



Teacher's Guide

Ninja Sea Turtles Lab

A simulation of population genetics

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Background

This activity investigates the relationship between the level of genetic diversity in a population and its likelihood of survival. It also reviews factors that may affect biodiversity. The game reinforces the relationship between genotype and phenotype, principles of meiosis and natural selection, and can be modified to show advanced biology concepts such as Hardy-Weinberg equilibrium.

Concepts Covered

- Natural selection changes the genetic make-up of a population (gene pool)
- Certain traits aren't "better" than others, just better suited to that particular environment
- Particular genetic traits are passed from parent to offspring by chance, but certain traits may help or harm an organism's chance of living and reproducing, depending on their environment.
- Having a more genetically diverse population better ensures its survival
- Humans effect biodiversity in many negative ways, but have potential to effect biodiversity in positive ways.

Vocabulary Covered

- Meiosis
- Allele
- Homozygous/Heterozygous
- Dominant/Recessive
- Gene Pool
- Gene Flow
- Chromosome
- Natural Selection

Advanced Vocabulary

- Hardy-Weinberg Equilibrium
- Founder effect
- Bottleneck effect

Preparation

→ Copies

Per class of 20, you will need:

- 120 sticks of each color (4 colors, so about 4 bags - less if they reuse allele sticks)
- 20 markers to write on sticks with
- 10 copies of "Turtle Island"
- 40 copies of "Turtle Cards"
- 10 copies of "Game Cards"
- 10 copies of "Dice"

→ Set-Up

Place 10 turtle islands around the classroom, spaced as far apart as possible.

At each island, place:

- 12 sticks of each color
- 2 markers
- 1 of each type of die
- 32 turtle cards (4 copies of 8 per page)
- One of each of 16 “Life Event Cards”
- One of each of 8 “Mutation Cards”



Extensions for the Lab

→ Emphasis on Natural Selection

- Specify island conditions and set up cards at each island that benefits a particular trait and harms its opposite, according to the island's environment
 - I.e. light colored turtles on island with light sand or smaller, more maneuverable turtles on islands with rocky land

→ Incorporating Hardy-Weinberg

- Have the students first play the game in Hardy-Weinberg equilibrium (no life event or mutation cards, no choice of which offspring to mate, migrating turtles, and 1 turtle offspring per mating) to show a basic conservation of the allele frequencies and then modify any of the 5 Hardy-Weinberg equilibrium requirements:
 - Large population (counter this by putting students into smaller groups of 2-4)
 - No migration (counter this by allowing mainland turtles with various alleles to immigrate to the islands)
 - No sexual selection (counter this by designating a particular trait as “sexy” and have students mate with a turtle with that trait whenever possible)
 - No natural selection (counter this with the life event cards)
 - No mutation (counter this with the mutation cards)
- Have the students calculate allele frequencies before and after any or all of these conditions

Additional Information and Websites

- Every species of sea turtle is endangered or threatened.
- A turtle's gender depends on the temperature at which it is incubated. Global warming is having an effect on the ratio of females to males.
- Animation of the impact of global warming on gender ratios of turtles:
http://wwf.panda.org/what_we_do/endangered_species/marine_turtles/lac_marine_turtle_programme/projects/climate_turtles/
- Animation of the impact of uncontrolled pet dogs on turtle populations:
<http://www.tourdeturtles.org/flash/PredationNestsAndHatchlings.swf>
- Animation of baby sea turtles hatching and going out to sea:
<http://kids.nationalgeographic.com/kids/animals/creaturefeature/loggerhead/>
- Video with Jeff Corwin investigating the impact of global warming on sea turtles:
http://www.defenders.org/includes/factsheets/video_player.php?type=seaturtles
- Great footage of sea turtles in action:

[http://www.oceanfootage.com/stockfootage/Sea Turtle](http://www.oceanfootage.com/stockfootage/Sea_Turtle)

- Video with Jeff Corwin investigating the impact of the gulf oil spill on sea turtles:
<http://animal.discovery.com/videos/gulf-oil-spill/>

Optional Extension Project

Biodiversity Presentations

Concepts Covered

- Why is biodiversity important at the species level?
- What does it mean if a species is “endangered” or “extinct”?
- What are some reasons for why a species might become endangered or extinct?
- Should humans get involved in trying to save a species?

Background

You are going to act as representatives of a particular endangered or threatened species, and try to convince the members of the CITIES conference (your audience (the class) to donate money to preserving their species.

In groups of 3, choose an organism (from any kingdom) that is endangered or threatened. Part of your grade is based on group work and the other part is based on your particular role. One person will summarize the information, one person will create the poster, and one person will present the information.

You will each be allotted \$500 and can donate any amount of money to the species of your choice (except your own group).

Procedure:

- Step 1 - Brainstorm an animal (or several animals) that your group might want to investigate.
- Step 2 – Select an organism and find its scientific name, and its Kingdom, Phylum, Class, Order, Family, Genus & Species groups. Include this information on your poster.
- Step 3 - Find out what your organisms eats (prey), and what eats it (predator). Create a food web on your poster with at least 8 organisms (including your organism). Label the producers and primary, secondary and upper-level consumers.
- Step 4 - Research your organism’s role in its environment - is it a producer making energy for other organisms? Is it a consumer keeping other organisms in balance, and providing food for higher-level consumers? What would happen to the ecosystem if your organism became extinct?
- Step 5 – Research the history of your organism. Why did your organism become endangered? Is there anything that humans could have done to prevent this organism from becoming endangered?
- Step 6 – Provide a closing argument for why CITES should give their money to this organism rather than other endangered organisms.

Presentations

While listening to other presentations, take notes in the Biodiversity Notes Chart, and remember that you will be graded for your participation during the presentations.

Assessment

See Biodiversity Presentation Rubric.