

الانبار	الجامعة
العلوم	الكلية
علوم الحياة	القسم
الثانية	المرحلة
اللافقریات	اسم المادة باللغة العربية
Invertebrates	اسم المادة باللغة الانكليزية
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الاسعات	عنوان المحاضرة باللغة العربية
Cnidaria (Coelentrata)	عنوان المحاضرة باللغة الإنكليزية
4	رقم المحاضرة

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Phylum: Cnidaria (Coelentrata)

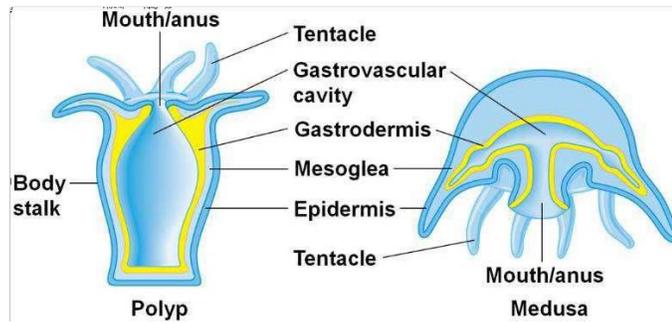
Introduction:

Phylum Cnidaria is an interesting group of more than 9000 species. It takes its name from cells called cnidocytes, which contain the stinging organelles (**nematocysts**) characteristic of the phylum. Nematocysts are formed and used only by cnidarians.

Characteristics of Phylum Cnidaria

1. Entirely aquatic, some in fresh water but mostly marine.
2. Radial symmetry or biradial symmetry
3. Two basic types of individuals: polyps and medusa.
4. Exoskeleton or endoskeleton of chitinous, calcareous, or protein components in some.
5. Body with two layers, epidermis and gastrodermis, with mesoglea (diploblastic). in some (triploblastic)
6. Gastrovascular cavity with a single opening that serves as both mouth and anus.
7. Special stinging cell organelles called nematocysts
8. Nerve net with symmetrical and asymmetrical synapses; with some sensory organs; diffuse conduction.
9. Muscular system of an outer layer of longitudinal fibers at base of epidermis and an inner one of circular fibers at base of gastrodermis.
10. Asexual reproduction by budding (in polyps) or sexual reproduction by gametes (in all medusae and some polyps)
11. No excretory or respiratory system and no coelomic cavity.

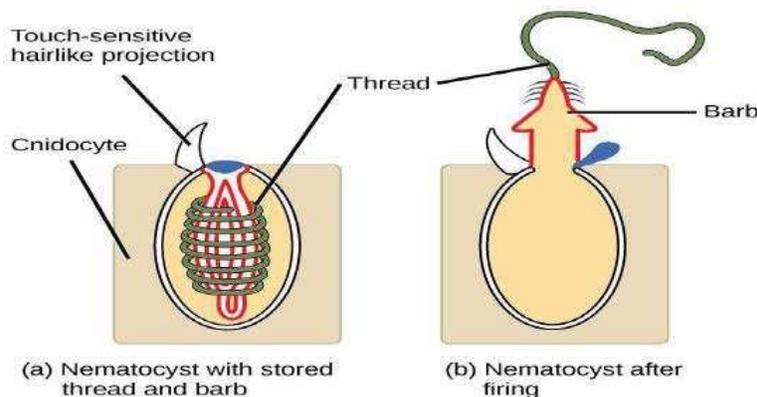
Dimorphism and Polymorphism in Cnidarians One of the most interesting aspects of this phylum is the dimorphism and often polymorphism displayed by many of its members. All cnidarian forms fit into one of two morphological types (dimorphism): a **polyp**, or hydroid form, which is adapted to a sedentary or sessile life, and a **medusa**, or jellyfish form, which is adapted for a floating or free-swimming existence.



Polyp	Medusa
Fixed	Free swimming
Body cylindrically elongated	Body umbrella-like
Tentacles are usually 24	16 tentacles in young medusa
Mesoglea poorly developed	Mesoglea well developed
Sense organs are absent	Sense organs are present
Mouth circular	Mouth rectangular
Gastro -vascular cavity simple, without radial and circular canal	Gastro -vascular cavity represented by stomach, 4 radial canals and one circular canal
Reproduces asexually	Reproduces sexually

Nematocysts: Stinging Organelles

One of the most characteristic structures in the entire cnidarian group is a stinging organelle called a nematocyst. Nematocysts are tiny capsules composed of material similar to chitin and containing a coiled tubular “thread” or filament, which is a continuation of the narrowed end of the capsule. This end of the capsule is covered by a little lid, or operculum. The inside of the undischarged thread may bear tiny barbs, or spines. A nematocyst is enclosed in the cell that has produced it, the cnidocyte (during its development, a cnidocyte is properly called a cnidoblast).



Body Wall The

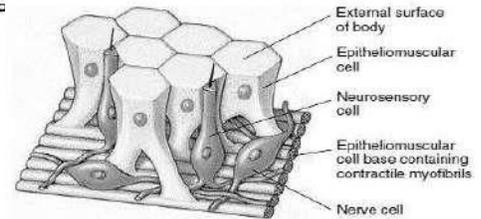
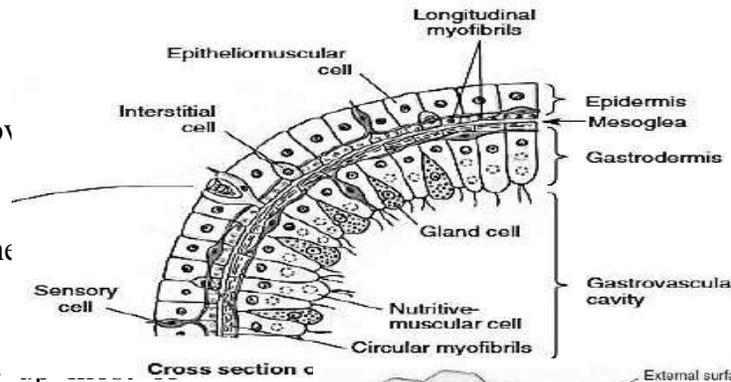
body wall

surrounding the gastro

1-Epidermis:

The epidermal layer contains epithelial and nerve cells.

a-Epitheliomuscular cells make up the epidermis and serve both for covering and for muscular contraction. Contraction of these fibrils shortens the body or tentacles.



b-Interstitial cells are undifferentiated stem cells found among the bases of the epitheliomuscular cells. Differentiation of interstitial cells produces cnidoblasts, sex cells, buds, nerve cells, and others, but generally not epitheliomuscular cells (which reproduce themselves).

c-Gland cells are tall cells located around the basal disc and mouth, that secrete an adhesive substance for attachment and sometimes a gas bubble for floating.

d-Sensory cells are scattered among the other epidermal cells, especially near the mouth and tentacles and on the basal disc. The free end of each sensory cell bears a flagellum, which is the sensory receptor for chemical and tactile stimuli. The other end branches into fine processes that synapse with nerve cells.

e-Cnidocytes containing nematocysts occur throughout the epidermis

f-Nerve cells of the epidermis are generally multipolar (have many processes), although in more highly organized cnidarians the cells may be bipolar (with two processes). Their processes (axons) form synapses with sensory cells and other nerve cells and junctions with epitheliomuscular cells and cnidocytes.

2-Gastrodermis. The gastrodermis, a layer of cells lining the gastrovascular cavity. The cells of the gastrodermis include nutritive-muscular, interstitial, and gland cells.

a-Nutritive-muscular cells are usually tall columnar cells and have laterally extended bases containing myofibrils. Water is brought in through the mouth by beating of cilia on the nutritive muscular cells. The two cilia on the free end of each cell also serve to circulate food and fluids in the digestive cavity. The cells often contain large numbers of food vacuoles.

b-Interstitial cells are scattered among the bases of the nutritive cells. They transform into other types of cells when the need arises.

c-Gland cells secrete digestive enzymes.

3-Mesoglea. The mesoglea lies between the epidermis and gastrodermis and is attached to both layers. It is gelatinous, and both epidermal and gastrodermal cells send processes into it. The mesoglea helps to support the body and acts as a type of elastic skeleton.

Classification of Cnidaria

1-Class Hydrozoa . Solitary or colonial; asexual polyps and sexual medusae, although one type may be suppressed; hydranths with no mesenteries; medusae (when present) with a velum; both freshwater and marine. Examples: *Hydra*, *Obelia*.

2-Class Scyphozoa. Solitary; polyp stage reduced or absent; bell shaped medusae without velum; gelatinous mesoglea much enlarged; margin of bell or umbrella typically with eight notches that are provided with sense organs; all marine. Example: *Aurelia*

3-Class Anthozoa All polyps; no medusae; solitary or colonial; gastrovascular cavity subdivided by at least eight mesenteries or septa bearing nematocysts; gonads endodermal; all marine. Example: *Metridium*

Examples: *Hydra*

Is simple, solitary and fresh-water form. It is free living. *Hydra* has only one form of zooid (the polyp), no polymorphism. *Hydra* is elongated, cylindrical and like an elastic tube measures 1-3 cm in length. Proximal end of the body is known as basal disc or foot, used for attachment with some objects or for locomotion. The free distal end bears the mouth situated on conical elevation called the hypostome. The hypostome is encircled by few (6-10) tentacles. The tentacles are hollow, slenderfinger-like projection provided with nematocyst. Body wall is diploblastic consist of an outer ectoderm and an inner endoderm separated by mesoglea. Body wall encloses a digestive cavity or gastro-vascular cavity which extends to tentacles. Lateral buds may present on the sides of the body which may give rise to new individuals by asexual reproduction. Gonads appear as buds on the sides of the body. Testes lie near the oral end, while the ovaries near the base. Reproduction both asexual and sexual. *Hydra* may be monoecious or dioecious, and it has no free swimming stage.

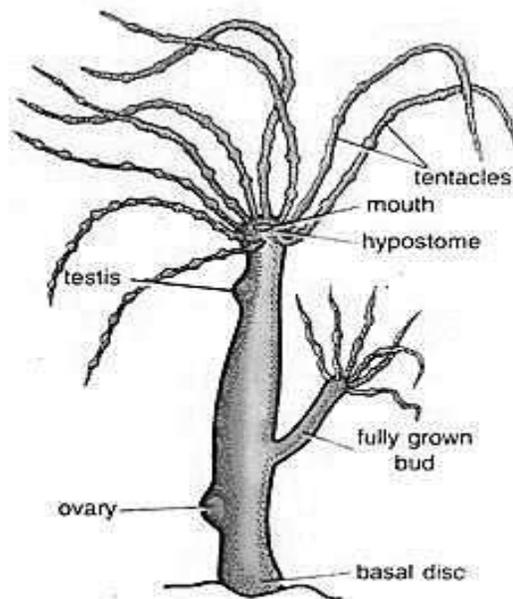


Fig. 31.1. *Hydra*.

Nutrition *Hydra* The food consists of small crustaceans like Cyclops, small annelids and insect larvae. On touching a tentacle by the prey, the stinging apparatus penetrate it and

inject a poisonous to paralyze it. The tentacle holding the captured animal contracts and bends over the mouth. The mucous gland cells of the hypostome cover the engulfed food with mucus, then enzymatic gland cells produce a proteolytic enzyme like trypsin which partly digests the proteins this digestion is extracellular. Some endoderm cells form pseudopodia engulf the smaller partly digested particles into food vacuoles. The remaining digestion is completed in the vacuoles, and it is called intracellular digestion. Thus, Hydra combines the intracellular digestion of Protozoa and extracellular digestion of higher animals.

Respiration and Excretion in *Hydra* There are no special organs for respiration and excretion. Gaseous exchange occurs through the general body surface. Nitrogenous wastes are largely in the form of ammonia, which also diffuses through the general body surface. It is also thought that the gastro dermis of basal disc is said to accumulate some excretory matter, which may be discharged through a pore.

Nervous System of *Hydra* There are many nerve cells, each with two to four branching nerve fibers. The nerve fibers are primitive because they do not form axons or dendrites, moreover the nerve fibers form actual contacts with fibers of other nerve cells.

Reproduction in *Hydra*:

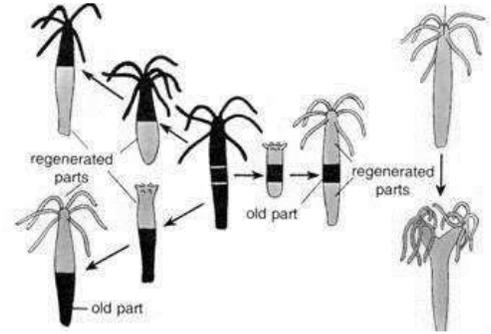
(i) *Asexual Reproduction of Hydra:*

Asexual Budding: A bud develops as a simple evagination of the body wall. The ectoderm cells increase in number at one point to form a knob below which the endoderm cells acquire reserve food, then both ectoderm and endoderm are pushed out to form a bud.

(ii) Sexual Reproduction: Most species are dioecious some are monoecious. Eggs in the ovary usually mature one at a time and are fertilized by sperm shed into the water. Zygotes undergo holoblastic cleavage to form a hollow blastula. The inner part of the blastula delaminates to form the endoderm (gastrodermis), and the mesoglea is laid down between ectoderm and endoderm. A cyst forms around the embryo before it breaks loose from the parent, enabling it to survive the winter. No free swimming stage is available in the life history of *Hydra*.

Regeneration in *Hydra* Regeneration may be

defined as the ability of certain animals to restore the lost or worn out parts of their bodies. *Hydra* has the considerable power of regeneration.



Example *Obelia*

Is colonial hydroid. It is trimorphic colony having three types of zooids:

- 1- **Hydranth** or polyp has cylindrical body attached to the axis of the hydrocaulus by its proximal end and free at its distal end. It is covered by cup-shaped hydrotheca. The hypostome is covered by tentacles. It is nutritive zooid of the colony.
- 2- **Blastostyle or reproductive zooides** is club-shaped without mouth and tentacles. It is enclosed by covering gonotheca. It gives rise to buds which develop into medusa.
- 3- **Medusa** is bell-shaped reproductive zooid with concave and convex side. It is provided with marginal tentacle, four radial canal, a ring canal, four gonads. From the center of the sub-umbrella arises a short projecting manubrium at its apex is a square mouth surrounded by four oral lobes. Medusa is free swimming zooid.

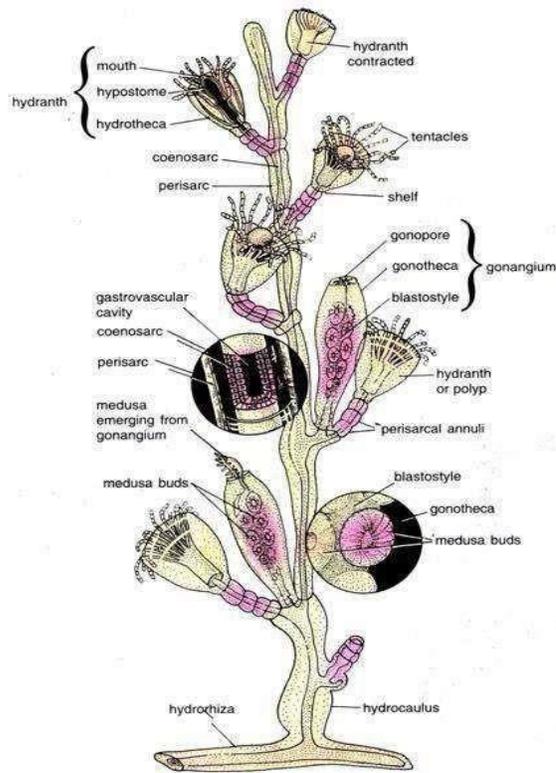


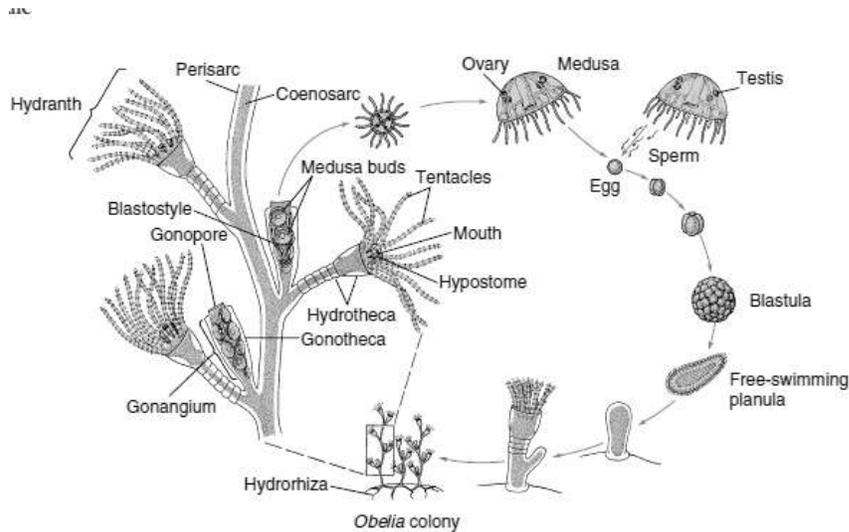
Fig. 32.1. *Obelia*. A portion of colony.

Life cycle

1. **Fertilization**- the fertilization usually take place in open sea water where the gametes are swims freely. Sometime the sperm are carried into female medusa with water current.

2. **Development**- the development include following :

- **Cleavage**- The zygote undergo holoblastic and equal cleavage to form solid ball of cell called morula. The morula changed into a single layered blastula. Its single layered cell which then then convert into solid gastrula.
- **Planula** is a free-swimming larva but eventually it attached to some solid surface. Once attached to a substrate, a planula quickly develops into one feeding polyp. As the polyp grows, it begins developing branches of other feeding individuals, thus forming a new generation of polyps by asexual budding.
- **Hydrula**- a simple polyp or hydrula is formed which grows a hydrorhiza from its base, from which an *Obelia* colony is formed by budding.



Example *Aurelia*

is a commonest jelly-fish or moon-jelly, occurs in coastal waters of tropical and temperate oceans of the world close to the surface of water. It is cosmopolitan in distribution. Medusa phase is dominant it is called jelly fish. The bell margin of the umbrella-shaped medusa has 8 notches for **tentaculocysts or rhopalium** (which are the sense organs of jelly-fish). As well as the margin equipped with many small hollow tentacles. The true velum is absent. Long oral arms are present. Canal system complicated, gastric pouch present and the canals are branched. Gastric ridges are present and are bearing gastric filaments. Gonads are exclusively endodermal and four in number.

