes had consumed/rejected the newts and whether they lived/died. They then also recorded the amount of time the garter snakes were exposed to the newts along with the recovery time after their exposure.

What did they see? The snakes that consumed the newts and survived usually had a greater resistance than those that died from consuming the newts or those that rejected eating the newts. This indicates that stronger resistance may be a trait that is selected for since this aids in survival for the snakes that do consume rough-skinned newts. They also saw that the recovery time was dependent on the exposure time. The longer the snake was exposed to the newt, the longer it took for the snake to recover.

Since those with higher resistance to the toxin have a higher chance of survival and also could possibly have a lower recovery time than a snake with low resistance, it could be inferred that garter snakes with high resistance are being selected for. However, newts with higher levels of tetrodotoxin could also have a higher rate of being rejected and therefore surviving from the predator attack. For this reason, the newts with high levels of toxin could be selected for**. Both the**

predator and prey are co-evolving to aid in their own survival which illustrates pairwise coevolution.

CHECK YOUR LEARNING:

1. In a scenario where one fruit-eating bird species modifies its mouthparts to have access to a new fruit and the plants make these fruits with digestion-resistant seeds, so they get dispersed what type of co-evolution are what talking about?
2. A plant provides bugs with nutrients but is damaged by the bugs' constant feeding. Is this an example of mutualism? Why or why not?

THINGS YOU MIGHT STRUGGLE WITH:

1. Understanding the difference between pairwise and diffusion coevolution. This website could help with understanding the difference: https://www.ucl.ac.uk/~ucbhdjm/courses/b242/Coevol/Coevol.html
2. Once again, understanding the graphs is key for this chapter but could also be one of the hardest parts. Remember to clearly lead the footnotes, axes, title, and also the description of what was measured in the passage.

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below

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Answers

1. Pairwise co-evolution
2. No, it is not. This is only advantageous for the bug but NOT for the plant as well.