CHAP: ANIMAL CLASSIFICATION, PHYLOGENY, AND ORGANIZATION

- ✓ **Animal Systematics**
- ✓ **Molecular Approaches to Animal Systematics**

  Kingdoms of Life
- ✓ **Evolutionary Relationships and Tree Diagrams**
- ✓ **Patterns of Organization**
- ✓ **Other Patterns of Organization**

EVOLUTIONARY RELATIONSHIPS AND TREE DIAGRAMS

EVOLUTIONARY RELATIONSHIPS AND TREE DIAGRAMS

- ✓ evolutionary-tree diagrams can help clarify evolutionary relationships and timescales
- ✓ they are often a source of misunderstanding because they illustrate relationships among levels of classification above the species

Problems of interpretation

- Depicting phyla or classes as ancestral is misleading
- Even though phyla or classes are depicted as ancestral, modern representatives of these "ancestral phyla" have had just as long an evolutionary history as animals in other taxonomic groups that may have descended from the common ancestor.
- All modern representatives of any group of animals should be visualized at the tips of a "tree branch," and they may be very different from ancestral species

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EVOLUTIONARY RELATIONSHIPS AND TREE DIAGRAMS

- Zoologists use modern representatives to help visualize general characteristics of an ancestral species, but never to specify details of the ancestor's structure, function, or ecology.
- Ladderlike progression of increasing complexity of evolutionary trees is misleading, because evolution has often resulted in reduced complexity and body forms that are evolutionary failures.
- In many cases, evolution does not lead to phenotypes that permit survival under changing conditions, and extinction occurs.

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EVOLUTIONARY RELATIONSHIPS AND TREE DIAGRAMS

- Further, the common representation of a phylogeny as an inverted cone, or a tree with a narrow trunk and many higher branches, is often misleading. This implies that evolution is a continuous process of increasing diversification. The fossil records show that this is often wrong.

Example: echinoderms (sea stars and their relatives) fossil record

PATTERNS OF ORGANIZATION

PATTERNS OF ORGANIZATION

- ✓ One of the most strikingly ordered series of changes in evolution is reflected in body plans in the animal kingdom and the protists.
- ✓ Evolutionary changes do not always mean “progress” and increased complexity. Evolution frequently results in backtracking, in failed experiments, and in inefficient or useless structures. Evolution results in frequent dead ends, even though the route to that dead end may be filled with grandeur.

PATTERNS OF ORGANIZATION

- **SYMMETRY**

  Symmetry describes how the parts of an animal are arranged around a point or an axis

ANIMAL SYMMETRY

TERM	DEFINITION
Asymmetry	The arrangement of body parts without a central axis or point (e.g., the sponges).
Bilateral symmetry	The arrangement of body parts such that a single plane passing between the upper and lower surfaces and through the longitudinal axis divides the animal into right and left mirror images (e.g., the vertebrates).
Radial symmetry	The arrangement of body parts such that any plane passing through the oral-aboral axis divides the animal into mirror images (e.g., the cnidarians). Radial symmetry can be modified by the arrangement of some structures in pairs, or other combinations, around the central axis (e.g., biradial symmetry in the ctenophorans and some anthozoans, and pentaradial symmetry in the echinoderms).

PATTERNS OF ORGANIZATION

❑ ASYMMETRY

- ✓ Asymmetry, which is the absence of a central point or axis around which body parts are equally distributed,
- ✓ characterizes most protists and many sponges
- ✓ Asymmetry cannot be said to be an adaptation to anything or advantageous to an organism.
- ✓ Asymmetrical organisms do not develop complex communication, sensory, or locomotor functions.

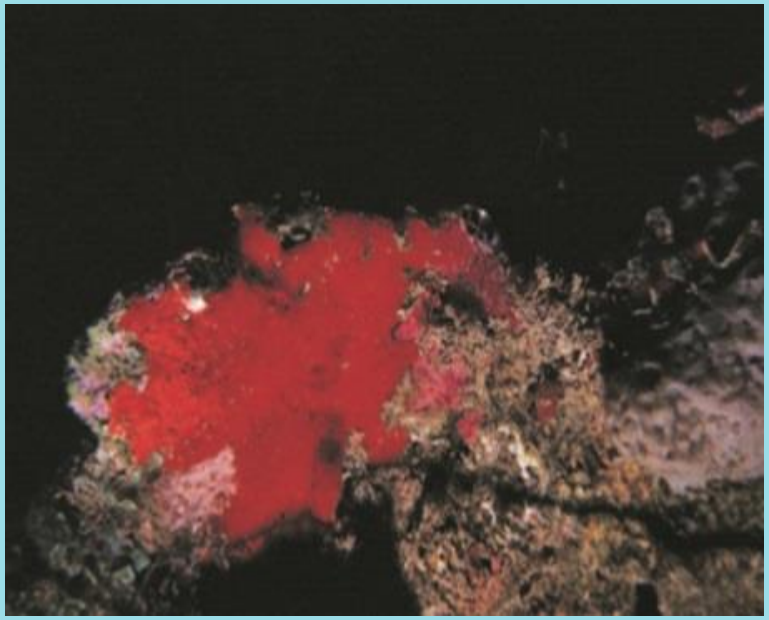

Fig: Asymmetry. Sponges display a cell-aggregate organization, and as this red encrusting sponge (*Monochora barbadensis*) shows, many are asymmetrical.

PATTERNS OF ORGANIZATION

❑ RADIAL SYMMETRY

- ✓ Radial symmetry is the arrangement of body parts such that any plane passing through the central oral-aboral axis.
- ✓ It divides the animal into mirror images
- ✓ Often modified by the arrangement of some structures in pairs, or in other combinations, around the central oral-aboral axis.
- ✓ The paired arrangement of some structures in radially symmetrical animals is called **biradial symmetry.**
- ✓ The arrangement of structures in fives around a radial animal is called **pentaradial symmetry**.

Fig: Radial Symmetry. Planes that pass through the oral-aboral axis divide radially symmetrical animals, such as this tube coral polyp (*Tubastraea, sp*), into equal halves. Certain arrangements of internal structures modify the radial symmetry of sea anemones.

PATTERNS OF ORGANIZATION

❑ BILATERAL SYMMETRY

- ✓ the arrangement of body parts such that a single plane, passing between the upper and lower surfaces and through the longitudinal axis of an animal, divides the animal into right and left mirror images.
- ✓ Bilateral symmetry is characteristic of active, crawling, or swimming animals.
- ✓ The end that meets the environment is usually where complex sensory, nervous, and feeding structures evolve and develop.
- ✓ These developments result in the formation of a distinct head and are called cephalization (Gr. kephale, head).

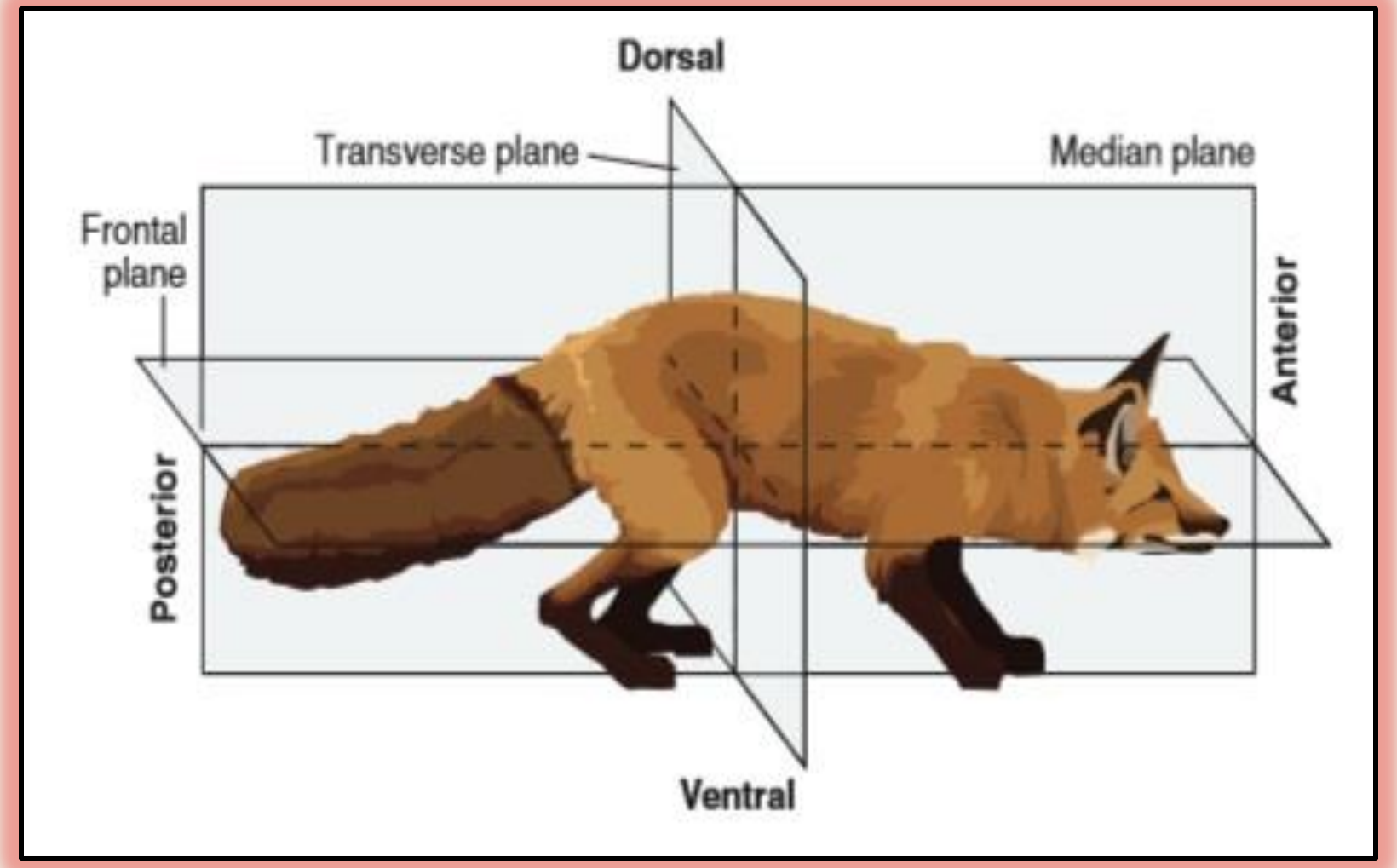

Fig: Bilateral Symmetry. Planes and terms of direction useful in locating parts of a bilateral animal. A bilaterally symmetrical animal, such as this fox, has only one plane of symmetry. An imaginary median plane is the only plane through which the animal could be cut to yield mirror-image halves.

TERMS OF DIRECTION

TERM	DESCRIPTION
Aboral	The end opposite the mouth
Oral	The end containing the mouth
Anterior	The head end; usually the end of a bilateral animal that meets its environment
Posterior	The tail end
Caudal	Toward the tail
Cephalic	Toward the head
Distal	Away from the point of attachment of a structure on the body (e.g., the toes are distal to the knee)
Proximal	Toward the point of attachment of a structure on the body (e.g., the hip is proximal to the knee)
Dorsal	The back of an animal; usually the upper surface; synonymous with posterior for animals that walk upright
Ventral	The belly of an animal; usually the lower surface; synonymous with anterior for animals that walk upright
Inferior	Below a point of reference (e.g., the mouth is inferior to the nose in humans)
Superior	Above a point of reference (e.g., the neck is superior to the chest)
Lateral	Away from the plane that divides a bilateral animal into mirror images
Medial (median)	On or near the plane that divides a bilateral animal into mirror images

OTHER PATTERNS OF ORGANIZATION

- The Unicellular (Cytoplasmic) Level of Organization
- Diploblastic Organization
- Triploblastic Organization
  - The Triploblastic Acoelomate Pattern
  - The Triploblastic Pseudocoelomate Pattern
  - The Triploblastic Coelomate Pattern

1) The Unicellular (Cytoplasmic) Level of Organization

- ✓ Organisms whose bodies consist of single cells or cellular aggregates are unicellular organism.
- ✓ Unicellular body plans are characteristic of the Protista.
- ✓ cytoplasmic organization
- ✓ Unicellular organization is not simple.
- ✓ All unicellular organisms perform the functions in a single cell.
- ✓ These cells exhibit little interdependence, cooperation or coordination of function.
- ✓ These organisms show some division of labour

2. Diploblastic Organization

- ✓ The organization in which two layers forms different tissues is called diploblastic organization
- ✓ Body parts of these animals are organized in two layers. These layers are derived from to embryonic tissue layers.

(a) Ectoderm: It gives rise to the epidermis. Epidermis is the outer layer of the body wall.

(b) Endoderm: It gives rise to the gastrodermis. Gastrodermis lines the gut cavity.

(c) Mesoglea: A non-cellular layer between the epidermis and the gastrodermis is called mesoglea.

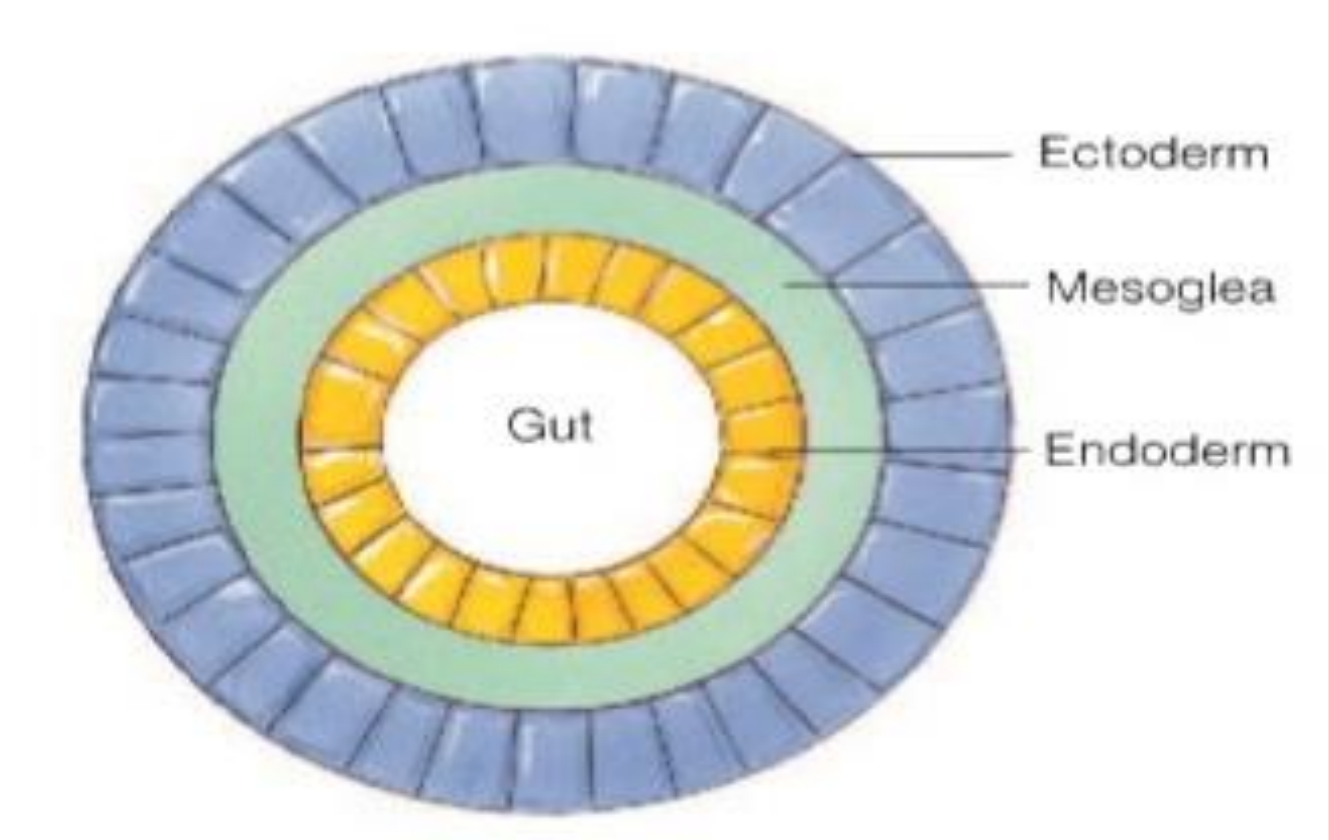

Fig: Diploblastic Body Plan. Diploblastic animals have tissues derived from ectoderm and endoderm. Between these two layers is a noncellular mesoglea

Triploblastic Organization

The animals whose tissues are derived from three embryological layers are called triploblastic layers.

(a) Ectoderm: It forms the outer layer of the body wall and nervous system.

(b) Endoderm: It lines the gut.

(c)Mesoderm: It is sandwiched between the ectoderm and endoderm. It gives rise to supportive, contractile and blood cells.

Most triploblastic animals have an organ-system level of organization. tissues are organized to form excretory, nervous, digestive, reproductive. circulatory and other systems. Triploblastic animals are bilaterally symmetrical. They are relatively active.

Coelom

Triploblastic animals are organized into several subgroups on the basis of body cavity coelom. **Coelom is a fluid-filled space in which the internal organs can be suspended and separated from the body' wall.** Body cavities or coelom have following advantages

1. It provides more space for organ development
2. It provides more surface area for diffusion of gases, nutrients, and wastes into and out of organs.
3. It provides an area for storage**.**
4. It acts as hydrostatic skeletons.
5. It helps in the elimination of wastes and reproductive products from the body.
6. It helps in increasing the body size.

Types of Triploblastic pattern

(a) Triploblastic Acoelomate Pattern:

- ✓ The animals without coelom are called acoelomates.
- ✓ mesodermally derived tissues form a relatively solid mass of cells.
- ✓ Some cells between the ectoderm and endoderm of acoelomate animals are loosely organized cells called parenchyma.
- ✓ Parenchymal cells are not specialized for a particular function.

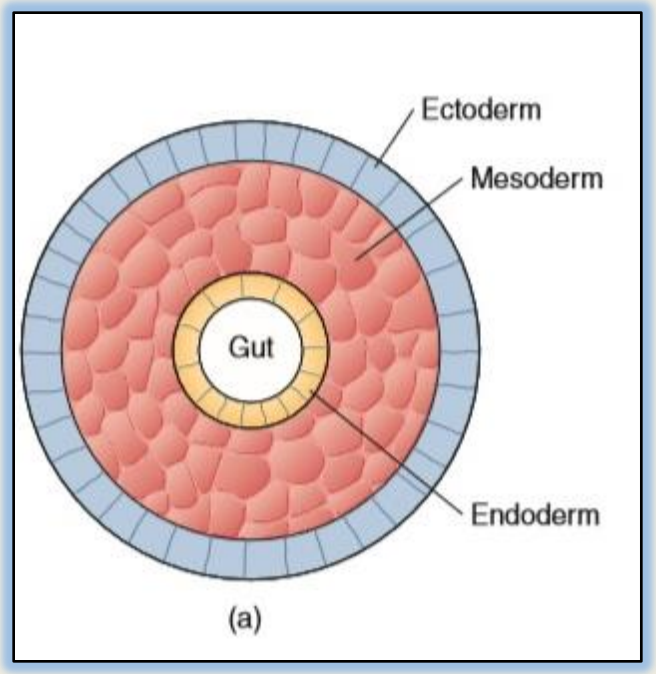

Fig:(a)Triploblastic acoelomate pattern.

Types of Triploblastic pattern

(b) Triploblastic Pseudocoelomate Pattern:

- ✓ A pseudocoelom is a body cavity not entirely lined by mesoderm.
- ✓ It is remnant of blastocoel.
- ✓ Muscular or connective tissues are not associated with the gut tract.
- ✓ There is no mesodermal sheet covers the inner surface of the body wall.
- ✓ there is no membranes suspend organs in the body cavity.

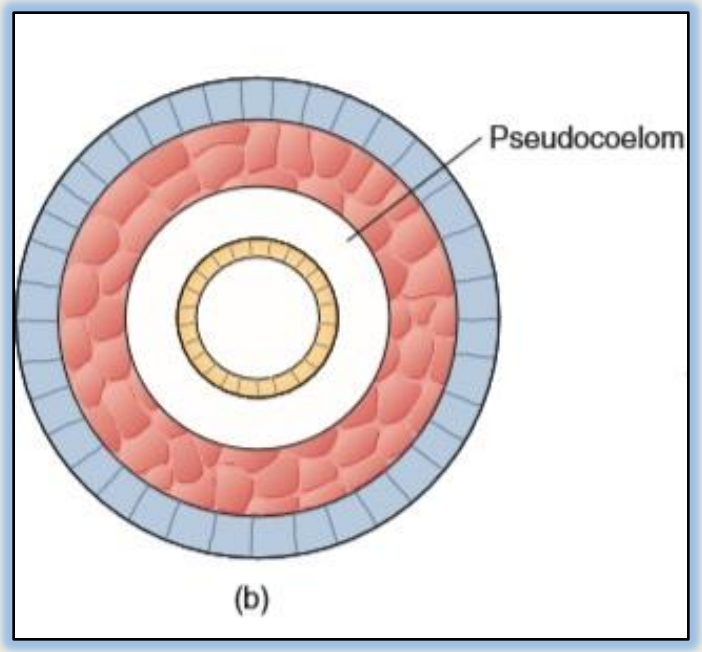

Fig: (b) Triploblastic pseudocoelomate pattern

Types of Triploblastic pattern

(c) Triploblastic coelomate Pattern:

- ✓ A coelom is a body cavity completely surrounded by mesoderm.
- ✓ It has a thin mesodermal sheet called peritoneum.
- ✓ The peritoneum lines the inner body wall. It is continuous with the serosa.
- ✓ Serosa lines the outside of visceral organs.
- ✓ The peritoneum and the serosa are continuous at certain point.
- ✓ These points form suspending sheets called mesenteries.
- ✓ Mesenteries suspend visceral structures in the body cavity.

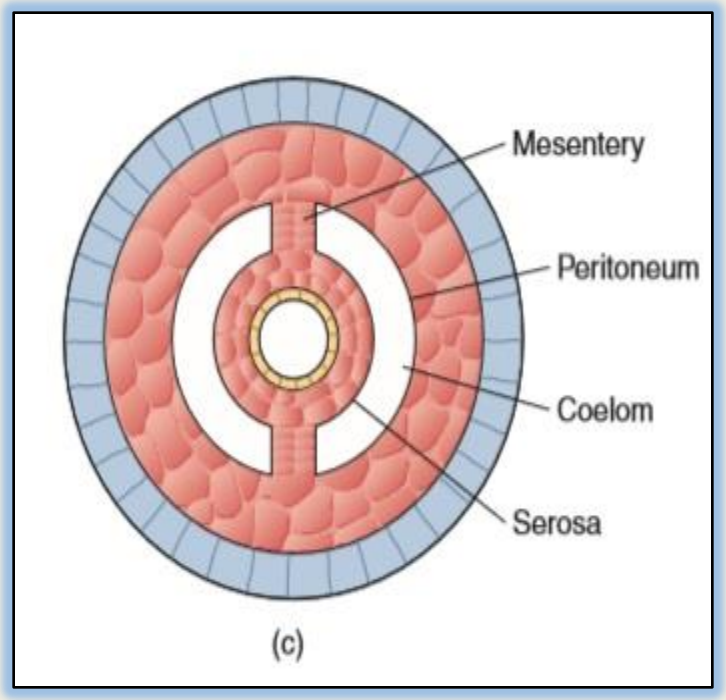

Fig: (c) Triploblastic coelomate pattern