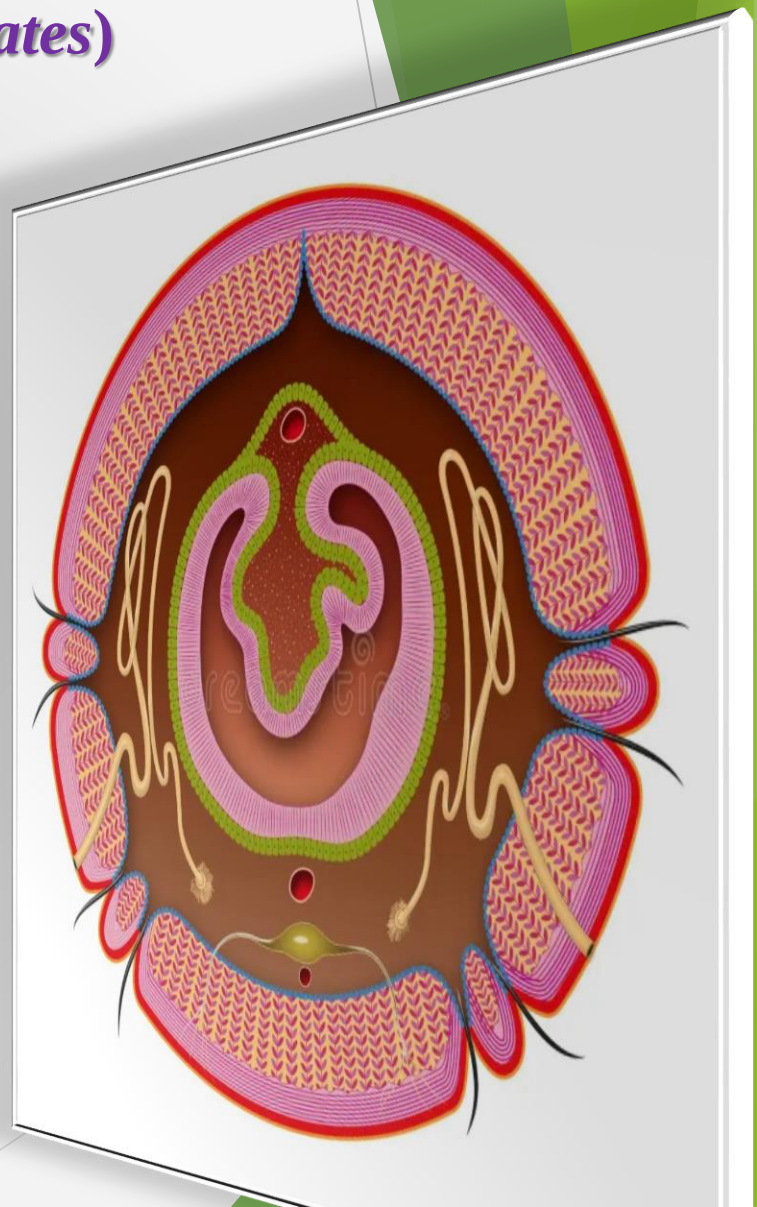
NON-CHORDATES II: COELOMATES

Unit-1

(Introduction to Coelomates)



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Date: 27.12.2022

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Introduction

- The coelom is the fluid-filled body cavity present between the alimentary canal and the body wall.
- Coelomates are animals that possess a coelom, which is a fluid-filled body cavity that is completely lined by mesodermal tissue.
- The coelom is derived from the embryonic mesoderm and is separated from the gut by the mesentery, a double-layered membrane that suspends the digestive tract within the body cavity.
- Coelomates include a wide variety of animals, including annelids (e.g. earthworms), arthropods (e.g. insects and crustaceans), mollusks (e.g. snails and clams), echinoderms (e.g. starfish and sea urchins), and chordates (e.g. fish, birds, and mammals).
- Having a coelom provides several advantages to animals, including a hydrostatic skeleton that can aid in movement, protection and cushioning of internal organs, and a space for the development and movement of various organ systems.

Types of Coelom:

There are three main types of coelom that can be found in coelomate animals:

- **Acoelomate**: These are animals that lack a true coelom and instead have solid bodies with no fluid-filled cavity. Flatworms are an example of acoelomate animals.

- **Pseudocoelomate**: These are animals that have a body cavity that is partially lined with mesodermal tissue, but not completely. The space between the mesoderm and the endoderm is filled with fluid, creating a pseudo coelom. Nematodes (roundworms) and rotifers are examples of Pseudocoelomate animals.

- **Coelomate**: These are animals that have a true coelom that is completely lined by mesodermal tissue. The coelom is separated from the gut by the mesentery, a double-layered membrane. Annelids (e.g. earthworms), arthropods (e.g. insects and crustaceans), mollusks (e.g. snails and clams), echinoderms (e.g. starfish and sea urchins), and chordates (e.g. fish, birds, and mammals) are examples of acoelomate animals.

Function of Coelom:

- The coelom, which is a fluid-filled body cavity that is completely lined by mesodermal tissue, plays several important functions in coelomate animals. Some of these functions are:
- Providing a hydrostatic skeleton: The coelomic fluid within the body cavity provides support and rigidity to the animal's body, which enables it to move and maintain its shape.
- Cushioning and protection of internal organs: The coelom acts as a cushioning layer around the organs, protecting them from mechanical shocks and impacts.
- Enabling more efficient organ system development: Having a coelom provides a space for the development and movement of various organ systems, allowing for more complex and efficient organ systems to evolve.
- Serving as a space for circulation and exchange of nutrients: In some animals, the coelomic fluid can serve as a means of transporting nutrients and other substances around the body.
- Providing a space for growth and movement: The coelom can also provide a space for growth and movement of internal organs, allowing for more flexibility in the animal's body plan.

Evolution of Coelom:

- Coelom is a body cavity that is present in many animals, including humans. It is lined with mesodermally-derived tissue and contains the internal organs.
- There are different theories about the evolutionary origin of coelom, and some of these theories are discussed below:
- **Schizocoelous Theory**: This theory suggests that coelom evolved from a split in the mesoderm, resulting in two layers that enclose a cavity. This process is known as schizocoely, and it is seen in many protostomes, such as arthropods and mollusks. In these animals, the coelom is formed by the expansion of the blastocoel, which is the cavity that forms during gastrulation.
- **Enterocoelous Theory**: This theory proposes that coelom evolved from outpocketings of the gut, which eventually formed into the coelom. This process is known as enterocoely, and it is seen in deuterostomes, such as vertebrates and echinoderms. In these animals, the coelom is formed from the mesoderm that arises from the wall of the archenteron, which is the primitive gut.
- **Coelom from Multiple Origins Theory**: This theory suggests that coelom evolved independently in different lineages of animals. For example, the coelom in annelids may have evolved differently from the coelom in chordates. This theory is supported by the fact that the coelom has different characteristics in different groups of animals.

Metamerism of Coelom:

- Metamerism is the repetition of body segments or parts along the longitudinal axis of an animal. The coelom is often segmented in animals that exhibit metamerism, with each segment containing its own set of organs and associated structures.
- One of the key advantages of metamerism and segmented coeloms is that it allows for specialization of body segments. For example, in annelids such as earthworms, each segment contains its own set of muscles, nerves, and blood vessels, allowing for greater control and flexibility in movement. This specialization also allows for more efficient and complex organ systems to develop, as each segment can focus on a specific function.
- Segmented coeloms are also seen in other groups of animals, including arthropods and chordates. In arthropods, the segmented coelom is often called a hemocoel and is filled with blood rather than the fluid found in other coeloms. In chordates, the segmented coelom forms the basis for the development of the vertebrae, which are segmented structures that protect the spinal cord.
- Overall, the metamerism of the coelom has played a significant role in the evolution and diversification of animal life. It has allowed for greater specialization and complexity in organ systems, as well as providing greater control and flexibility in movement.

Types of Metamerism of Coelom:

There are two main types of metamerism of coelom seen in animals:

- **Homonomous or Serial Metamerism:** This type of metamerism is characterized by the repetition of similar segments along the length of the animal's body. Each segment contains a similar set of organs and structures, and the segments are often numbered or named to differentiate them. Homonomous metamerism is seen in annelids, such as earthworms, where each segment contains a set of muscles, nerves, and blood vessels that control movement and other functions.

- **Heteronomous or Tagmatization Metamerism:** This type of metamerism is characterized by the grouping of segments into distinct body regions, or tagmata, which are specialized for different functions. Each tagma contains a unique set of organs and structures, and the segments within each tagma may be fused or modified to perform specific functions. Heteronomous metamerism is seen in arthropods, such as insects and crustaceans, where the body is divided into three distinct tagmata: the head, thorax, and abdomen.

Metamerism of Functions:

- Metamerism, or the repetition of body segments along the longitudinal axis of an animal, has several important functions:
- **Specialization of body segments**: Metamerism allows for each body segment to become specialized for a particular function. This specialization can result in greater efficiency and complexity of organ systems, as each segment can focus on a specific function.
- **Redundancy of body segments**: In animals that exhibit metamerism, each segment contains a similar set of organs and structures. This redundancy can be advantageous in situations where a particular segment is damaged or lost, as the remaining segments can compensate for the loss.
- **Greater control and flexibility in movement**: The segmentation of the body allows for greater control and flexibility in movement, as each segment can move independently of the others. This is particularly important in animals that need to move quickly or in complex ways, such as invertebrates and vertebrates that use muscles for locomotion.
- **Development of specialized structures**: In animals with heteronomous metamerism, such as arthropods, the segmentation of the body allows for the development of specialized structures within each tagma. For example, the thorax of insects contains wings and legs that are adapted for flight and walking, respectively.


Thank you