

HASPI Medical Biology Lab 24

Adapting to the Environment

NGSS HS-LS4-5

Teacher Information



Description

a. Adapting to the Environment

Students simulate variations and adaptations of the hand to observe the impact of these variations on food collection. The increase or decrease of a mutation in a population over several generations of food collection is simulated, and data is collected. Students then have the opportunity to evaluate their data to determine how the change in environmental conditions (food source) resulted in an increase in the number of individuals with a specific variation, and the extinction of individuals with another specific variation. Students hypothesize how these populations could result over time in the emergence of new species.

Next Generation Science/Common Core Standards

Students who demonstrate understanding can:

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in:

(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Medical Application: Evaluate the evidence supporting claims that changes in environmental conditions have resulted in: (1) increases in the number of individuals of pathogenic organisms, (2) the emergence of new strains of pathogenic organisms over time, and (3) the extinction of some pathogenic organisms.

NOTE: Most of the medical application is present in the Connections & Applications section of this lab.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence <ul style="list-style-type: none"> Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. 	LS4.C: Adaptations <ul style="list-style-type: none"> Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. 	Cause and Effect <ul style="list-style-type: none"> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
Connections to other DCIs in this grade-band: HS.LS2.A, HS.LS2.D, HS.LS3.B, HS.ESS2.E, HS.ESS3.A		
Articulation to DCIs across grade-levels: MS.LS2.A, MS.LS2.C, MS.LS4.C, MS.ESS3.C		
Common Core State Standards Connections:		
ELA/Literacy –		
RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.		
WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.		
Mathematics –		
MP.2 Reason abstractly and quantitatively.		

Essential Question

By the end of class students will be able to:

- Evaluate evidence supporting claims that changes in the environment result in changes in populations and species.
- Provide examples and causes of speciation and extinction.

Time

Estimated Time	Actual Time (please make note below)
Lab 24: 55 - 60 minutes	

Note: Share the actual time on the forum (www.haspi.org) or at HASPI curriculum conference

Materials

HASPI is a grant-funded project and on occasion we are able to provide supplies to participating sites. If we are unable to provide supplies, the company, item number, and approximate cost have been included.

Supply	Provided (P) or Needed (N)	Quantity	Company/Item #	Approximate Cost
Masking tape	P	2 rolls	Office Depot/20581201	\$8.00
Rice	P	1 bag	Grocery	\$3.00
Lima beans	P	1 bag	Grocery	\$3.00
Popcorn	P	2 bags	Grocery	\$5.00
Plastic cups	P	40	Grocery	\$6.00
Paper towels	N	As needed	-	-

Company Contact Information:	
Office Depot www.officedepot.com 800.GODEPOT	Grocery Can be found at any local grocery store

Common Student Misconceptions

The following is a list of possible misconceptions that students experience. Please feel free to add any additional misconceptions students experienced during this activity to be better prepared for the future use of this lab/activity.

- Students may confuse the concept that genetic variations that lead to adaptations already exist in the genotype of a species, and that mutations do not occur in response to environmental conditions.
- Students may believe that if individuals with a specific hand shape are unable to survive and reproduce, that the hand shape is extinct. Remind students that the trait can still exist in the population even when it is not physically present.

Additional Misconception Notes:

Guiding Questions

These questions are meant to support discussion of the concept/standard.

- Review the hand shape variations. Have students predict which hand shape will be most effective at collecting each food source.
- Review additional examples of adaptations that plants, animals, and pathogenic organisms have used to increase their rates of survival and reproduction.

The Task/Response System

Through multiple discussions and suggestions, HASPI has decided to use the task/response system for lab procedures and directions. The response column can be utilized to:

- provide space for answers to questions provided in the task column
- provide space for data/observation records
- provide images to help relay a step
- support reinforcement of the standards/concepts immediately during the lab investigations
- any other way you see fit to use it!

Additional Information

Information	Page #	Location
Lab 24: Adapting to the Environment		
This is an activity that the instructor will need to facilitate throughout. You will need to choose the first four students, and any additional "offspring." You will also need to start and stop each round, and record the survivors on the board. It will require a lot of teacher direction.	Pages 607-611	Lab 24
Since students that do not survive may become an "offspring" later on, have the students remove the tape, but keep it in one piece so it can be reused.	Pages 607-611	Lab 24
There is no set answer for each round, and the results will vary depending not only on the hand shape, but on the ability of each individual to effectively collect the "food source." If it happens that no one collects enough food, start with the first 4 individuals and extend the time period.	Pages 607-611	Lab 24
All of the "food sources" and cups can be collected and reused for the following class or school year, except the popcorn. The popcorn will need to be popped before the exercise.	N/A	N/A
Copy the Tables 1, 2, and 3 from the student sheet onto the white board or a projected film for the students to complete as they conduct the activities.	Pages 607-611	Lab 24

Resources and References

- Holsinger, K.E. 2013. Patterns of Biological Extinction. Creative Commons.
- BBC. 2013. Animal and Plant Adaptations and Behaviours. www.bbc.co.uk.

Images (in order of appearance)

- <http://www.mpushini-fauna.com/resources/Vervet.jpg>
- http://www.abc.net.au/reslib/200804/r241681_980802.jpg
- <http://www.redorbit.com/media/uploads/2013/02/science-022813-003-617x416.jpg>
- <http://www.southafrica.net/uploads/blog/1.jpg>
- <http://onh.eugraph.com/herps/rsnewt/15480405.jpg>
- <http://www.arizona-leisure.com/gfx/venomous-rattlesnake.jpg>
- <http://www.chm.bris.ac.uk/motm/cineole/koala-eating.jpg>
- http://nelsonndhs.org/Per2_Fall_2010/Arctic%20Animals/Assets/724polar_bear.jpg
- <http://seaandsageaudubon.org/BatInformation/batsyumagrande.jpg>
- <http://incubatorwarehouse.com/media//chick-hatching.jpg>
- <http://bioexpedition.com/wp-content/uploads/2012/04/Arctic-Hare.jpg>
- <http://english-tonight.com/wp-content/uploads/2013/11/Earthworm1.jpg>
- http://evolution.berkeley.edu/evosite/evo101/images/allopatric_beetles.gif
- <http://i1-news.softpedia-static.com/images/news2/Bubonic-Plague-Kills-Teenager-in-Kyrgyzstan-378567-2.jpg>
- http://thecripplegate.com/wp-content/uploads/2012/02/the_plague.jpg
- http://ottawa-rasc.ca/wiki/images/c/c3/Odale_extinction.jpg