

# Phylum Cnidaria (aka: Phylum Coelenterata)

~9000 species

**Organisms:** Hydra, jellyfish, sea anemones, corals, obelia, Portuguese-man-of-war

From Greek "knid" meaning sea nettle (a plant with stinging hairs)

## **These organisms:**

Are soft-bodied carnivorous animal with stinging tentacles arranged in circles around their mouths.

Have a digestive body cavity called a gastrovascular cavity.

Have radial symmetry.

Have specialized tissues.

Are only a few cell layers thick.

    Outside layer is for protection.

    Inner layer is for digestion.

All live underwater, most in the ocean.

Have one body opening.

Have simple nervous systems.

Cell layers contract like muscles (have some muscle fibers.)

Have stinging cells.

Range in size from the tip of a pencil to half of a football field.

Has a central mouth surrounded by numerous tentacles extending outward from the body.

Have 2 body forms:

    Polyp: Cup-like, sessile body form; cylindrical body with arm-like tentacles, closes at one end; mouth points upward.

    Medusa: Umbrella-like, free-swimming body form; bell-shaped body with the mouth on the bottom.

## **Body Structures:**

**Tentacles-** long, arm-like structures used for grabbing; 6-100 per organism.

**Cnidocytes-** stinging cells located along tentacles; used for defense and capturing prey; contain nematocysts.

**Nematocysts-** poison-filled stinging structure (capsule) that contains a coiled dart; coiled stingers inside cnidocytes; some sticky and some barbed; used only once: after discharged a new one forms.

**Basal disc-** sticky layer of cells that attach to a solid object.

**Cnidocil-** small projecting trigger in the cnidocyte; responds to touch or chemicals in the water; causes nematocysts to fire.

**Nerve net-** loosely organized network of nerve cells that allow cnidarians to detect stimuli (ie: touch); usually distributed uniformly throughout the body, but in some species, it is concentrated around the mouth or in rings around the body.

**Statocysts-** groups of sensory cells that determine the direction of gravity.

**Ocelli** (oh-SEL-eye)- singular is ocellus; eyespots made of cells that detect light.

**Hydrostatic skeleton-** layer of circular muscles and a layer of longitudinal muscles that together with water in the gastrovascular cavity allow for movement.

**Spermaries-** testes, produce sperm

**Ovaries-** produce eggs

*\*\*\*Spermaries and Ovaries can be present in the same animal.*

**Gastrovascular cavity-** internal space within the body of the animal; digestive chamber with one opening.

### **3 Layers of cells-**

Gastroderm: inner lining of the gastrovascular cavity where digestion takes place.

Epidermis: outer layer of cells

Mesoglea: layer lying between epidermis and gastroderm;

thin non-cellular membrane to a thick jelly-like material containing cells.

**Gastrodermal cells-** large, flagellated, nutritive muscle cells; contain food vacuoles for intracellular digestion.

**Epidermis-** 2 types of cells

- 1.) **Epitheliomuscular cells:** larger, contain contractile fibrils at the bases.
- 2.) **Interstitial cells:** smaller, located between epitheliomuscular cells; act as germinal cells that give rise to sperm and eggs.

### **Feeding and Digestion:**

Capturing prey- when prey brush against the tentacles, nematocysts explode into the animal releasing poison to paralyze or kill prey.

After capture, the cnidarians pull their prey into their mouth with its tentacles and force it into its gastrovascular.

Digestion begins in the gastrovascular cavity. This digestion is extracellular (takes place outside the cells) as enzymes are secreted into the gastrovascular cavity.

Partially digested materials are absorbed by the gastroderm where digestion is completed intracellularly (within the cells.)

Materials not digested are removed from the body through the mouth.

### **Respiration/Circulation/Excretion:**

Nutrients are transported by diffusion.

Respiration and excretion of wastes occurs by diffusion through body walls.

### **Response:**

Responses are carried out by specialized cells and tissues (nerve net, statocysts, ocelli.)

### **Movement:**

Varies

**Use of the Hydrostatic skeleton-** ie: in sea anemones the circular muscles contract and closes the mouth so that water can not escape, the pressure makes it taller and forces motion.

In medusas, jet propulsion through muscle contractions causing the bell shaped body to close like an umbrella and push it forward.

### **Reproduction:**

Both sexual and asexual

#### Sexual reproduction:

most cnidarians;  
external fertilization in water;  
sexes are often separate;

How?

1. female releases eggs into water
2. male releases sperm
3. a zygote is formed and grows into a free swimming larva
4. the larva then attaches onto a hard surface and develops into a polyp that eventually buds and releases a new medusa.

#### Asexual reproduction:

Polyps-

budding causes the formation of new polyps  
new polyps are genetically identical to parents

Budding types:

1. Swelling on the side of a polyp forms a new polyp.
2. Production of tiny medusas that separate and become new individuals.

In Obelia: metagenesis (alteration of sexual and asexual generations.)

Polyp stage: asexual

Medusa stage: sexual

### **3 Classes:**

**Hydrozoa-** Hydra, Physalia (Portuguese man-of-war)

1. Polyps grow in branching colonies
2. Sometimes more than 1 meter in length.
3. Hydra:
  - a.) Lack the medusa stage
  - b.) Reproduce asexually by budding or sexually by producing eggs/sperm in the body wall.
  - c.) Solitary (live individually.)
4. Portuguese man-of-war
  - a.) Colonial
  - b.) Polyps are specialized to perform different functions
    - i.) One polyp forms a float
    - ii.) Others produce long tentacles
    - iii.) Some are for stinging prey
    - iv.) Some for reproduction

**Scyphozoa- Jellyfish**

1. Means "cup animals" (Greek skyphos meaning cup and zoon meaning animal.)

2. Live primarily as medusas (polyp stages form only in the larval stage.)
3. Generally 25 mm to 2 meters in diameter
  - a.) Largest 4 m in diameter and tentacles 30 m long.
4. Reproduce sexually.
5. Contain some glowing pigments.
6. The most common is aurelia.

**Anthozoa-** Sea Anemone, Coral, sea pansies, colonial sea pen, soft/horny/black corals

1. Called the "flower animal" from Greek anthos meaning flower and zoon meaning animal.
2. Look like flowers.
3. Have only one polyp stage.
4. Have a central body surrounded by tentacles.
5. Many are colonial.
6. Sexual and asexual reproduction:
  - a.) sexually-eggs and sperm are released and a zygote becomes a larva which grows into a new polp
  - b.) asexually- budding or split into 2 halves.
7. Stony and hard corals build coral reefs, require large amounts of light
8. Sea anemonies:
  - a.) solitary polyps
  - b.) live at all depths of the ocean
  - c.) red, purple, and blue body.
9. Coral:
  - a.) individual coral polyps look like miniature sea sanemonies
  - b.) most corals are colonial (polyps growing together in large numbers)
  - c.) as the colonies grow, they secrete  $\text{CaCO}_3$  or limestone skeletons.
  - d.) they grow slow
  - e.) they can live for thousands of years