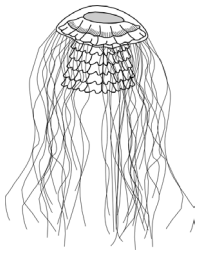
Jellies

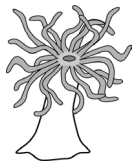
Lesson Objectives: Students will be able to do the following:
- Distinguish between a polyp and a medusa stage
- Characterize locomotion and feeding within the true jellies
- Describe a Cubozoan

Key Concepts: Cnidarians, classification, medusa, polyp, mesoglea, nematocysts

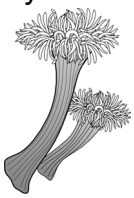
Cnidarians



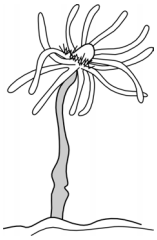
Jellies with their umbrella shaped bells and ribbon like tentacles can be seen drifting along in the ocean currents. These fascinating creatures belong to a much larger group of animals known as **Cnidarians**. These "jellies" are all soft bodied, aquatic animals that share some distinctive characteristics. These animals have sac-like bodies with a hollow central cavity. The body is made up of a jelly-like substance called **mesoglea**. This mesoglea is 98% water and is found between two cellular layers. The only body opening is a mouth.



Tentacles that contain stinging cells surround the mouth. These stinging cells or **nematocysts** have a variety of functions depending on the type of cell. Some are used as "sticky" cells to tangle or glue their prey, others release poisons that stun and kill prey. Cnidarians can be found with two different body shapes or plans: **polyps** and **medusae**. An anemone is an example of a jelly with a typical polyp shaped body. Its body looks like a cylinder. There is a mouth at one end with a muscular foot or pedal disc at the other end. These animals are often **sessile** staying attached to a substrate. A jelly with its bell shaped body and long tentacles is an example of a medusa. The medusae are seen swimming or drifting freely in the water.



Cnidarians can be further divided into groups called classes. The four classes of Cnidarians presently recognized by scientists are the Anthozoans, the Hydrozoans, the Scyphozoans, and the Cubozoans. Anthozoans are the largest class of jellies. This class includes corals and sea anemones. These animals only have polyp stages. Hydrozoans have the most variety within their class. They include hydroids, siphonophores, fire corals, and other medusae. Hydroids come in the polyp form (often looking like a plant) or the medusa form. Siphonophores include colonial animals such as the

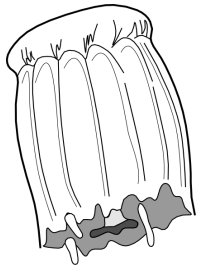


Portuguese Man-O-War. This animal looks like a true jelly with its transparent float and long tentacles, but it is really many animals living together in a colony. Hydroids can be mistaken for plants and have a complex life cycle with animals in this class alternating between the polyp and medusa stages. Scyphozoans are the true jellies. Some of these animals have only medusa stages while others alternate between medusa and polyp. Animals in this class swim by contracting their bell and expelling water from the underside. The Cubozoans are the most recently designated class of Cnidarians. They were originally classified as an Order within the Class Scyphozoa. Cubozoans are the box jellies. They are identified by their box shaped bells. The jellies within this group include some of the most poisonous species. The sea wasp can kill a human in just a few minutes. Box jellies appear to have an alternating life history (with polyps and medusae) although scientists are still learning about these unusual jellies.

Natural History of the True Jellies

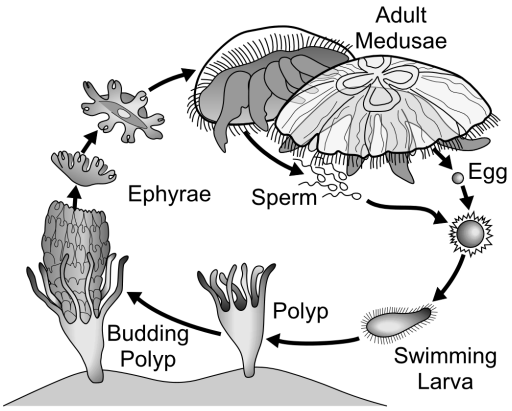
Jellies are versatile animals well equipped for life in a variety of ocean environments. Their transparent bodies make them difficult to see as they drift along in the ocean currents. Their watery bodies offer little nutrition to would-be **predators** while their strong venoms can stun or kill a meal. In addition, jellies designed for life in the cold dark ocean realm need very little oxygen and can withstand pressures that could crush a human.

To understand jellies better, we will take a closer look at a typical member of the Class Scyphozoa called *Aurelia aurita* or the common moon jelly. Moon jellies have flattened bells that resemble flying saucers. Along the edge of the bell is a fringe made up of short tentacles. These tentacles contain the stinging cells or nematocysts used by the jelly for protection and food gathering. When the jellyfish touches a passing prey the stinging cells release a poison that stuns or kills the prey. The food is then engulfed by the mouth and swept into the stomach by tiny hairs called cilia. Any part of the food that cannot be digested is released into the water also through the mouth.



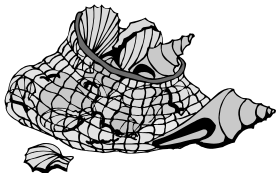
Moon jelly reproduction follows the usual cycle found in the true jellies. The adult medusae are either male or female. The males produce sperm that are dispersed in the water. Most female jellies do the same with their eggs, but the moon jelly holds her eggs under her bell. Larvae or juvenile stages hatch from the eggs. These larvae float around in the ocean until they find a suitable substrate. They attach themselves to

the substrate and grow into a polyp stage. The polyp **buds**, creating clones of itself. The polyp then divides itself into many flat segments. This process is called **strobilation**. During strobilation the flat segments separate and float away. These young jellyfish are called ephyrae. The ephyrae grow into adult medusae and the cycle begins again. Sometimes these creatures are seen in "blooms" containing thousands of animals. Scientists are continuing to study jellies to learn more about their reproductive blooms, their navigational abilities, and their responses to the physical aspects of their environment.

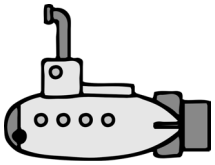


Moon Jelly Reproduction

What's Next?



Why do scientists still know so little about the jellies? In the past, organisms from the ocean depths were collected in trawls. These nets, when pulled to the surface, contained many interesting creatures. Some of these organisms were destroyed as they were lifted up from high-pressure ocean bottoms. The fragile jellies were torn apart and looked like gelatinous blobs. As technology advanced, scientists were able to build and use underwater submersibles. The first submersibles could descend to shallow depths and had a limited bottom time. Humans have visited the bottom of the ocean (the Challenger Deep at 11,000 meters) only once. Today, the deepest diving research submersible only reaches 6,500 meters, however remotely operated vehicles can reach 11,000 meters. As this technology has continued to advance, scientists have had more opportunities to study jellies and the complex "jelly web" that is responsible for cycling large amounts of food energy through ocean systems.



One group of interest to scientists is the Cubozoans or box jellies. The Cubozoans get their name from their box shaped bells. They have four tentacles or sets of tentacles used for food gathering. They eat worms, **krill**, and fish. Some of these jellies have deadly poisons. One specimen, the Australian stinger (*Chironex fleckeri*) has been responsible for human deaths. They use strong

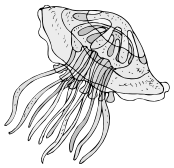
muscles to propel themselves through the water. They have been observed maneuvering around objects and even swimming away from approaching humans. Besides being good swimmers, these jellies can also see. The box jellies have eight eye spots or simple eyes. These eyes probably help the animal tell light from dark. The box jellies also have eight complex eyes with **corneas**, **retinas**, and **lenses**. These eyes are very similar to human eyes. It is not yet known how these eyes see,

because jellies do not have brains to translate the images. The box jellies also have statocysts. These spheres of calcium carbonate are similar to **otoliths** found in fish. They help the jelly tell if it is right side up or upside down. Scientists have also used these statocysts for aging the jellies (similar to how scientists can age fish using otoliths).

These scientific discoveries raise more questions about this environment and the organisms that live here. Hopefully, with more advances in technology some of the mysteries of the deep will be revealed.

Activity: The World's Foremost Jelly Expert

As technology advances, new discoveries are taking place in science. More areas are open to exploration. One of these areas includes the mid-waters of deep ocean basins. Here scientists have discovered a whole new "jelly web" responsible for a large amount of the energy transfer within this region. These jellies are fascinating creatures as they swim along almost undetected. Their bells pulsate and their tentacles trail behind as they move in the currents. Some of these creatures have eyes. Others have bioluminescent organs. Still others can navigate through the waters. All of these characteristics help jellies to be successful in their ocean home.



Objectives: Students will be able to do the following:
1. Name seven facts about a particular jelly.
2. Organize scientific information into a form that can be used by the general public.
3. Compare and contrast the features of two different types of jellies.

Materials:
- Research materials containing information about jellies. (Newspapers, journals, books, and the internet are good sources of information. Some good jelly sites include http://www.aquarium.org/jellies and http://www.ucmp.Berkeley.edu/cnidaria)
- Drawing instruments-pencil, colored pencils, markers, crayons, etc.
- Drawing paper

Procedure:
1. Have students gather materials about a variety of jelly groups.
2. Give students the following scenario: You are a world famous "jelly" scientist that has spent years learning about one particular jelly. You are reading a scientific journal that has this career opportunity included:

New state of the art aquarium facility in (your hometown) is seeking a world renowned "jellyist". The successful candidate will have at minimum a Ph.D. in Marine Biology or a related field with at least ten years research experience and two years aquarium experience. This position includes working closely with the public to create an understanding of the importance of the jelly web and how it impacts our community. The position also allows for continued research in the successful candidates area of expertise with opportunities to publish and present papers at worldwide conferences. This is a permanent full time position. Salary is commensurate with experience. Interested candidates should make application to: Selection Committee Brand New Aquarium.

You decide to apply for the position, since you meet all of the minimum requirements. You were successful in being chosen as one of the final candidates for the position. Now you must prepare a presentation for the selection committee that includes a brochure that can be used by the aquarium to advertise the new jelly exhibit (your specialty).

3. Have students research one particular jelly that will become their specialty.
4. Have students create a brochure that includes information about their jelly. (The following list can be adapted to the student level.)
    - Picture (drawn or computer generated, etc.)
    - The common name and scientific name
    - Seven basic facts (such as size, shape, habitat, body plan, etc.)
    - Life cycle
    - Any recent discoveries
    - Ecological importance
    - Adaptations for its specific environment
    - Anatomy
5. Have each student present his/her brochure to the committee (class).
6. Have each student also present at least one reason why they are the best person for the position at the new aquarium. (What characteristics do they possess that make them uniquely qualified for this position? Example: Good social skills would be helpful when working closely with the public).
7. Discuss the process involved in becoming an “expert”. Compare the activity to real life situations.
8. Discuss skills other than scientific skills needed to be a successful “job” candidate.

Possible Extensions:

1. Have students create a commercial for their “jelly”. (This could be a video project or live presentation.)
2. Have students work in groups as a research team in which each person is responsible for a particular area of information about their jelly. Have each team create a presentation. Discuss the strengths and weaknesses associated with teamwork. Compare and contrast this situation to real life research situations.

Student Information: Jellies

Jellies come in different shapes and sizes. Some are no bigger than marbles while others have bodies that can be two meters across. They can be seen washed up on beaches with their balloon shaped bells and long ribbons of tentacles. Others can be found at the ocean depths sending messages with flickering lights. Still others live in the shallow waters of the tidepools camouflaged as plants.

These jelly-like creatures have two different body stages or plans. The **medusa** is your typical jelly shape. It has a translucent bell. This bell can be a flattened disc, a curved umbrella shape, or even a cube. The mouth is located on the underside of the bell. The bell also has tentacles that point downward. This medusa can be found drifting or swimming through the water. The **polyp** stage has a central tube or stalk with a mouth at the top. The mouth is surrounded by tentacles. This stage can be found attached to the bottom or almost anything in the water (pier pilings, inner tubes, moorings, buoys, boats, etc.) where the tentacles gently sway in the water.

Even though jellies can look very different, they all have one thing in common. They all have stinging cells called **nematocysts**. These stinging cells are located on the tentacles. The nematocysts contain sharp barbs that are triggered when touched. There are several different types of nematocysts. Some are used to glue their **prey**. Others can be used to stun or kill their prey. These stinging cells can also be used to protect the jelly against a would-be **predator**. The sting of some jellies is so strong that it can kill a human.

Scientists are interested in studying jellies, because they are a key part of an important ocean **food web**. The “jelly web” cycles much of the energy through the dark ocean realm. Yet scientists know little about this food web. As technology advances, researchers are able to learn more about these interesting creatures.