

Biology is Everywhere: Finding Nemo

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Biology PAP

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Introductory Paragraph:

Biology is the study of life. It can be found anywhere in the world, from a sports competition to a musical instrument. There is even biology to be found in the children's movie *Finding Nemo*. Ecology can be applied to *Finding Nemo* because of all of the relationships between organisms and their environment in the ocean. Microorganisms and plants are two branches of biology that are found in the movie as well. Plants provide food and shelter for ocean organisms. Microorganisms provide food and may cause diseases for marine life. Body systems can also be applied to *Finding Nemo* because all marine life have systems that help them operate.

Ecology

Ecology is the study of organisms' interactions with their environment and the other organisms within it. This branch of biology involves studying the organisms' food sources, habitats, and individual relationships with other organisms. With this information, scientists are able to organize plants and animals into food chains and determine what roles they serve in their environments.

The movie *Finding Nemo* takes place in the ocean, an environment with many organisms of all different shapes and sizes. This means that there are many interconnecting food chains that interact, also known as a food web. The different characters in *Finding Nemo* can be organized into a food web. The producers of the food web are organisms like algae. Algae provides energy and nutrients for organisms like Dory, a herbivorous blue tang fish. Dory only eats plants, so algae is her main food source. Fish are the primary consumers in this food web. Even though Bruce the shark claims that "Fish are friends, not food," sharks make up part of the next level,

secondary consumers. Bruce and his friends are carnivores and eat only meat. Nigel and the other pelicans are also secondary consumers because they eat fish. The animal's place in the food web and what type of producer or consumer they are is the trophic level.

The clownfish in *Finding Nemo*, Marlin and Nemo, have a unique relationship with sea anemones. The anemone provides a habitat as well as protection from predators for the clownfish. In turn, the clownfish lure other fish into the anemone and eat any remnants, which both provides food for the anemone and helps keep it clean. This is known as a mutualistic relationship. Because the clownfish eat both plants and remnants of other animals, they are omnivorous creatures.

Microorganisms

Microorganisms are unicellular, microscopic organisms that can be found nearly everywhere in the world. Some microorganisms include bacteria, protists, and fungi. These microorganisms are generally beneficial and help support the lives of other, larger organisms. Organisms' lives depend on the microscopic creatures that live in and around them. "There are nearly 10 million microorganisms in just one milliliter of ocean water" (Microorganisms).

At the beginning of *Finding Nemo*, Mr. Ray shows his class a stromatolitic cyanobacterium. Stromatolites are small structures made of layer upon layer of cyanobacteria, a type of photosynthetic bacteria. This means that cyanobacteria can make their own food. Although cyanobacteria is harmless, some types of bacteria are pathogenic, which means that they cause diseases. *Vibrio* bacteria is a type that causes many foodborne infections that result

from eating undercooked seafood. This bacteria has flagellum to assist in movement, a capsule to aid in infecting cells by preventing phagocytosis, and DNA.

Protists are commonly found in the ocean and provide oxygen as well as an abundant food source for larger organisms. Autotrophic protists, or microscopic algae, use photosynthesis to make food for themselves. Heterotrophic protists either ingest their prey or serve as parasites and prey on phytoplankton.

Viruses are microorganisms that can be particularly dangerous in the ocean. Viruses consist of a nucleic acid, a capsid to protect the nucleic acid, and a viral envelope derived from host cell membrane. The viruses infect cells of clownfish, plants, starfish, or even coral by injecting their nucleic acid into the cell. The host cell makes copies of the virus's genetic material. In the lytic cycle, the virus overloads the cell and continues to replicate until the host cell explodes. In the lysogenic cycle, the viral DNA or RNA combines with the cell DNA and continues to replicate inside the cell until it comes under stress; at that point, the lytic cycle begins.

Genetics

Genetics is the study of inheritance, genes, and how traits are passed on through generations. Gregor Mendel is one of the pioneers of the study of genetics and his observations about pea plants' flower color helped form the basis of this branch of biology. Genetic diversity is largely due to differences in DNA sequences. DNA is a nucleic acid that carries the code for genetic information. Genes are the segments of DNA that contain instructions for making specific proteins. These proteins determine both physical appearance and the enzymes that the

body will produce. All of this coding inside the body gives organisms unique traits and makes them genetically different from one another.

In *Finding Nemo*, Nemo's parents are two different colors. Coral, the mother, is light orange, but Marlin, the father, is dark orange. Nemo, the offspring, is a dark orange like his dad. A Punnett square can be drawn to find the likelihood of one of Nemo's siblings being light orange. The first step would be to determine if the traits in question are dominant or recessive. In this case, it can be assumed that dark orange is dominant. This means that it would cover up light orange, the recessive trait. The next step is to deduce whether Nemo's parents are heterozygous or homozygous. Heterozygous means that there is one dominant allele and one recessive allele. Homozygous means that the alleles are either both dominant or both recessive. Because Nemo's mom is light orange, she must be homozygous recessive. Nemo's dad can be either heterozygous or homozygous dominant. In this situation, Nemo's dad will be heterozygous. Once the traits are crossed in the Punnett square, the result is that Nemo's sibling would have a 50% chance of being dark orange and a 50% chance of being light orange.

Body Systems: The Digestive System

The digestive system serves to turn food into energy and prepare the residue and indigestible items for removal. The nutrients absorbed from the food allow organisms to function and survive. Digestive systems vary from one organism to the next.

In the movie, Chum is a shark who attends the meeting with Bruce, Dory, and Marlin. Chum was supposed to bring a fish friend with him, but he ate the fish instead. He used his digestive system to extract nutrients from the fish. The digestive process began when the fish

entered Chum's mouth. For sharks, very little, if any, digestion occurs in the mouth because they usually swallow prey whole or in giant chunks. The fish travels through the esophagus and into the stomach. Sharks' stomachs are U-shaped and use very strong enzymes to break down the food. This is known as chemical digestion because chemicals, acids, and enzymes are used to dissolve the material instead of crushing and squashing food. Next, the mushy and well-digested food enters the intestine and nutrients are absorbed. Materials that are unable to be digested are vomited back up. This is shown in *Finding Nemo* when the fish bones poke out of Chum's mouth for a brief second before he pushes them back in.

Body Systems: The Circulatory System

The circulatory system moves blood throughout an organism's body and delivers oxygen and nutrients to different parts of the body. Although some systems vary only slightly from organism to organism, the circulatory system of a fish is drastically different from the circulatory system of a human- or any mammal, for that matter. In all organisms, the main components of the circulatory system include a heart, veins, arteries, and capillaries.

When Dory is meeting with the sharks, she is injured and her face begins to bleed. Blood is produced and cycled throughout Dory's body in a single circulatory pattern, which means it only goes through the heart once. A fish heart only has two chambers, unlike a four-chambered mammalian heart. Instead of right and left chambers, a fish heart only has one atrium and one ventricle. The way blood gets oxygenated in fish is very different from how it occurs in mammals. Oxygen-deprived blood travels to the heart through the veins and is sent to the gills, which is where the gas exchange takes place. Capillaries are used during the gas exchange

because the thin walls allow diffusion of oxygen and carbon dioxide. The oxygenated blood is then sent throughout the body using arteries.

Body Systems: The Nervous System

The nervous system essentially controls the rest of the body and allows for communication between different body parts. It controls both voluntary and involuntary actions. This system consists of a brain, a spinal cord, and a network of nerves. These parts together help organisms sense, move, and react to external stimuli.

In *Finding Nemo*, Dory and Marlin are able to move through the ocean, make decisions, and feel pain because of their brains. Fish brains are much simpler than the brains of other vertebrates, and have three sections: the forebrain, the midbrain, and the hindbrain. The forebrain is mostly responsible for a fish's sense of smell. The midbrain processes motor responses and allows fish to learn and see. The hindbrain has two parts: the medulla oblongata, which controls many involuntary actions of fish, and the cerebellum, which senses pressure, maintains balance, and regulates muscle movement (Bony). A fish's spinal cord connects the brain to all other parts of the body. The rest of the nervous system is a matrix of nerves. Nerve cells, or neurons, are another component and are found in the brain, spinal cord, and peripheral nerves. Neurons can be organized into two smaller categories: motor neurons and sensory neurons. Motor neurons control muscle contractions. They have a cell body on one end, a long axon in the middle, and dendrites on the other end. Sensory neurons control the senses and have dendrites on both ends, an axon in the middle, and a cell body in the middle as well. Gaps between neurons are called synapses and signals are transmitted across synapses by chemicals called neurotransmitters.

Because of the brain, spinal cord, and nerves, fish are able to operate and sense the world around them.

Body Systems: The Integumentary System

The integumentary system protects the body from many different kinds of damage: UV rays, pathogens, scratches and cuts, and water loss. Skin, hair, and nails are the major components of the integumentary system. This system may also include hooves, scales, and feathers depending on the organism.

Marlin and Dory are saved by a whale in *Finding Nemo*. Unlike clownfish and blue tang fish, whales are mammals. This means that, although there may not be much, whales have hair. The hair follicle lies embedded in the skin. Epidermis is the top layer of skin, made of dead, flattened skin cells. Dermis is the inner layer of skin that contains blood vessels, nerves, and glands. All of this is similar to the human integumentary system, but whales have one interesting feature that makes their system much different. Keratin is the substance that makes up hair and nails for humans. For whales, keratin is the substance that makes up baleen, the filter-like part of a whale's mouth that allows it to eat krill and plankton. Baleen is important to whales because it is the way that the giant organisms obtain nourishment.

Conclusion Paragraph:

Biology can be found in any place where life exists. *Finding Nemo* is a movie, but the characters have lives of their own. The characters and their environment demonstrate ecology because they form their own ecosystem. Even the smallest microorganisms contribute to the

world of *Finding Nemo* and its marine life. Nemo and his parents showed how traits can change through generations in all species, from humans to clownfish. Humans, sharks, whales, and fish all have organ systems that help them live their lives. Biology connects all organisms to one another and proves that life matters.

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