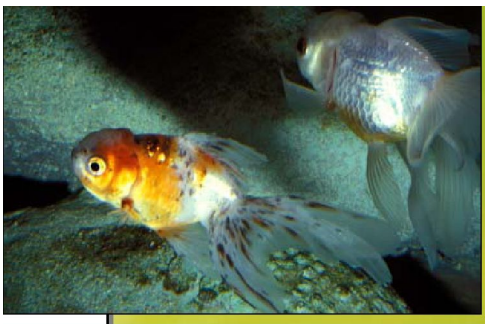
Life in a Fishbowl

David was trying to study for his biology quiz, but he was having trouble concentrating. He found himself watching his goldfish swim back and forth in their bowl. "Wow," he thought. "Pretty monotonous."

He turned back to his vocabulary list. **Cells:** the smallest parts of living material. **Cell membrane:** the structure surrounding a cell and holding its parts together. **Nucleus:** the control center of a eukaryotic cell ...



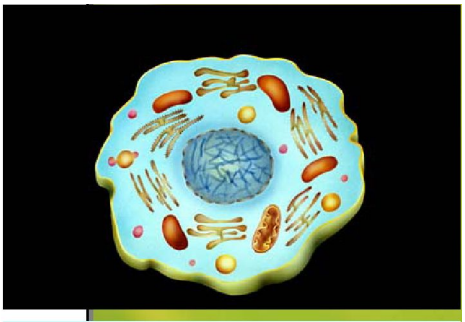
A goldfish is a eukaryotic organism.

Soon, David's mind drifted toward his fish again, but he forced himself to turn his thinking to biology. "If only the fish could help me study," he chuckled to himself. "Fish are alive. This biology text should apply to them."

David thought for a moment. Of course biology applied to his goldfish! He quickly read through his notes and applied the ideas to his pets: Fish are animals, made of eukaryotic cells, which means each of their cells has a nucleus.

Goldfish cells, like all eukaryotic cells, also contain other organelles. **Organelles** are small structures that help a cell function. They process nutrients to give the cell energy and contain information about reproduction. They provide the basic ingredients for protein production as well. Cells also contain **cytoplasm,** a fluid that fills the open spaces between a cell's other structures.

David considered the plants growing on the bottom of his aquarium and the algae floating at the top. He remembered these organisms are also made of cells, but their cells are different than goldfish cells. Plant cells are surrounded by **cell walls,** which give the plant its structure. Also, the cells of plants and algae contain special organelles called **chloroplasts,** which convert energy from the sun into energy for the organism.

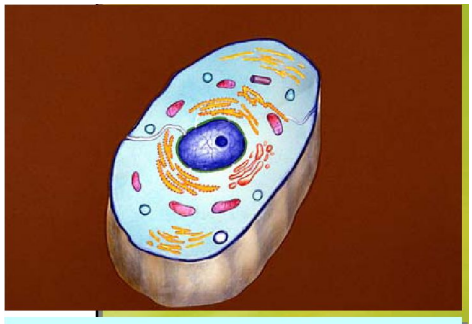


Animal cells contain a nucleus and other organelles but no cell walls.

In multi-celled organisms, like fish and humans, different kinds of cells form different kinds of **tissues.** David remembered learning about bone tissue, root tissue, skin tissue, muscle tissue, blood tissue, and many other kinds

of tissue. These tissues are all made of specialized cells. And the different types of tissues make up different organs in the body of an organism. These organs include eyes, gills, and stomachs in animals and flowers, leaves, and roots in plants.

Most of the time, organs work together to help the body conduct specific functions. For example, the nerves send messages through the spinal cord to the brain; these organs are all part of the same **organ system.** And most of the organs in the body are related. "The organs in a fish *must* be related because they're so small," David thought.



Plant cells contain organelles and are surrounded by a cell wall.

Then David read in his textbook that organ systems are related in all organisms. He thought about this fact for a minute. "Of course," he realized. "The muscles in my heart can't pump blood through my body if they don't get energy. They can't get energy unless my mouth takes in food." David also thought about the way his breathing becomes heavy when he runs; using his muscles requires his body to use his lungs as well. "All the organ systems in an organism's body are related and dependent on each other," David wrote in his notebook.

"In fact," David thought as he watched the fish hide behind a plant in the aquarium and nibble on some algae, "organisms themselves are interrelated. The fish need the plants and algae for food. The plants use carbon dioxide produced by the fish, and algae use other waste products in the tank." He remembered when he set up his aquarium—the instructions said it was important to keep all the contents in balance.

David looked again at the fishbowl. He thought, "An aquarium is its own little ecosystem, containing non-living substances, like the rocks and water, and living organisms, like the fish, plants, and algae. Each organism relies on organ systems that carry out important functions to help the organism live, grow, and reproduce. Each organ system contains several organs, which contain specialized tissues. The tissues are formed by specialized cells. And every cell has its own structure. "Amazing!" he thought.

