

A1. Investigate and interpret diversity among species and within species, and describe how diversity contributes to species survival

A1.1 observe variation in living things, and describe examples of variation among species and within species (e.g., observe and describe characteristics that distinguish two closely related species)

Variations of Species

A **species** can be defined as a group of organisms that is distinct from any other group of organisms. They share common characteristics and are capable of reproducing with each other to produce fertile offspring. Reproduction involving two individuals is called **sexual reproduction** and results in genetic variation.

Genetic variation is inherent in any natural population, and it arises due to spontaneous mutation and genetic recombination of an organism's DNA. Genetic variation translates into the observable variation that exists in the characteristics both within a given population of organisms and between populations of different organisms.

Natural selection promotes the adaptation of an organism to its environment by acting on these variations and selecting for the traits that better enable the organism to compete, survive, and reproduce. For example, during the Industrial Revolution, natural selection resulted in a shift toward the dark-coloured moth of the peppered moth population. This was because an increase in pollution in the environment provided dark-coloured moths with a camouflage advantage against predators. If the adaptations necessary for the organism to survive are fundamentally different from the original organism, a new species may develop. This is a process known as **speciation**.

A1.2 identify examples of niches, and describe the role of variation in enabling closely related living things to survive in the same ecosystem (e.g., investigate different bird species found in a local park ecosystem, and infer how each is adapted to life within that ecosystem)

Variation and Niches

Members of a species that are living in the same area and sharing resources form a **population**. Populations of different species in an area form a **community**.

Within a community, animals occupy a specific niche. The term **niche** refers to an organism's habits and habitat within the community. It includes things like what the animal eats and what effect it has on the habitat and other species. The niches of a population of a species can vary depending on differences in the area it inhabits. This is due to differences in food supply and competitors in the area. Niches can also change throughout an individual organism's lifespan. A larval mosquito lives in an aquatic niche, but adult mosquitoes inhabit a terrestrial niche.

When two species occupy a common habitat, it is possible that they could compete for the same resources. This is referred to as **interspecies competition**, and it leads to a decrease in each species' share of the resources. This can lead to starvation and death. Thus, interspecies competition limits the size of populations in an area.

In order for similar species to coexist in the same area, they need to have slightly different niches. This means that they do not directly compete for resources; instead, they divide resources among them. This is called **resource partitioning**.

A1.3 investigate and interpret dependencies among species that link the survival of one species to the survival of others

- identify examples of symbiotic relationships (e.g., organisms that benefit other organisms by providing habitat, food, means of fertilization, or a source of oxygen)
- classify symbiotic relationships as mutualism, commensalism, parasitism

Dependencies Among Species

Species of living things interact with each other. Each species depends on many other species in the environment. For example, plants use sunlight, carbon dioxide, water, and nutrients during photosynthesis to store energy and release oxygen. The oxygen produced by plants is used by animals for respiration. Plants also serve as food for herbivores.

Plants also provide shade and habitat for many animals. In turn, the plants depend on insects for pollination. Carnivores depend on herbivores and omnivores as food sources. Decomposers break down dead and decaying plants and animals.

Interaction among different species is usually brief since it is mostly for the purpose of obtaining food. In some cases, however, interaction continues for a longer period of time. These are called **symbiotic associations**. In symbiosis, at least one member is benefited. The other may be

- relatively unaffected (commensalism)
- also benefited (mutualism)
- Harmed (parasitism)

Commensalism is an association in which only one organism benefits, but the other is not harmed. For example, one organism may consume the unused food of another as in the case of the remora and the shark. When the shark feeds, the remora picks up the scraps. The shark does not prey on the remora. Another example of commensalism is the relationship between a robin and a tree. The robin picks up sticks and twigs that it finds on the ground and builds a nest up in the branches of the tree. The robin benefits by having shelter, and the tree is unaffected by the robin's presence.

Mutualism is an association in which both organisms benefit. For example, lichen is made up of both fungus and algae. The fungal cells in lichen benefit because the algal cells produce food for them through photosynthesis. The algal cells also benefit from this relationship because the fungus prevents their dehydration. Another example of mutualism is the roots of legume plants and nitrogen-fixing bacteria.

Parasitism is an association in which one organism benefits and the other organism is harmed. The organism that benefits is called the **parasite**, whereas the one that is harmed is the **host**. A parasite lives on or in the body of the host and obtains nourishment from it. For example, viruses, bacteria, fungi, protozoans, flatworms., nematodes, and some insects can be parasites on different plants and animals.

A1.4 identify the role of variation in species survival under changing environmental conditions (e.g., resistance to disease, ability to survive in severe environments)

Variation and Species Survival

As the environment changes, species exhibit some variations that are essential for their survival. Environmental changes do not only mean changes in climate, but also changes in availability of food, spread of new diseases, and the presence of predators. These all have an effect on the survival of the species. Variation within a population that allows the species to adapt to a new environment can lead to the survival of that species. For example, the banded snail lives in variety of habitats: dark branches, oak woods, or leafy green meadows. Its shell colour varies from yellow to pink to brown. It changes colour in the spring and summer to blend with its environment. Because of such variability, the snail can protect itself from predation and is better adapted to survive.