

# Worksheet: The theory of natural selection

**Senior Phase**  
**Grade 7 - 9**

**Learning area:** Natural Science

**Strand:** Life and living

**Theme:** Biodiversity, change and continuity

**Specific Aim 1:** Acquiring knowledge of natural sciences

**Specific Aim 2:** Investigating phenomena in natural sciences



Activity Sheet

## THE THEORY OF NATURAL SELECTION

Darwin's basic theory of natural selection, suggests that there are variations among individuals in a population. These variations help individuals survive environmental changes, predation or competition. The individuals that possess the "successful" variation, produce more offspring than others. Their offspring, in turn, reproduce again, carrying the successful variation from one generation to the next. This allows the population to evolve with the successful variation. Variation between the individuals of a species results from inheriting different genes, and hence traits, from the parents. Variation also occurs through genetic mutation. A gene mutation is a permanent change in the DNA sequence that makes up a gene. This change can be inherited by the offspring of an organism.



### Activity 1: Investigate how natural selection occurs

In this practical activity, you will investigate how natural selection occurs using various utensils to "capture food".

#### Brief

Living on an island in the Indian Ocean there are five species of a bird called the Neenibeaneater. They all have similar features except for their beaks which show different variations. All Neenibeaneaters eat beans as their staple diet. Some Neenibeaneaters have a clothespin beak; some have a tweezer beak, while others have a needle beak. Once, a new species of Neenibeaneaters was discovered. It had a spoon-shaped beak, giving it the name of the Spoon-Mouthed Neenibeaneater.

#### Materials

- 3 bags of beans (sugar or butter)
- 10 trays
- 10 clothespins
- 10 plastic spoons
- 10 tweezers
- 10 dissecting needles



### **Method**

1. Divide learners into four groups of 10.
2. Give each group the utensils that represent the beak of their specific Neenibeaneaters living on the island.
3. The Spoon-mouth Neenibeaneaters are rare, so only two learners will be assigned to be this type of neenibeaneater.
4. Demonstrate to each group how their utensil should work.
5. Each learner must have their own utensil.
6. Give each group a tray with beans. Learners can share bean trays but must have their own utensil.
7. It is very important that you use your utensils in the correct way (as demonstrated by your teacher).
8. You, the Neenibeaneater, will be required to pick up at least 20 beans. If 20 beans are not collected during the time period, your Neenibeaneater dies.
9. Start with one minute on the clock. Count how many beans you collected. This will be done twice.
10. When a Neenibeaneaters dies, the learner must be given the new utensil of the surviving Neenibeaneater – this Neenibeaneater represents the offspring of a surviving Neenibeaneater species.
11. The time will be reduced to 45 seconds. Count how many beans you collected. This will be done twice.
12. The time will be reduced to 30 seconds. Count how many beans you collected. This will be done twice.
13. The time will be reduced to 15 seconds. Count how many beans you collected. This will be done twice.
14. The time will be reduced to 5 seconds. Count how many beans you collected. This will be done twice.
15. Record your results.

### **Questions:**

1. Which Neenibeaneater is the surviving species? Explain your answer.
2. What happens to animals that cannot compete as well with other animals in the wild?
3. Can you think of any real-life examples of the Neenibeaneater, where one species has a definite advantage over another?

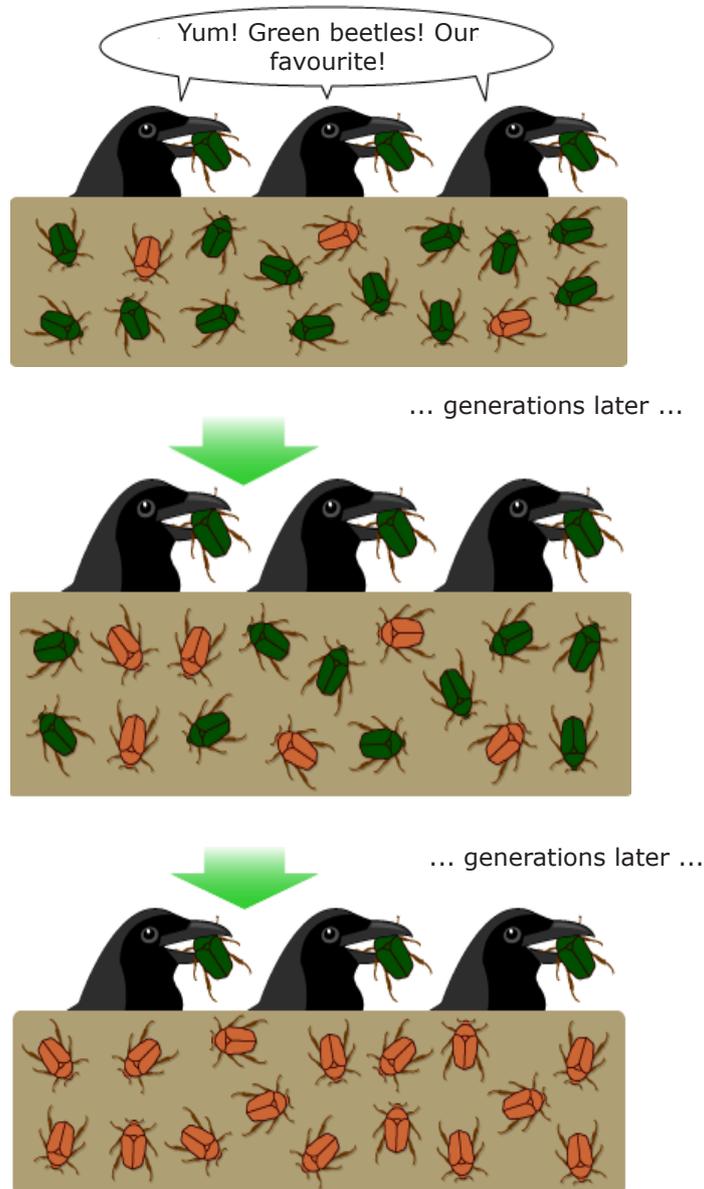


4. Sometimes animals, that are introduced into an area that they never lived in before, out-compete and endanger local species. Why do you think this happens?
5. Why do some birds have very long pointy beaks, while other birds have short flat beaks?
6. How do you think diseases can affect natural selection?



### Activity 2: Explain natural selection

1. Write a paragraph to explain how natural selection occurs. Use the diagram below to assist you in your explanation.



2. Explain how natural selection is a result of four features of living systems, namely variation, inheritance, selection, and time.
3. What role does the environment play in natural selection and the extinction of species?



## Teacher notes

### Activity 1: Investigate how natural selection occurs

#### Questions:

1. Learners own answer depending on results.
2. They will eventually die out.
3. Learners own answer. Discuss with learners that a good example of these are the invasive species e.g Rooikrans grows faster than fynbos, and sends down huge tap roots, so it steals nutrients and water from the soil. Fynbos gets crowded out as it is relatively slow growing and unable to compete with the fast-growing Rooikrans.
4. Invasive alien species may become predators, competitors, or parasites, and bring diseases to our native (indigenous) plants and animals. Invasive aliens may grow faster, or utilize certain elements in the environment more effectively than indigenous types. They also have fewer natural predators or diseases. Invasive alien species have the ability to thrive in a variety of different habitat types and climate regions.
5. Their beaks are adapted to exploit different food sources, and they feed in different ways.
6. Diseases are a part of natural selection, weeding out susceptible or weaker individuals, and allowing resistant or stronger individuals to survive and breed.

### Activity 2: Explain natural selection

1. There is variation in the traits of individuals, some beetles are green and some are brown.

There is differential reproduction. Since the environment can't support unlimited population growth, natural selection results in the reproduction of only some of the individuals born. In this example, green beetles are more visible and therefore get eaten by birds and survive to reproduce less often than brown beetles do.

There is heredity. The surviving brown beetles have brown baby beetles because this trait has a genetic basis and is passed on from generation to generation.

End result: The more advantageous trait, brown colouration, which allows the beetle to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be brown.

If you have variation, differential reproduction, and heredity, you will have evolution by natural selection as an outcome.



2. Successful (in evolutionary terms) individuals within a species possess advantageous variations or desired traits that give them a selective advantage over other individuals in the same population. These variations are passed on from parents to their offspring. As generations pass, the population evolves towards the variation that is more successful.

Natural Selection = The process in nature by which, according to Darwin's Theory of Evolution, only the organisms best adapted to their environment tend to survive and transmit their genetic characteristics in increasing numbers to succeeding generations, while those less adapted tend to be eliminated.

Time = If this process continues, eventually all individuals in the population will have the same traits.

3. Survival of the fittest. The fittest individual is not necessarily the strongest, fastest, or biggest. A genotype's fitness includes its ability to survive, find a mate, produce offspring — and ultimately leave its genes in the next generation. The environment will determine which trait in a population is the best suited at the time. Those that are not suited will eventually die out over time as fewer and fewer offspring with disadvantageous traits survive.

### **Important definitions regarding genes.**

**Gene:** The basic biological unit of heredity. A segment of deoxyribonucleic acid (DNA) needed to contribute to a function.

**DNA:** Genes are composed of DNA, a molecule in the memorable shape of a double helix, a spiral ladder. Each rung of the spiral ladder consists of two paired chemicals called bases. There are four types of bases. They are adenine (A), thymine (T), cytosine (C), and guanine (G). As indicated, each base is symbolized by the first letter of its name: A, T, C, and G. Certain bases always pair together (AT and GC). Different sequences of base pairs form coded messages.

