Animals

Introduction to Animal Evolution
What is an Animal?

- Multicellular, heterotrophic, eukaryotes
- Cells lack cell walls, held together by structural proteins (collagen)
- Contain nervous and muscle tissue
- Most reproduce sexually with a dominant diploid stage
Development

- Zygote (cleavage)
- Morula
- Blastula
- Gastrula
  - Blastopore
  - Archenteron
  - Two layers of tissue (endoderm & ectoderm)
Origin of Animals

[Diagram showing the origin of animals from choanoflagellates.]
Animal Phylogeny Overview

- Organization Level
- Body Symmetry
- Body Cavities
- Development
- Segmentation
Organization Level

- Cellular Level vs. Tissue Level
  - Cellular Level: Porifera (sponges)
  - Tissue Level: all others
Body Symmetry

- Radial vs. Bilateral
  - Radial Symmetry: Cnidaria & Ctenophora
  - Bilateral Symmetry: all others
Body Cavities

- Acoelomates: Platyhelminthes (flatworms)
- Pseudocoelomates: Nematoda (roundworms)
- Eucoelomates: all others

store nutrients
movement
hydrostatic skeleton
space for organ development
Development

- Protostomes vs. Deuterostomes
Protostomes vs. Deuterostomes

- **Cleavage**
  - Spiral and Determinate

- **Coelom Formation**
  - Schizocoelous
    - Formed from 4D cells

- **Fate of Blastopore**
  - Mouth

- **Cleavage**
  - Radial and Indeterminate

- **Coelom Formation**
  - Enterocoelous
    - Formed from pockets of the archenteron

- **Fate of Blastopore**
  - Anus
Development

- Protostomes vs. Deuterostomes
  - Protostomes:
    - Mollusca (clams, snails)
    - Annelida (segmented worms)
    - Arthropoda (Crustaceans, insects)
  - Deuterostomes:
    - Echinodermata (Seastars)
    - Chordata (vertebrates)
Animal Phylogeny

Deuterostomia
- Hemichordata
- Echinodermata
- Chordata
  - Platyhelminthes
    - Rotifera
    - Ectoprocta
    - Brachiopoda
    - Mollusca
  - Annelida
- Nematoda
- Arthropoda

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Points of agreement

1. All animals have common ancestor
2. Sponges are basal animals
3. All other animals have true tissues
4. Most animals are bilateral
5. Chordates and Echinoderms are related (deuterostomes)
Animals not in the clade deuterostomes (protostome development) are divided into two groups:

- Ecdysozoans
- Lophotrochozoans
Animal Structure and Function
Tissue

Groups of cells with a common structure and function
Tissues

- Epithelial Tissue
  - tightly packed cells used for lining

- Connective Tissue
  - cells scattered through an extracellular matrix

- Nervous Tissue
  - transmits signals (neurons)

- Muscle Tissue
  - fibers for contraction
Epithelial Tissue

- Cell layers
  - Simple
  - Stratified
  - Pseudostratified

- Shape of Cells
  - Cuboidal
  - Columnar
  - Squamous
Connective Tissue

- **Collagenous Fibers**
  - Collagen (most abundant protein)
- **Elastic Fibers**
  - Elastin (protein)
- **Reticular Fibers**
  - Collagen
  - join connective tissues
Connective Tissue

Loose Connective Tissue
- binds epithelial to underlying tissue
  - Fibroblasts (extracellular fibers)
  - Macrophages (immune system)
Connective Tissue

- Adipose Tissue
  - stores fat
- Fibrous Connective Tissue
  - Tendons
  - Ligaments
Connective Tissue

- Cartilage
  - chondrocytes
- Bone
  - osteoblasts
  - Haversian system
Connective Tissue

**Blood**
- plasma
- erythrocytes
- leukocytes
- platelets
Nervous Tissue

- Neurons
  - Cell body
  - Axons
  - Dendrites
Muscle Tissue

- Skeletal
- Cardiac
- Smooth
## Organ Systems

### Table 40.1 Organ Systems in Mammals

<table>
<thead>
<tr>
<th>Organ System</th>
<th>Main Components</th>
<th>Main Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestive</td>
<td>Mouth, pharynx, esophagus, stomach, intestines, liver, pancreas, anus</td>
<td>Food processing (ingestion, digestion, absorption, elimination)</td>
</tr>
<tr>
<td>Circulatory</td>
<td>Heart, blood vessels, blood</td>
<td>Internal distribution of materials</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Lungs, trachea, other breathing tubes</td>
<td>Gas exchange (uptake of oxygen; disposal of carbon dioxide)</td>
</tr>
<tr>
<td>Immune and lymphatic</td>
<td>Bone marrow, lymph nodes, thymus, spleen, lymph vessels</td>
<td>Body defense (fighting infections and cancer)</td>
</tr>
<tr>
<td>Excretory</td>
<td>Kidneys, ureters, urinary bladder, urethra</td>
<td>Disposal of metabolic wastes; regulation of osmotic balance of blood</td>
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<tr>
<td>Endocrine</td>
<td>Pituitary, thyroid, pancreas, adrenal, and other hormone-secreting glands</td>
<td>Coordination of body activities (such as digestion and metabolism)</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Ovaries or testes and associated organs</td>
<td>Reproduction</td>
</tr>
<tr>
<td>Nervous</td>
<td>Brain, spinal cord, nerves, sensory organs</td>
<td>Coordination of body activities; detection of stimuli and formulation of responses to them</td>
</tr>
<tr>
<td>Integumentary</td>
<td>Skin and its derivatives (such as hair, claws, skin glands)</td>
<td>Protection against mechanical injury, infection, dehydration; thermoregulation</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Skeleton (bones, tendons, ligaments, cartilage)</td>
<td>Body support, protection of internal organs, movement</td>
</tr>
<tr>
<td>Muscular</td>
<td>Skeletal muscles</td>
<td>Locomotion and other movement</td>
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</tbody>
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