INVERTEBRATES

Summary
SYMMETRY

(a) Radial symmetry

(b) Bilateral symmetry
DIPLOBLASTIC VS TRIPLOBLASTIC

**Endoderm**
- Digestive
- Respiratory

**Ectoderm**
- Outer covering
- Nervous

**Mesoderm**
- Muscles
- Circulatory
- Skeletal
**BODY CAVITY**

(a) Coelomate

- Coelom
- Body covering (from ectoderm)
- Tissue layer lining coelom and suspending internal organs (from mesoderm)

(b) Pseudocoelomate

- Pseudocoelom
- Body covering (from ectoderm)
- Muscle layer (from mesoderm)

(c) Acoelomate

- Body covering (from ectoderm)
- Tissue-filled region (from mesoderm)
- Digestive tract (from endoderm)
Mouth develops from blastopore

Anus develops from blastopore

Digestive tube
PORIFERA

Osculum
Mesohyl
Porocytes
Water flow
Spicules
Spongocoel
Choanocyte
Amoebocyte
Epidermis

Collar
Food particles in mucus
Flagellum
Phagocytosis of food particles
Choanocyte
Amoebocyte
• Asymmetrical
• No true tissue
• No body cavity
• Sessile
• Filter feeders
With the sac body plan, there is only one opening to the gut.

With the tube-within-a-tube body plan, there are two openings to the gut.
- Diploblastic
- No body cavity
- Radial symmetry
- Gastrovascular cavity
- Nematocysts
Anatomy of hydra

- mouth
- tentacle
- gastrovascular cavity
- gastrodermis
- mesoglea
- nerve net
- epidermis

bud
CNIDARIA
‘Nettle animals’

ANTHOZOA
Corals and sea anemones

SCYPHOZOA
Swimming jellyfish

STAUROZOA
Stalked jellyfish

CUBOZOA
Box jellyfish

HYDROZOA
Hydroids and siphonophores
Bilateral symmetry
Triploblastic
Protostome
Acoelomate
Cephalized
Flame cells maintain osmotic balance
Mouth, pharynx, & gastrovascular cavity
Life cycle of a tapeworm, *Taenia*

Each larva becomes a bladder worm encysted in muscle.

Meat contains many bladder worms.

Primary Host

Secondary Host

Feces contain many larvae-containing eggs.

Bladder worm attaches to human intestine.

Gravid proglottid has many larvae-containing eggs.

Tapeworm has proglottids that become more mature.

Scolex

Hooks

Sucker

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1.0 mm

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250 μm
NEMATODA

- Bilateral symmetry
- Cephalized
- Triploblastic
- Protostome
- Pseudocoelomate

Diagram labels:
- mouth
- intestine
- pharynx
- excretory pore
- ovary
- cuticle
- reproductive pore
- anus
- retracted piercing device
- nerve ring
- pseudoceleom
MOLLUSCA

Bilateral symmetry
Triploblastic
Protostome
Coelomate
Open circulation
Nephridia
Gills

Class Gastropoda
Class Bivalvia
Class Cephalopoda
Mantle, Foot, & Visceral Mass

- Mantle
- Foot
- Visceral Mass
- Coelom
- Nephridium
- Heart
- Gonads
- Stomach
- Shell
- Radula
- Mantle cavity
- Anus
- Gill
- Esophagus
- Intestine
- Nerve cords
- Mouth
Earthworm, *Lumbricus*

- anus
- hearts
- dorsal blood vessel
- coelom
- crop
- nephridium
- ventral blood vessel
- ventral nerve cord
- clitellum

**ANNELOIDA**
Bilateral symmetry
Triploblastic
Coelomate
Protostome

Segmentation
Closed circulation
Respiratory skin
Esophagus, crop, gizzard
Nephridia (2 per segment)
**Arthropoda**

- Triploblastic
- Protostome
- Coelomate
- Open circulation
- Exoskeleton
- Jointed appendages
- Gills, Tracheal system, or book lungs
- Malpighian tubules
- **Class Crustacea**
- **Class Arachnida**
- **Class Insecta**

![Diagram of an arthropod with labeled parts]

- **Digestive gland**
- **Intestine**
- **Heart**
- **Stomach**
- **Brain**
- **Eyes**
- **Poison gland**
- **Ovary**
- **Anus**
- **Spinerets**
- **Silk gland**
- **Gonopore (exit for eggs)**
- **Sperm receptacle**
- **Book lung**
- **Chelicera**
- **Pedipalp**

*Figure 33.32*
GRASSHOPPER Anatomy

- Antennae
- Compound eye
- Jaws
- Palps
- Wings
- Long jumping legs
- Spiracles
- Walking legs
- Abdomen
- Thorax
- Head
Figure 33.6a–e

Complete Metamorphosis

Incomplete Metamorphosis

Egg → Nymph → Adult

3 Stages Only

(a) Larva (caterpillar) (b) Pupa (c) Pupa (d) Emerging adult (e) Adult
Ecdysis
Radial or bilateral symmetry
Triploblastic
Coelomate
Deuterostome
Endoskeleton
Water vascular system
Tube feet