THE COELOM

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The coelom is the main body cavity in most animals and is positioned inside the body to surround and contain the digestive tract and other organs. It is a large fluid-filled cavity lying between ectoderm and endoderm. The coelom is a secondary cavity formed by splitting of mesoderm. In some animals, it is lined with mesothelium. In other animals, such as molluscs, it remains undifferentiated.

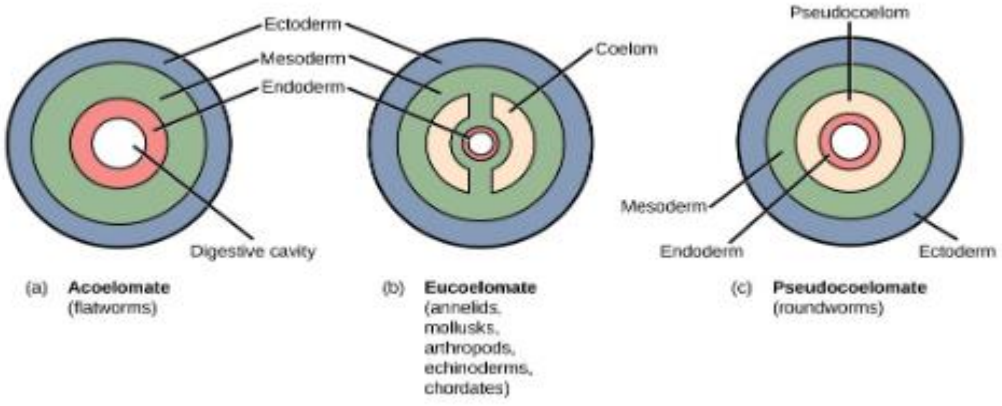
The earliest known animal with a coelom is *Vernanimalcula guizhouena*, which lived 600 million years ago, during the Ediacaran period.

Development of Coelom:

Coelom is the mesodermally lined cavity between the gut and the outer body wall. During the development of the embryo, coelom formation begins in the gastrulation stage. The developing digestive tube of an embryo forms as a blind pouch called the archenteron.

In Protostomes, the coelom forms by a process known as schizocoely. The archenteron initially forms, and the mesoderm splits into two layers: the first attaches to the body wall or ectoderm, forming the parietal layer and the second surrounds the endoderm or alimentary canal forming the visceral layer. The space between the parietal layer and the visceral layer is known as the coelom or body cavity.

In Deuterostomes, the coelom forms by enterocoel. The archenteron wall produces buds of mesoderm, and these mesodermal diverticula hollow to become the coelomic cavities. Deuterostomes are therefore known as *enterocoelomates*. Examples of deuterostome coelomates belong to: chordates, echinoderms and hemichordates.



Theories regarding Origin of Coelom:

The origin of the coelom is uncertain. The oldest known animal to have had a body cavity was the *Vernanimalcula guizhouena*. Current hypothesis include:

1. The Enterocoel theory: According to Lankester (1875), the coelom evolved from gastric pouches of cnidarian ancestors. This is supported by research on flatworms and small worms recently discovered in marine fauna.

2. Nephrocoel theory: According to Lankester (1874), coelom originated as a expanded inner end of a nephridium.

3. Schizocoel theory: According to this theory, coelom has mesenchymal origin.

4. Gonocoel theory: This most accepted theory given by Hatscheck (1875) and supported by Goodrich (1945). According o this theory, the serial repletion of gonads observed in faltworms indicates the initial step towards mesodermic repletion.

Functions:

A coelom can absorb shock or provide a hydrostatic skeleton. It can also support an immune system in the form of coelomocytes that may either be attached to the wall of the coelom or may float about in it freely. The coelom allows muscles to grow independently of the body wall; this feature can be seen in the digestive tract of tardigrades which is suspended within the body in the mesentery derived from a mesoderm-lined coelom.

Significance of Coelom:

1. It plays an important role in the progressive development of complexity of structure.
2. It protects internal organs from external shock.
3. It provides flexibility to body.
4. It provides formation of movement and opportunity ofor enlargement of viscera.
5. It works as hydraulic skeleton and circulatory system.

Classification of Animals on the basis of Coelom:

In the past, some zoologists grouped bilaterian animal phyla based on characteristics related to the coelom for practical purposes, knowing and explicitly stating, that these groups were not phylogenetically related.

Animals were classified in three informal groups according to the type of body cavity they possess as:

1. Acoelomata,
2. Pseudocoelomata and
3. Coelomata.

The Acoelomate: The coelom evolved from an acoelomate ancestor. They lack coelom due to solid nature of mesoderm. The space between endoderm and ectoderm is filled by mesenchyme and muscle fibres.

Acoelomate animals: The group includes Profrera, Coelenterata, Ctenophora, flatworms, Rhynchocoela and Nemertinea have no body cavity at all. Semi-solid mesodermal tissues between the gut and body wall hold their organs in place.

These groups were never intended to represent related animals or a sequence of evolutionary traits.

However, although this scheme was followed by a number of college textbooks and some general classifications, it is now almost totally abandoned as a formal classification. Indeed, as late as 2010, one author of a molecular phylogeny study mistakenly called this classification scheme the traditional, morphology-based phylogeny.

Pseudocoelomate animals which have a fluid filled body cavity. Tissue derived from mesoderm partly lines the fluid filled body cavity of these animals. Thus, although organs are held in place loosely, they are not as well organized as in a coelomate. All pseudocoelomates are protostomes; however, not all protostomes are pseudocoelomates. An example of a Pseudocoelomate is the roundworm. Pseudocoelomate animals are also referred to as Blastocoelomate.

A pseudocoelomate or blastocoelomate is any invertebrate animal with a three-layered body and a pseudocoel. The coelom was apparently lost or reduced as a result of mutations in certain types of genes that affected early development. Thus, pseudocoelomates evolved from coelomates. Pseudocoelomate is no longer considered a valid taxonomic group, since it is not monophyletic. However, it is still used as a descriptive term.

Important characteristics:

1. Lack a vascular blood system
2. Lack a skeleton
3. No segmentation
4. Most are microscopic
5. Parasites of almost every form of life
6. Eutely in some animals
7. Loss of larval stage in some animals
8. pedomorphism may be found

Pseudocoelomate phyla

According to Brusca and Brusca, bilaterian pseudocoelomate phyla include:

1. Rotifera
2. Kinorhyncha
3. Nematoda
4. Nematomorpha
5. Acanthocephala
6. Loricifera

Some authors list the following phyla as pseudocoelomates:

Ecdysozoans pseudocoelomates

1. Nematoda
2. Nematomorpha
3. Loricifera
4. Priapulida
5. Kinorhyncha

Lophotrochozoans pseudocoelomates

1. Gastrotricha
2. Entoprocta
3. Rotifera
4. Acanthocephala

Acoelomates lack a fluid-filled body cavity between the body wall and digestive tract. This can cause some serious disadvantages. Fluid compression is negligible, while the tissue surrounding the organs of these animals will compress. Therefore, acoelomate organs are not protected from crushing forces applied to the animal's outer surface. The coelom can be used for diffusion of gases and metabolites etc. These creatures do not have this need, as the surface area to volume ratio is large enough to allow absorption of nutrients and gas exchange by diffusion alone, due to dorso-ventral flattening:

1. Platyhelminthes
2. Gastrotricha,
3. Entoprocta,
4. Gnathostomulida,
5. Cycliophora

According to others, acoelomates include the cnidarians (jellyfish and allies), and the ctenophores (combjellies), platyhelminthes (flatworms including tapeworms, etc.), Nemertea, and Gastrotricha.

Coelomata (eucoelomates) have a body cavity called a coelom with a complete lining called peritoneum derived from mesoderm. The complete mesoderm lining allows organs to be attached to each other so that they can be suspended in a particular order while still being able to move freely within the cavity. Most bilateral animals, including all the vertebrates, are coelomates.

Coelom developed in triploblasts but was subsequently lost in several lineages. schizocoelom: develops from split in mesoderm found in annelids, arthropods and molluscs

Haemocoelom: A true coelom reduced and cavity filled with blood found from arthropoda and mollusca

Enterocoelom: It develops from wall of embryonic gut found from echinodermata to chordata.

According to Brusca and Brusca, the following bilaterian phyla possess a coelom:

1. Nemertea,
2. Priapulida
3. Annelida
4. Onychophora
5. Tardigrada
6. Arthropoda
7. Mollusca
8. Phoronida
9. Ectoprocta
10. Brachiopoda
11. Echinodermata
12. Chaetognatha
13. Hemichordata
14. Chordata
15. Entoprocta,
16. Pentastoma,
17. Pogonophora

The embryonic blastocoel persists as a body cavity. These protostomes have a fluid filled main body cavity unlined or partially lined with tissue derived from mesoderm.

This fluid-filled space surrounding the internal organs serves several functions like distribution of nutrients and removal of waste or supporting the body as a hydrostatic skeleton.