LEARNING GUIDE: ON THE ORIGIN OF LIFE, THEORY OF NATURAL SELECTION

Subject Code: Biology 1: Fundamentals of Biology 1
Learning Guide Code: 2.0 (Evolution)
Lesson Code: 2.2 (On the Origin of Life, Theory of Natural Selection
Time Frame: 30 minutes

MATERIALS NEEDED

To complete this module, you need the following:
1. Pen and paper
2. Laptop Computer/Internet-ready gadgets
3. Biology: A global Approach by Campbell et al. (2015).
4. Stable internet connection

TARGET

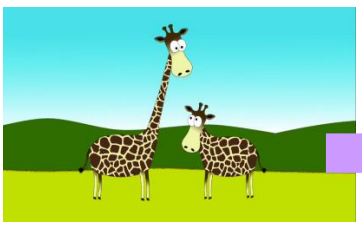
After completing this module, you are expected to:

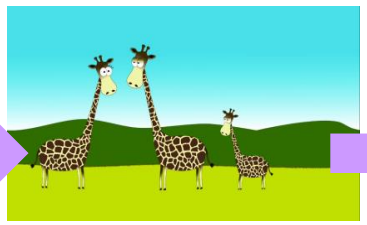
- Show understanding of the theory of evolution by natural selection
- Perform the natural selection simulation activity

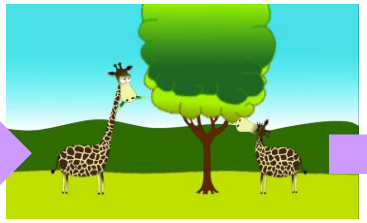
HOOK

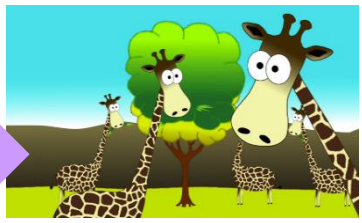
Remember the story of how giraffes got their long necks as told by Lamarck? In this module, we will take a look at the same story of giraffes but we will imagine it as told by Darwin. Below are parts of the story. Your task is to arrange them such that they make a coherent whole. Use the pictures as a guide to lead you to the correct sequence of the story. Match the parts of the story with the correct picture.

Can you give it a try?









In the case of our giraffes here, the long-necked ones did not acquire that trait through stretching. It is just that in the population of giraffes, some were born with long necks, some were not. Those with long necks have an advantage than those who don't have it, because they can eat leaves and shoots much higher than the others can reach.

In Africa, a population of giraffes are occupying the same habitat, a savanna in the Saharan region. Some giraffes have long necks while others have short necks.

Aha! These giraffes got their long or short necks from their parents! Just look at this baby giraffe. Now look at its parents. See the resemblance?

In the long run, those long-necked giraffes will thrive better than the short-necked giraffes because they will not starve. And because they have a better chance of survival than the short-necked giraffes, then they also have a higher chance to reproduce and pass this advantageous traits to their offsprings. Over time, there will be more long-necked giraffes in the population.

IGNITE

As you would recall in the previous module, Thomas Malthus was able to influence Darwin through his book, The Principle of Population. Malthus saw the reality that overpopulation can exceed food supply. This led Darwin to conclude that the same phenomenon happens in organisms and that leads to a struggle for existence. Those organisms who have better traits that enable them to survive will have a higher chance of survival than those who don't have them. He termed this mechanism as natural selection. And the traits are called adaptation, "an evolutionary modification that improves the chances of survival and reproductive success in a given environment" (Solomon et al., 2006). Over time, the piling of these modification can lead to the arising of new species.

Darwin's theory of evolution by natural selection is based on his observations of the natural world. They are the following:

FIGURE 1. Dog Morphological Variation. Mary Bloom, American Kennel Club (2010, March 2). Retrieved from: https://upload.wikimedia.org/wikipedia/commons/6/69/Dog_morphological_variation.png. This file is licensed under the Creative Commons Attribution-Share Alike 4.0 International License.

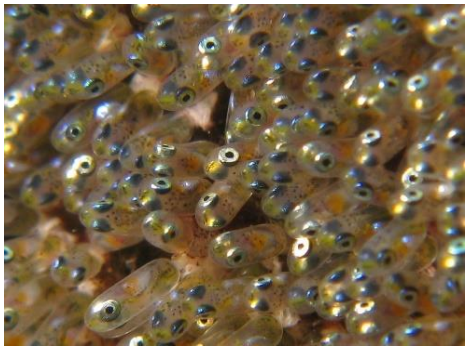


FIGURE 2. Anemone Fish Spawn: Eggs or Babies? Prilfish (2009, September 7). Retrieved from: https://www.flickr.com/photos/silkebaron/3897962738.This file is licensed under the Creative Commons Attribution 2.0 Generic (CC BY 2.0).

FIGURE 3. A Struggle for Existence-Wolves. Goudard, Bouverie (2014, April 15). Retrieved from: https://www.flickr.com/photos/86012097@N08/13877049703. This file is licensed under the Creative Commons Attribution 1.0 Universal (CC0. 1.0) Public Domain Dedication.

1. Variation

Individuals vary within a population. This is because the traits they inherit from their parents also vary. Some may be conferred with traits that improve their chances of survival while others do not. According to Darwin, the variation must be inherited for evolution by natural selection to be true.

2. Overproduction

Each species has the ability to produce numerous offspring than can survive.

3. Limits on population growth.

Overproduction can lead to a struggle for existence. As more individuals are produced than the environment can hold, resources become limited. This may cause competition between members of a population. Other limits on population growth are predators, diseases, and unfavorable environmental conditions.

4. Differential reproductive success.

Organisms which have traits that are better suited to their environment have a better chance of survival and so they can live long enough to reproduce. Those who don't have these advantageous traits or desirable adaptations may die early without even reaching reproductive age or may give birth to less fit offsprings. Eventually, the population will be composed mostly of individuals that are well adapted to the environment.

Today, biologists incorporated Mendel's Theory of Inheritance with Darwin's Theory of evolution. It is termed as the modern synthesis or synthetic theory of evolution. The word synthesis is defined as the combination of ideas to form a theory or a system. Obviously, it is where the synthetic theory of evolution got its name.

For a better understanding of the theory, you may watch the videos below. Some comments in the comment box are not necessary in the learning process so just focus on the video as your learning material and take note of important points explained.

What is Natural Selection: https://www.youtube.com/watch?v=0SCjhI86grU
Natural Selection: https://www.youtube.com/watch?v=7VM9YxmULuo
Evolution by Natural Selection (updated): https://www.youtube.com/watch?v=rf5fKLd2bEs

Given the discussion in the module preceding this and the discussion above, I now assume that you now have a better grasp of natural selection. Below are the points however that you need to keep in mind to avoid breeding of misconceptions.

1. Individuals do not evolve, it is the population that does.

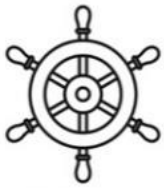
Evolutionary change is based on changes in the genetic makeup of populations over time. There are many factors that could lead to changes in an individual. It could be developmental or caused by the environment or it can happen during the course of a lifetime. These changes however are insignificant and will not cause a shift in the genetic make-up of a population. The change, therefore, has to be genetic and random mutations paves way to that.

2. Natural selection can only act on heritable traits that differ within a population

It has been previously stressed that traits should be heritable for natural selection to act on it. Another requirement is that it should differ within a population because if all individuals in a population are identical for a given trait, natural selection would have no option to select from.

3. The traits that nature will select is always a moving target.

What will be considered as a beneficial or detrimental trait depends on the environment the population is in. What is useful in one environment may or may not remain useful in another.

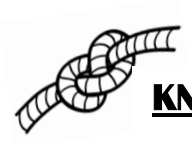


NAVIGATE

*Note: This is a **GRADED** assessment.*

Choose one from the following online quizzes. Answer it to check your understanding of the lessons we discussed so far and place your score on the space given.

Quiz	Score
A. Practice Quiz for Darwin and Natural Selection: https://www2.palomar.edu/anthro/practice/evoquiz2.htm *Important note: Number 11 is a bonus question. Consider your answer correct.*	
B. **Quiz: Theory of Evolution**: https://www.cliffsnotes.com/study-guides/biology/biology/principles-of-evolution/quiz-theory-of-evolution	
C. Quiz: Theory of Evolution: https://www.proprofs.com/quiz-school/story.php?title=_33334	
D. Origin of Species Quiz: https://www.abc.net.au/science/games/quizzes/2009/originofspecies/ *Important note: Numbers 4 and 5 are bonus questions. Consider your answers correct.*	



KNOT

Charles Darwin's theory of evolution is based on these four observations: variation, overproduction, limits on population growth and differential reproductive success. Variation exists between individuals of a population and each species have the ability to overproduce. As a result, resources gets limited and sometimes not enough for all so competition arises. This competition might cause death to other individuals in a population thereby acting as a limit on population. Those individuals who have traits that are more compatible to the environment tend to survive and reproduce more compared to those that don't have such traits.

Important notes to remember on natural selection to avoid misconceptions are the facts that individuals do not evolve, natural selection is operating on traits which are heritable and varying among individuals and these traits may be beneficial or not depending on the kind of environment organisms occupy.

REFERENCES:

Book

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Solomon, E., Berg, L., Martin, D. (2006). Biology. Seventh Edition. Thomson Learning.

Online Resources

Stated Clearly. (2013, May 14). *What is Natural Selection?* (Video).YouTube. https://www.youtube.com/watch?v=0SCjhI86grU

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Origin of species quiz › science quizzes (ABC science). (2012, 11). ABC (Australian Broadcasting Corporation). https://www.abc.net.au/science/games/quizzes/2009/originofspecies/

Images

Mochinski, Chris. (2015, May 11). *Charles Darwin-The Theory of Natural Selection.* (Video). YouTube. https://www.youtube.com/watch?v=vnktXHBvE8s

Mary Bloom, American Kennel Club / CC BY-SA (https://creativecommons.org/licenses/by-sa/4.0)

Anemone fish spawn - Eggs or babies? (n.d.). Flickr. https://www.flickr.com/photos/silkebaron/3897962738

"A struggle for existence - Wolves" By Bouverie Goddard. The idea of the 'struggle for existence' captured the imagination of many writers and artists. George Bouverie Goddard (1832-1886) was an English artist. He painted 'The struggle for existence' in. (n.d.).
Flickr. https://www.flickr.com/photos/86012097@N08/13877049703

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