Evolutionary Arms Race

Go to the Evolutionary Arms Race simulation on Biology Simulations.

1. Click on the “Introduction” button to read the scenario information.
2. What effect does the toxin have on the predator species in the scenario?

3. In the “arms race” how is the prey changing over time?

4. In the “arms race” how is the predator changing over time?

Part I: Toxin Resistance “Cost”

1. Click on the “Introduction” button to read the Part I information.
2. Run the simulation 5 times and record the times.
    a. Each trial will randomly select a different predator from the population.
    b. Each selected predator will have their speed tested after injecting 0, 1, 2, and 3 units of toxin.
    c. Click on the red gate to start the first (control - 0 toxin) test
    d. At the end of the test run, click on the predator to start the next test.
    e. The simulation will automatically increase the amount of toxin for each test run.
    f. After the 3-unit test run, click “Restart Simulation” to repeat with a new predator.
3. Record time data:

Chart 1	Time (seconds)				
Units of Toxin	**Predator 1**	**Predator 2**	**Predator 3**	**Predator 4**	**Predator 5**
0					
1					
2					
3					

4. Describe the impact of toxin amount on predator speed.

5. For each predator, calculate and record the difference between the control time and the time for each toxin injection (0 toxin time - toxin time). For example, if the predator ran the 0 toxin test in 7.9 seconds and the 1 unit trial in 7.5 seconds, the difference is 0.4.

Chart 2	**Difference from control *(0 unit time - toxin time)***				
Units of Toxin	**Predator 1**	**Predator 2**	**Predator 3**	**Predator 4**	**Predator 5**
1					
2					
3					

6. Graph
    a. Make a graph with *control time* (0 Units of toxin time from Chart 1) on the x-axis and the *difference from control* for 3 Units of Toxin (from the bottom row in Chart 2) on the y-axis.
    b. You will have 5 data points, one for each predator.

7. Describe your results.

8. Adaptations sometimes come with a “cost”. Based on your data, what is this predator's evolutionary cost of toxin resistance?

9. Research and describe a real-world example of an evolutionary advantage that comes with a “cost.”

Part II: How does the percentage of toxic prey in the predator’s diet affect predator toxin resistance over time?

1. Click on the “Introduction” button to read the Part II information.
2. Write a hypothesis.

3. Select **4** different percentages to test and record them in the chart.
4. Run 3 trials for each percentage, record the data, and calculate the averages.

	Predation of toxic prey %:			
	Generation 0		**Generation 10**	
Speed (m/s)	*0 units*	*2 units*	*0 units*	*2 units*
Trial 1				
Trial 2				
Trial 3				
Average				

	Predation of toxic prey %:			
	Generation 0		**Generation 10**	
Speed (m/s)	*0 units*	*2 units*	*0 units*	*2 units*
Trial 1				
Trial 2				
Trial 3				
Average				

	Predation of toxic prey %:			
	Generation 0		**Generation 10**	
Speed (m/s)	*0 units*	*2 units*	*0 units*	*2 units*
Trial 1				
Trial 2				
Trial 3				
Average				

	Predation of toxic prey %:			
	Generation 0		**Generation 10**	
Speed (m/s)	*0 units*	*2 units*	*0 units*	*2 units*
Trial 1				
Trial 2				
Trial 3				
Average				

5. Calculate the average decrease in speed between 0 and 2 units of toxin for generation 0 and generation 10 for each of your selected predation percentages.

	Speed decrease (0 units - 2 units)	
Predation of toxic prey %	*Generation 0*	*Generation 10*

6. Make a graph with predation % on the x-axis and speed decrease on the y-axis.

7. Based on the result of Part I, what does a large decrease in speed with the injection of toxin indicate about predator resistance to the toxin?

8. Describe your results.

9. Based on your results, is your hypothesis accepted or rejected? Explain.

10. Compare your results to other students. Are they consistent? Explain.