An Introduction to Animal Structure and Function

The cells of most animals interact at three levels of organization: tissues, organs, and organ systems.

Outline

1. Key concepts
2. Organization of the animal body
3. Tissues types
4. Organ systems
5. Bioenergetics of Animals
6. Homeostasis
7. Key terms
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Key Concepts:

1. The cells of most animals interact at three levels of organization: tissues, organs, and organ systems
2. Four types of tissues are seen in most animals: epithelial, connective, muscle, and nervous tissues
3. Each animal cells engages in metabolic activities
Key Concepts:

4. Animals are heterotrophs that harvest chemical energy from the food they ingest.
5. Mechanisms of homeostasis moderate changes in the internal environment.

Organization of the animal body

1. Cells – basic structural and functional units.
2. Tissue – a group of cells, usually similar in both structure and function. They are bound together to carry out one or more specialized tasks.
3. Organ – a body part, two or more tissue types that function together.
4. Organ systems – two or more organs that work to perform a common function.

Hierarchy of organization
Tissue types

1. Epithelial tissue - Protective coverings of the body, linings of internal organs. 
cells close together act as a barrier

2. Connective tissue - structural support of body parts, energy storage, etc.
cells separated by matrix
tendons, ligaments, cartilage, bone, adipose tissue and blood

3. Muscle tissue - movement of body parts and internal organs.
contractible cells
A. Skeletal – cells very long, voluntary control.
B. Smooth – line internal organs, involuntary control.
C. Cardiac – only in heart, involuntary.

4. Nerve tissue – regulation of body activities by receiving and sending electric signals.
composed of cells called neurons
excitable cells

Epithelial Tissues

Free surface
Epithelial

Glandular Epithelium

Exocrine
- Mucus
- Saliva
- Earwax
- Milk
- Oil
- Digestive enzymes
- Endocrine
- Hormones

Connective Tissues
Connective Tissue

- Cartilage
- Bone
- Adipose tissue
- Blood

Muscle Tissue

3 types
- Skeletal
- Smooth
- Cardiac
Muscle Tissue

Location and General Arrangement of Muscle Cells

c. muscle
Nervous Tissue

Neuron
Stimulation
(Electrical charges)

Skin - An Organ

Organ systems are interdependent

- Integumentary
- Muscular
- Respiratory
- Skeletal
- Digestive
- Nervous
- Urinary
- Endocrine
- Reproductive
- Circulatory
- Lymphatic
Organ Systems

<table>
<thead>
<tr>
<th>Organ System</th>
<th>Main Components</th>
<th>Main functions</th>
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<tbody>
<tr>
<td>Digestive</td>
<td>Intestines, liver, pancreas, anus</td>
<td>Food processing (digestion, absorption, detoxification)</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>Integumentary</td>
<td>Skin, hair, sebaceous glands, sweat glands</td>
<td>Body defenses (fighting infections and cancer)</td>
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<tr>
<td>Renal</td>
<td>Kidneys, ureters, urinary bladder, urethra</td>
<td>Disposal of metabolic wastes, regulation of osmotic balance of fluid</td>
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<tr>
<td>Endocrine</td>
<td>Pituitary, thyroid, parathyroid, adrenal, and other hormones 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 transmission of responses to them</td>
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<tr>
<td>Immune</td>
<td>Skin and its derivatives (such as hair, claws, skin glands)</td>
<td>Protection against mechanical injury, infection, drying out, thermoregulation</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Skeletal 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>
</tr>
</tbody>
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Bioenergetics of Animals

1. Animals are heterotrophs that harvest chemical energy from the food they ingest.
2. Metabolic rate provides clues to an animal’s bioenergetic “strategy”.
   a. endotherm (basal metabolic rate - BMR)
   b. ectotherm (standard metabolic rate - SMR)
3. Metabolic rate per gram is inversely related to body size among similar animals

Homeostasis:

1. Mechanisms of homeostasis moderate changes in the internal environment
   a. body temperature
   b. blood pH
   c. blood pressure
2. Homeostasis depends on feedback circuits
   a. Negative feedback
   b. Positive feedback
Negative-feedback

In a negative-feedback system, a change in the variable being monitored triggers the control mechanism to counteract further change in the same direction.

Our own body temperature is kept close to a set point of 37°C by the cooperation of several negative-feedback circuits that regulate energy exchange with the environment.

In contrast to negative feedback, positive feedback involves a change in some variable that trigger mechanisms that amplify rather than reverse the change.

For example, during childbirth, the pressure of the baby’s head against sensors near the opening of the uterus stimulates uterine contractions. These cause greater pressure against the uterine opening, heightening the contractions, which cause still greater pressure. Positive feedback brings childbirth to completion, a very different sort of process from maintaining a steady state.
1. A tissue is a group of cells and intercellular substances that perform a common function.
2. Epithelial tissues cover external body surfaces and line internal cavities and tubes.
3. Connective tissues bind together, support, strengthen, protect, and insulate other tissues.
4. Muscle tissues are contractile and move the body or parts of it.

5. Nervous tissue intercepts and integrates information about internal and external conditions, and governs the body’s responses to change.
6. An organ is a group of different tissues that perform a common function.
7. An organ system is a group of organs that perform a common function which contributes to the survival of the body.
In Conclusion

8. Tissues, organs, and organ systems work together to maintain homeostasis
9. Feedback controls help maintain internal operating controls
10. Negative feedback mechanisms help maintain normal body ranges whereby positive feedback intensifies the changes