METAZOA

Metazoans refer to multicellular eukaryotic organisms with a holozoic mode of nutrition. This group is further subdivided into two sub-kingdoms, namely Parazoa and Eumetazoa, based on the complexity of organization.

- Parazoa: Parazoa encompasses sponges, wherein cells are loosely aggregated and fail to form distinct tissues or organs.
- Eumetazoa: Eumetazoa comprises the remaining animals, characterized by cells organized into structural and functional units known as tissues, organs, and organ systems. Unlike Parazoa, Eumetazoans exhibit a higher level of complexity in their cellular organization.

Levels of Organization

The concept of organization entails a structured arrangement, a fundamental aspect of life's intricate tapestry. At the heart of this organizational marvel lies the cell, the fundamental building block of all living entities. As cells unite and specialize, they give rise to tissues, which further coalesce into organs, forming the foundation of complex organ systems, and culminating in the majestic symphony of an entire organism.

- **Cellular Level of Organization**: At the cellular level, the spotlight falls on individual cells, each a powerhouse of functionality. While these cells may form loose aggregates, they do not yet manifest into distinct tissues. Nonetheless, within this realm, a subtle division of labor among cells begins to emerge, exemplified by Poriferans.
- **Tissue Level of Organization:** Ascending the ladder of complexity, we encounter the tissue level, where cells of similar structure and function coalesce to form tissues. These cohesive units execute a spectrum of essential functions within the animal kingdom. This level of organization finds its embodiment in Coelenterates and Ctenophores.
- **Organ Level of Organization:** Progressing further, tissues converge to fashion organs, marking the organ level of organization. Here, each organ assumes a specialized role, dedicated to a particular physiological function. Platyhelminthes epitomize this tier of organization, showcasing the amalgamation of tissues into distinct organs.
- **Organ-System Level of Organization:** The pinnacle of organizational complexity is reached at the organ-system level, where organs synergize to form functional systems, each meticulously engineered to execute a specific physiological function. For instance, the digestive system seamlessly integrates organs like the stomach, intestine, gall bladder, and pancreas. This level of organization spans from Aschelminthes to chordates, exemplifying the zenith of anatomical and functional intricacy.

Patterns of Complexities of Various Organ System

The journey of complexity in organ systems commenced with lower animals such as platyhelminthes and aschelminthes, gradually ascending to higher phyla, each step marked by a nuanced layer of intricacy. These progressive developments serve as discernible patterns, offering a foundational framework for the classification of animals.

Digestive System: The digestive apparatus of animals unveils two distinct patterns of complexity:

- **Incomplete Digestive System:** This configuration entails a solitary opening serving as both mouth and anus, facilitating a streamlined passage for ingested matter. Coelenterates, Ctenophores, and Platyhelminthes exemplify this rudimentary digestive design.
- **Complete Digestive System:** Here, a dichotomy emerges with separate orifices for ingestion and excretion, embodying a heightened level of digestive sophistication. From Aschelminthes to chordates, this evolved setup governs the orderly flow of nutrients and waste, underscoring the evolutionary progression in digestive physiology.

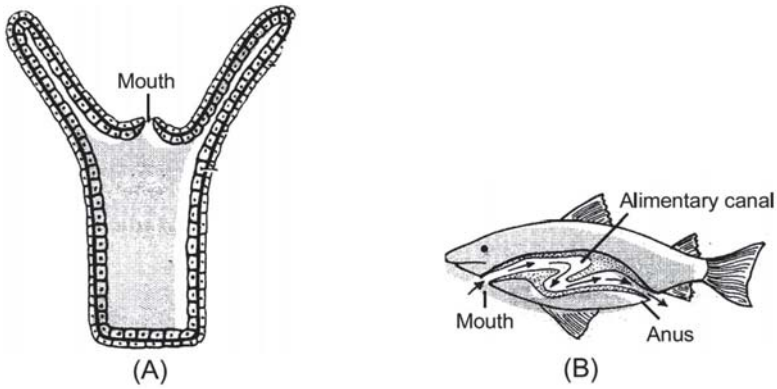

Fig.: Types of digestive system: **(A)** Incomplete, **(B)** Complete

Circulatory System: The circulatory network manifests in two distinctive forms:

- **Open Circulatory System:** Within this framework, blood courses through open spaces, directly engaging body cells and tissues in a fluid exchange of vital substances. Arthropods, non-cephalopod molluscs, Hemichordates, and Tunicates adhere to this simplistic circulatory arrangement.
- **Closed Circulatory System:** Herein, blood navigates a complex network of vessels, including arteries, veins, and capillaries, orchestrating a meticulous circulation sans direct interaction with cellular constituents. Annelids, Cephalopod molluscs, and Chordates epitomize this refined circulatory architecture, ensuring efficient nutrient delivery and waste removal.

Reproductive System: The spectrum of reproductive strategies unveils a striking contrast between lower and higher animals:

- **Asexual and Sexual Reproduction:** Sponges and coelenterates embrace a dual reproductive repertoire, encompassing both asexual and sexual modalities. Conversely, as organisms ascend the evolutionary ladder, sexual reproduction emerges as the predominant mode, heralding a shift towards enhanced genetic diversity and adaptability.

Body Symmetry

- **Asymmetry: -** When any plane that passes through the centre does not divide the body of animals into two equal halves.
  E.g. most of the sponges are asymmetrical.
- **Radial symmetry: -** When any plane passing through the central axis of the body Divide the animal into two identical halves.
  E.g. Coelenterates, Ctenophores and Echinoderms (adult)
- **Bilateral symmetry: -** When the body can be divided into identical left & right halves in only one plane.
  E.g. Platyhelminthes to Chordates.

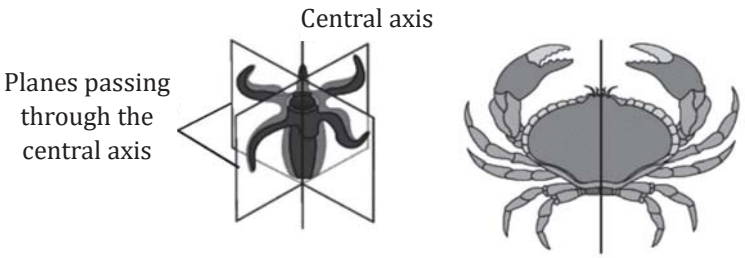

Fig: Radial symmetry

Fig: Bilateral symmetry

Germ layers

- **Diploblastic: -** Animals in which the cells are arragned in two embryonic layers ectoderm and endoderm with an interviewing undifferentiated mesoglea e.g. Coelenterates and Ctenophores.
- **Triploblastic: -** Those animals in which the developing embryo has a third germinal layer-Mesoderm in between the ectoderm and endoderm e.g. Platyhelminthes to Chordates.

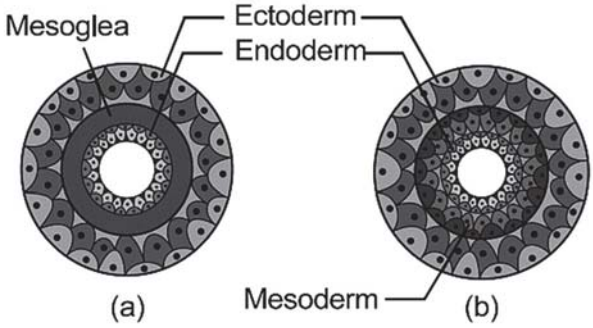

Fig.: Showing germinal layers: **(a)** Diploblastic, **(b)** Triploblastic

Coelom or Body Cavity

Presence or absence of a cavity between the body wall and gut wall is very important in classification.

- **Acoelomates :-** Animals in which the body cavity is absent
  E.g. Porifera, Coelenterata, Ctennophora, Platyhelminthes
- **Pseudocoelomates: -** In same animals body cavity is not lined by mesoderm, instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. Such a body cavity is called pseudo coelom.
  E.g. Aschelminthes.
- **Coelomates: -** Animals possessing coelom i.e. the body cavity which is lined by mesoderm on all sides

On the basis of embryonic development, the coelom is of two types

- **Schizocoel** - Coelom formed by splitting of a mesodermal mass
  E.g. Annelida, Arthropoda, Mollusca.
- **Enterocoel** - Coelom formed by fusion of gut pouches during embryonic stage
  E.g. Echinodermata, Hemichordata and Chordata.

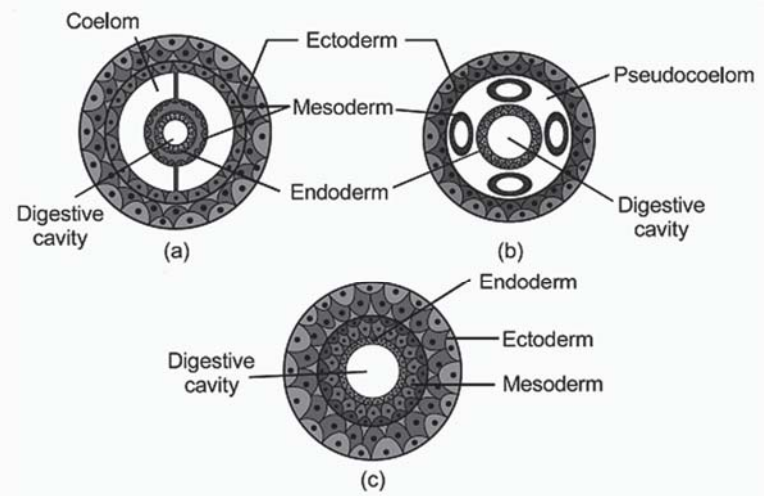

Fig.: Diagrammatic sectional view of :
(a) Coelomate, **(b)** Pseudocoelomate, **(c)** Acoelomate

Body plan

- **Cell-aggregate type: -** e.g. Sponges
- **Blind Sac type:**-Animals in which digestive system is incomplete, it has only single opening to the outside of the body that serves as both mouth and anus.
  E.g. Coelenterates to Platyhelminthes
- **Tube-within-tube type: -** Found in those animals having complete digestive tract i.e. with separate openings mouth and anus.
  E.g. Nemathelminthes to Chordates

Segmentation

- **Pseudo metameric :**- e.g. Tapeworms
- **Metameric: -** In Annelids, Arthropods and Chordates. In these animals, the body is externally and internally divided into segments with a serial repetition of at least some organs, this is called metameric segmentation and the phenomenon is known as Metamerism.

Notochord:

It is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in some animals.

- **Non-chordates :**- Animals without notochord e.g. Porifera to Hemichordata
- **Chordates:** - Animals with notochord. Eg. Chordata

Circulatory system:-

- **Open type: -** In which the blood is pumped out of heart and the cells & tissues are directly bathed in it.
  E.g. Arthropods, Molluscs, Echinoderms, Hemichordates and some lower Chordates like tunicates
- **Closed type: -** In which the blood is circulated through a series of vessels of varying diameters i.e. arteries. Veins and blood capillaries
  E.g. Annelids, Cephalopod molluscs, Vertebrates etc.

Embryonic development: - On the basis of fate of blastopore, animals can be divided into two categories:

- **Protostomiates :**- Animals in which mouth is formed first (Blastopore ® Mouth)
  E.g. Platyhelminthes to Mollusca
- **Deuterostomiate :** Animals in which anus is formed earlier than mouth (Blastopore ® Anus)