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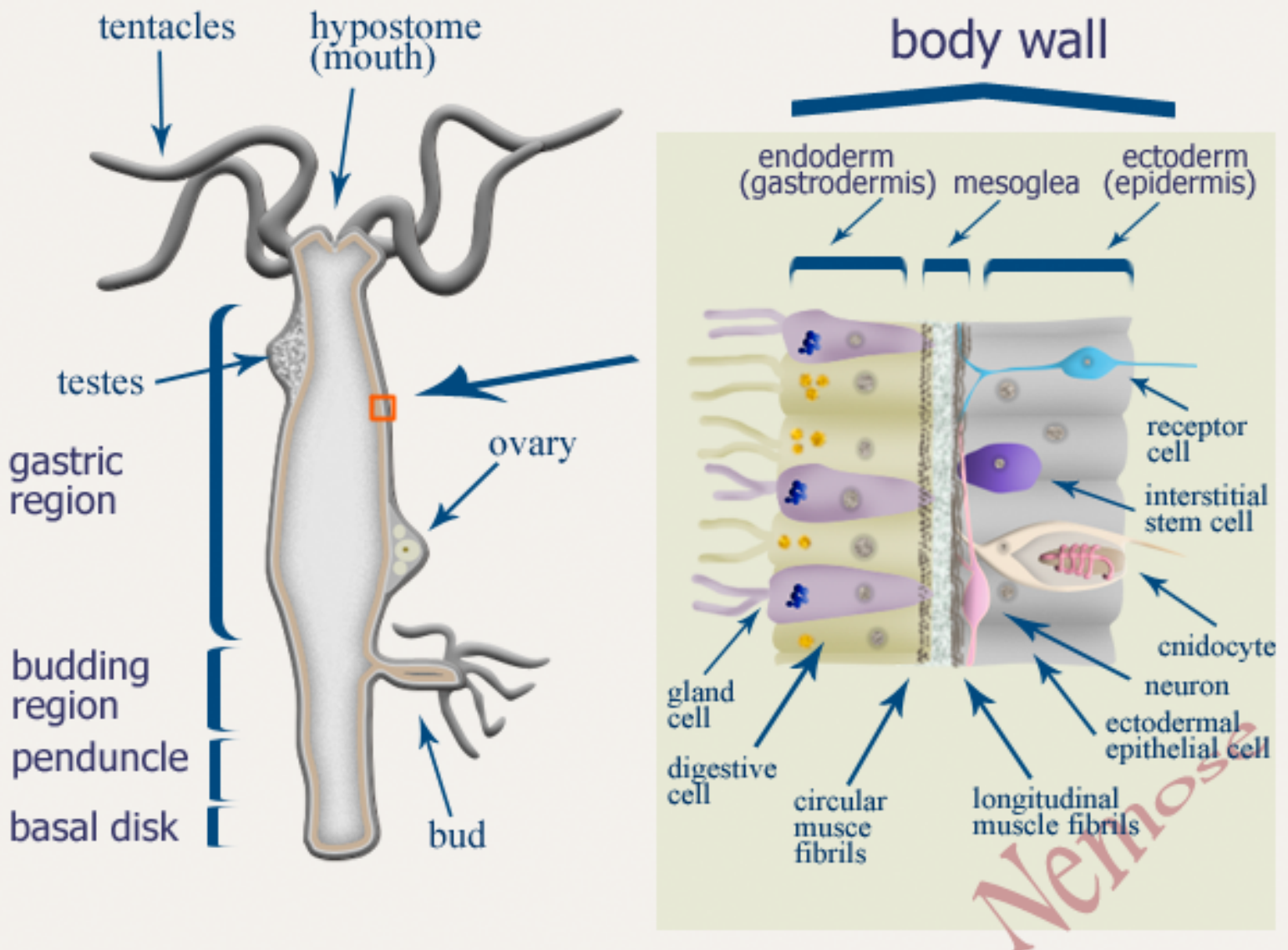
***Hydra magnipapillata*, fresh water polyp**

- **Taxonomy**
- **Brief facts**
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- **Stem cells lineages**
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Taxonomy

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Cnidaria - Hydrozoa - Hydroida - Anthomedusae - Hydridae - Hydra - *Hydra magnipapillata*

Generalized anatomy of *Hydridae*



Brief facts

- *Hydra magnipapillata* is a small fresh water polyp that has been well known for over 200 years for its remarkable regenerative capacity.
- The Hydra is a member of the phylum *Cnidaria* (the name refers to the stinging cells, **cnidocytes** or **nematocytes**, which are unique to cnidarians). The cells are used to catch prey and eject toxins.
- The Hydra's body has a radial symmetry. Its tissue organization is very simple: the organism has only two germ layers (**diploblastic** organism), **ectoderm** and **endoderm** that constitute outer layer (**epidermis**) and inner

layer (**gastrodermis**) of the animal, respectively. The two layers are separated by **mesoglea** (jellylike substance).

- Cnidarians developed the first nervous system in animal history. It resembles a net and lacks central structures, such as a brain and ganglions. Nevertheless, it allows for coordinated movements and is necessary for feeding behavior. Interestingly, the hydra is the only organism that can survive (when fed forcefully) and even reproduce normally without its nervous system. The hydra that lacks its nervous system is called **epithelial hydra**.
- The substance that fills intracellular spaces of Hydra's organism is called **extracellular matrix (ECM)**. It is secreted by the cells. Hydra's ECM is very flexible; a property that accounts for longitudinal and radial mobility of the organism. The elasticity of the ECM can now be explained in part by the unique structure of the organism's collagens. Some aspects of the structure resemble what is seen in **Ehlers-Danlos syndrome**, a condition that in humans results in abnormal flexibility of joints and skin sensitivity.
- Hydras do not have special respiratory and circulatory systems: the entire body surface participate in gas exchange. Gases and nutrients transported directly from cell to cell or by diffusion through the watery mesoglea.
- Hydra shows extreme regeneration capability: when hydra polyps are cut to pieces they regenerate the missing structures completely. The hydra's body can even be macerated into individual cells that after brief centrifugation form aggregates, from which heads and feet will appear over the course of a few days. This indicates that Hydra can create patterning signals and developmental gradients along its body *de novo*. It is explained in part by synthesis of **morphogens** - signaling molecules that by forming concentration gradients in the tissue of the body define the positional identity of the cells.
The regeneration is not possible, though, from terminally specialized body parts such as **tentacles** and **basal disc**.
- Hydra often is mentioned as being immortal. Hydra is immortal not because it consists of immortal cells but because aged cells are constantly replaced by young substitutes generated from stem cells. Excess of cells produced under abundant supply of nutrients is exported by a process of budding, used in ovaries to nurse an egg, or eliminated by phagocytosis.
- There are many fascinating aspects of hydras that simply cannot be described in the very short review.

Life cycle

Life Cycle Stages

The Hydra has a reduced life cycle: it does not have a medusa or colonial polyp stage.

- **asexual MeSH**

budding; when food is plentiful, hydras may produce buds in the body wall which grow to be miniature adults and break away when they are mature; as a result of budding genetically identical organisms are produced

- **sexual**

- **egg**

- **unfertilized egg**
 - **fertilized egg MeSH**

eggs are fertilized by sperm from testes which form on the external surface of the stalk; the fertilized eggs secrete a tough outer coating (**theca**) and, as the adult dies, these resting eggs fall to the bottom of the lake or pond; under favorable conditions the eggs will hatch into a miniature adults in about 2 days

- **juvenile**

undersized animal

- **adult**

sexually matured polyp attached to the substrate; hydra are unique among the animals in that they do not undergo senescence (aging), and so are theoretically immortal

Hydra's stem cell lineages

There are only three not interchangeable stem cell lineages in the hydra's organism.

- epithelial cells

ectodermal and endodermal cells continually divide in the body columns of the hydra, displacing tissue layers in apical and basal directions; when they reach tentacles or basal disc, they become terminally differentiating and stop dividing

- ecdodermal cells

these cells differentiate into epithelial cells of epidermis (outer layer)

- endodermal cells

these cells differentiate into epithelial cells of gastrodermis (inner layer); the endodermal cells are quite mobile and play important role in phagocytosis of extra cells to maintain more or less constant body mass of the organism

- interstitial cells

these cells differentiate into nerve cells, gland cells (which normally proliferate themselves), nematocytes, and germ cells; the cells are actively dividing and can be easily killed by the drugs that inhibit cell division such as **colchicines** or **hydrourea**; the loss of the interstitial cells eventually results in **epithelial hydra**; the epithelial hydra can regenerate but it will never develop the interstitial cell lineage again; in this respect, hydra differs from **planarians** in which totipotent cells called **neoblasts** are wholly responsible for regeneration, whereas epithelial cells do not proliferate

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PubMed articles

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- Major subject **Hydra Free full text articles**

Websites and other references

- **[A Proposal to construct a BAC Library from *Hydra magnipapillata*](#)**



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