Lecture ((4))

Phylum: Cnidaria (Coelenterata)

General characteristic of Cnidaria

1. Radial symmetry
2. Cnidaria are diploblastic animals (have two germ layers during development ectoderm and endoderm).
3. Adult body with an outer cellular layer (epidermis or ectoderms) and an inner cellular layer (gastrodermis) with a non-cellular layer (mesoglea = jelly like material) between two layers.
4. Some specialized tissues present.
5. Possess unique stinging or adhesive structures (cnidae) found in specialized cells (cnidocytes) most common cnidae called nematocyst, Cnidarians are distinguished from all other animals by having cnidocytes that fire harpoon like structures and are used mainly to capture prey, in some species, cnidocytes can also be used as anchors.
6. They have simple nerve net form a nervous system.
7. Cnidaria have phenomenon Alternation of generations with asexually reproducing polyp stage and sexually reproducing medusa stage.
8. Cnidaria have a ciliated, motile planula larva.

Classification of phylum Cnidaria

1. Class: Hydrozoa … *Hydra*

- Most are marine, few are fresh water.
- Individually very small and inconspicuous
- Polyp is dominant stage ,some completely lack medusa.
- Medusa when present has vellum around margin

- Most are colonial -small plant like appearance
- Most have polymorphism with Alternation of generations.

2. Class: Scyphozoa…. *Aurellia*
    - Most of larger Jellyfish belong to this group
    - Medusa without vellum , The mesoglea includes mobile amoeboid cells.
    - The Scyphozoa are an exclusively marine class
    - Polyp stage reduced or completely absent
    - mesoglea are an internal gelatinous material, thick layer.
3. Class : Anthozoa…. *Favia*
    - Flower animals, all are marine.
    - The basic unit of the adult is the polyp no medusa stage
    - Many cells in mesoglea.
    - Some are solitary most are colonial.
    - Most secrete skeleton of calcium carbonate or protein

The genus *Hydra*

Phylum: Cnidaria

Class: Hydrozoa

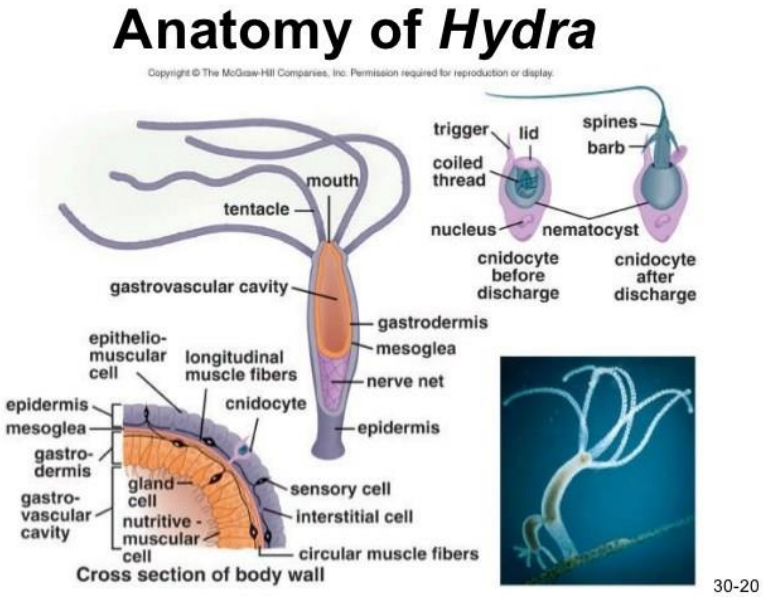
Order: Anthomedusae

Family: Hydridae

General characteristic of *Hydra*

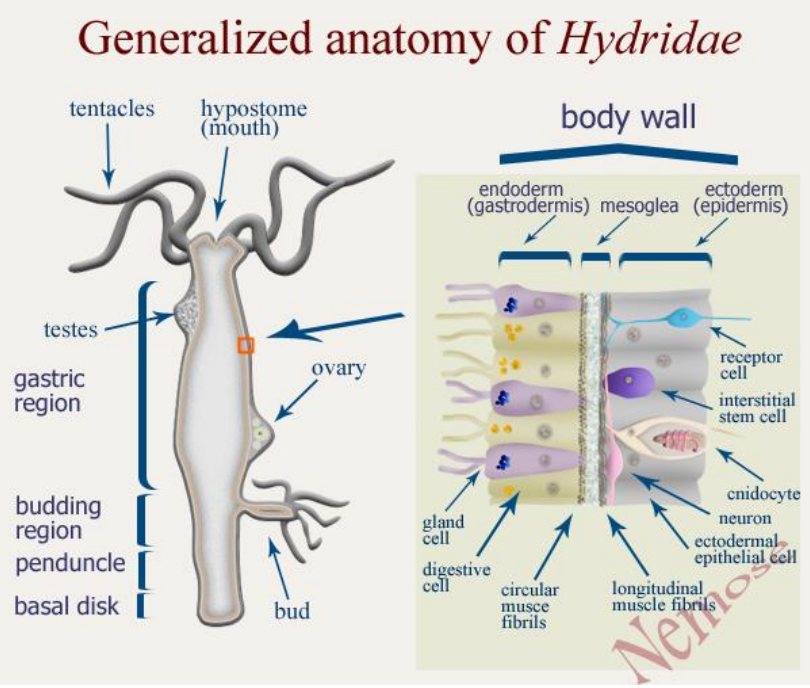
1. Small, multicellular, has tubular body up to 10 mm.
2. Radial symmetry.
3. They can found in most un polluted freshwater, ponds, lakes and stream in the temperature and tropical region.
4. Contain in the foot region basal disc, gland cells in the basal disc secrete a sticky fluid that accounts for its adhesive properties.

5. mouth found in free end of the body surrounded by one to twelve thin, mobile tentacles. Each tentacle, or cnida , is clothed with highly specialized stinging cells called cnidocytes. cnidocytes contain specialized structures called nematocysts.
6. The nervous system of *Hydra* is a nerve net, which is structurally simple compared to animal nervous systems. Hydra have sensitive nerve cells located in the body wall and tentacles.
7. Respiration and excretion occur by diffusion everywhere through the epidermis.
8. Hydra undergoes morphallaxis (tissue regeneration) when injured or severed



Motion in *Hydra*

1. Somer-saulting
2. Looping
3. Floating

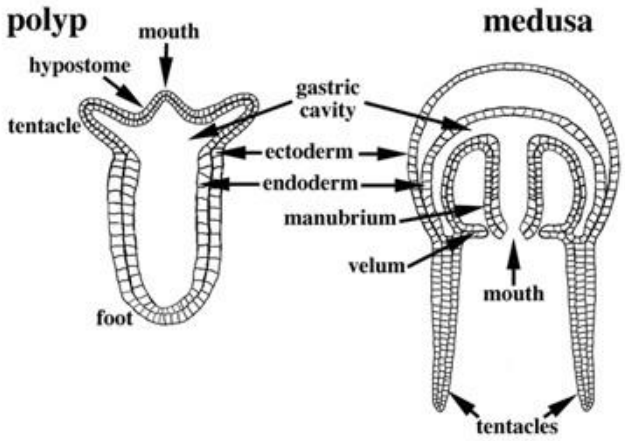


Feeding of *Hydra*:

Hydra mainly feed on aquatic invertebrates such as *Daphnia* and *Cyclops*. While feeding, Hydra extend their body to maximum length and then slowly extend their tentacles. Despite their simple construction, the tentacles of *Hydra* are extraordinarily extensible and can be four to five times the length of the body. Once fully extended, the tentacles are slowly manoeuvred around waiting for contact with a suitable prey animal. Upon contact, nematocysts on the tentacle fire into the prey, and the tentacle itself coils around the prey. Within 30 seconds, most of the remaining tentacles will have already joined in the attack to subdue the struggling prey. Within two minutes, the tentacles will have surrounded the prey and moved it into the opened mouth aperture. Within ten minutes, the prey will have been engulfed within the body cavity, and digestion will have started. *Hydra* are able to stretch their body wall considerably in order to digest prey more than twice their size. After two or three days, the indigestible remains of the prey will be discharged through the mouth aperture via contractions.

Reproduction of *Hydra*:

When food is plentiful, many *Hydra* reproduce asexually by producing buds in the body wall, which grow to be miniature adults and break away when they are mature. When a *Hydra* is well fed, a new bud can form every two days. When conditions are harsh, often before winter or in poor feeding conditions, sexual reproduction occurs in some *Hydra*. Swellings in the body wall develop into either ovaries or testes. The testes release free-swimming gametes into the water, and these can fertilize the egg in the ovary of another individual. The fertilized eggs secrete a tough outer coating, and, as the adult dies (due to starvation and/or cold), these resting eggs fall to the bottom of the lake or pond to await better conditions.



Types cells of *Hydra*:

Epidermis:

Epitheliomuscular**,** Interstitial cell **,** Cnidocyte**,** Sensory cells**,** Nerve cells**,** Germ cells.

Endodermis (Gastrodermis):

Epitheliomuscular cells (Digestive cells)**,** Interstitial cells**,** Gland cells**,** Sensory cells**,** Nerve cells.

Cnidocyte:

A cnidocyte (also known as a cnidoblast or nematocyte) is an explosive cell containing one giant secretory organelle or cnida (plural cnidae) that defines the phylum Cnidaria (corals, sea anemones, hydrae, jellyfish, etc.). Cnidae are used for prey capture and defense from predators. Despite being morphologically simple, lacking a skeleton and many species being sessile, cnidarians prey on fish and crustaceans. A cnidocyte fires a structure that contains the toxin, from a characteristic subcellular organelle called a cnidocyst (also known as a cnida or nematocyst). This is responsible for the stings delivered by a cnidarian

Structure and function:

Each cnidocyte contains an organelle called a cnida, cnidocyst, nematocyst, ptychocyst or spirocyst. This organelle consists of a bulb-shaped capsule containing a coiled hollow tubule structure attached to it. An immature cnidocyte is referred to as a cnidoblast. The externally oriented side of the cell has a hair-like trigger called a cnidocil, When the trigger is activated, the tubule shaft of the cnidocyst is ejected and, in the case of the penetrant nematocyst, the forcefully ejected tubule penetrates the target organism. This discharge takes no more than a few microseconds, and is able to reach accelerations of about 40,000 g. Recent research suggests the process occurs in as little as 700 nanoseconds, thus reaching an acceleration of up to 5,410,000 g. After penetration, the toxic content of the nematocyst is injected into the target organism, allowing the sessile cnidarian to devour the prey.

Discharge mechanism of a nematocyst:

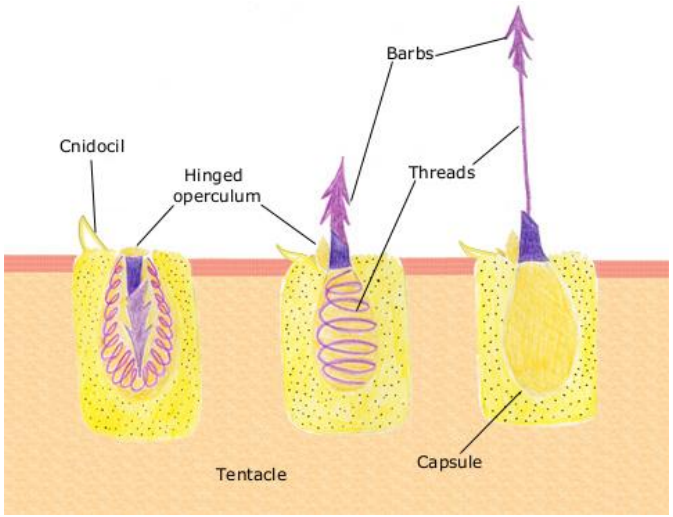
The cnidocyst capsule stores a large concentration of calcium ions, which are released from the capsule into the cytoplasm of the cnidocyte when the trigger is activated. This causes a large concentration gradient of calcium across the cnidocyte plasma membrane. The resulting osmotic pressure causes a rapid influx of water into the cell. This increase in water volume in the cytoplasm forces the coiled cnidae tubule to eject rapidly. Prior to discharge the coiled cnidae tubule exists inside the cell in an "inside out" condition. The back pressure resulting from the influx of water into the cnidocyte together with the opening of the capsule tip structure or operculum, triggers the forceful eversion of the cnidae tubule causing it to right itself as it comes rushing out of the cell with enough force to impale a prey organism.

Types of cnidae:

Over 30 types of cnidae are found in different cnidarians. They can be divided into the following groups:

1. Penetrant: a harpoon like structure used to penetrate, referred to as nematocysts.
2. Glutinant: a sticky surface used to stick to prey, referred to as ptychocysts and found on burrowing (tube) anemones, which help create the tube in which the animal lives.
3. Volvent: A lasso-like string is fired at prey and wraps around a cellular projection on the prey, which are referred to as spirocysts.

- Depending on the species, one or several types can appear simultaneously on the organism.


Barbs
Cnidocil
Hinged operculum
Threads
Capsule
Tentacle