

## Chapter 1 Outline

- Introduction to Physiology
- Scientific Method
- Homeostasis
- The Primary Tissues
  - Muscle Tissue
  - Nervous Tissue
  - Epithelial Tissue
  - Connective Tissue
- Organs and Systems

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## Human Physiology

- **Physiology**: study of how body works to maintain life
- **Pathophysiology**: how physiological processes are altered in disease or injury

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Our understanding of physiology and medicine is based on science

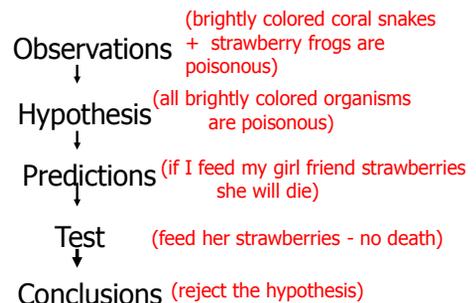
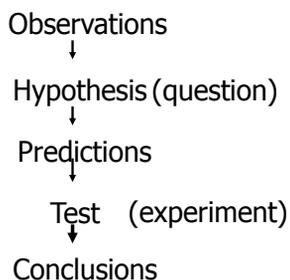
- So what is science?
  - Knowledge gathered from questions based on observations
  - i.e., Scientific inquiry **begins** with questions based on observations

- How do you decide which questions can be answered scientifically?
- Questions can be answered scientifically if the question (hypothesis) can be experimentally tested and shown to be false.

Falsifiable hypothesis? One in which we have the ability to say **NO** or **False**

To do this we use the Scientific Method

### Scientific Method:



Observations (brightly colored coral snakes  
+ strawberry frogs are  
poisonous)

Hypothesis (all brightly colored organisms  
are poisonous)

Predictions (if I feed my girlfriend strawberries  
she will die)

Test (feed her strawberries)

Conclusions (accept the hypothesis?)

- she dies - so we accept the hypothesis.

Did we prove that all brightly colored organisms are poisonous?

No - maybe something else killed her (not the strawberries)

Science advances by showing that a hypothesis is false

Observations Plant dies in dorm!

Hypothesis • Didn't water it enough

Predictions • If add more water it will live

Test • Water 50 same/50 with more H2O  
• dies / dies

Conclusions? Reject hypothesis

(Something else is killing the plants!)

Observations Plant dies in dorm!

Hypothesis • Didn't water it enough

Predictions • If add more water it will live

Test • **Water 50 same/ 50 with more H2O**  
• **all die / all live!!!**

Conclusions? Accept hypothesis

Did we prove that lack of water killed the first plant or the plants after them?

**No!!**

Something other than what we tested may have killed the plants or enabled the second group of plants to live.

- We accept hypotheses conditionally

(Future studies may reject this hypothesis)

- Can all questions be answered scientifically?
  - Falsifiable hypothesis
  - Standardized accepted forms of measurements
  - Experimental groups
  - Sample size
  - Peer review

Remember 3 important points:

1. Science advances by disproving hypotheses
2. Hypotheses are only accepted conditionally
3. Not all questions can be addressed using the scientific method

## Theories

- A theory is a hypothesis that is supported by a good deal of evidence  
i.e., we haven't been able to reject the hypothesis after many many studies.

- Law?

Science is based on ethics

## Using Scientific Method to Develop New Drugs

- ▶ When a new drug is suggested by experiments:
  - ▶ Its effectiveness and toxicity is tested first in tissue culture, rats, mice

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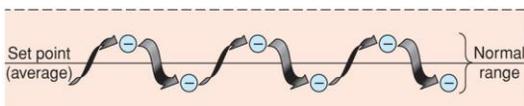
## Using Scientific Method to Develop New Drugs

- ▶ If effective and safe, clinical trials performed
  - ▶ **Phase I Trials:** Toxicity and metabolism tested in healthy human volunteers
  - ▶ **Phase II Trials:** Effectiveness and toxicity tested in target population
  - ▶ **Phase III Trials:** Widespread test of drug in diverse population
  - ▶ **Phase IV Trials:** Drug is tested for other potential uses

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## Homeostasis

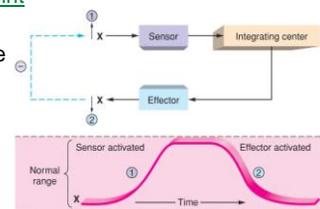
- ▶ Is maintenance of a state of **dynamic constancy**
  - ▶ In which conditions are stabilized above and below a physiological set point
    - ▶ By negative feedback loops



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## Negative Feedback Loops

- ▶ **Sensor:** Detects deviation from **set point**
- ▶ **Integrating center:** Determines response
- ▶ **Effector:** Produces response



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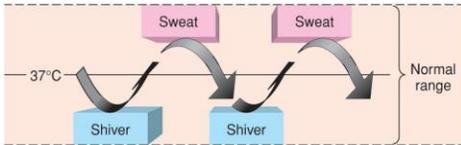
## Homeostasis

▶ Regulatory mechanisms:

Intrinsic: control is built into organ being regulated

Extrinsic: control comes from outside of organ

▶ E.g. body temperature is controlled by antagonistic effects of sweating and shivering

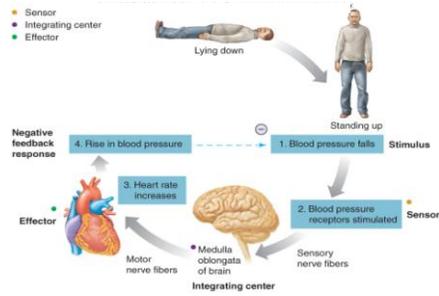


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## Homeostasis

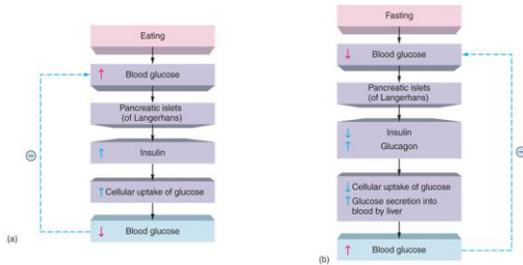
▶ Regulatory mechanisms:

▶ Negative feedback loops control blood pressure



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## Negative Feedback Hormonal Control of Blood Glucose



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## Homeostasis

▶ Regulatory mechanisms:

▶ Positive feedback is rare because it amplifies changes

▶ It is involved in producing blood clots

▶ In females: LH surge that causes ovulation



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## Muscle Tissue

▶ Specialized for contraction

▶ 3 types: skeletal, cardiac, smooth

## The Primary Tissues

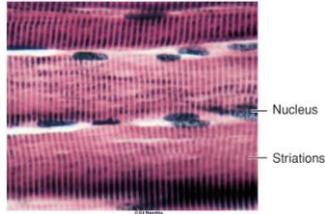
How many?  
What are they?

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## Skeletal Muscle

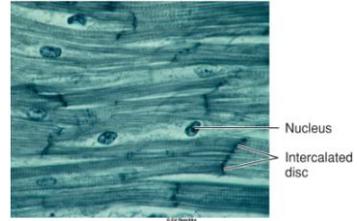
- ▶ Characteristics?



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## Cardiac Muscle

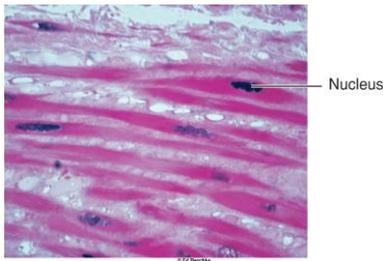
- ▶ Characteristics?



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## Smooth Muscle

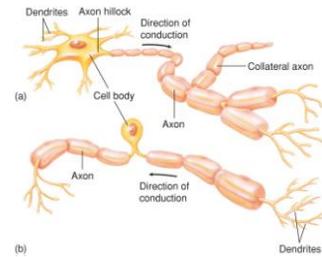
- ▶ Characteristics?



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## Nervous Tissue

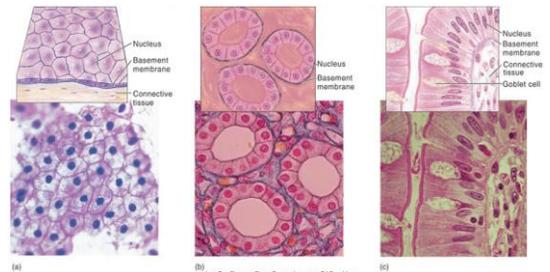
- ▶ Consists of \_\_\_\_\_ and support or \_\_\_\_\_ cells
- ▶ What do they do?
- ▶ Anatomy?



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## Epithelial Tissue

- ▶ Characteristics/functions?
- ▶ Shapes/layers?



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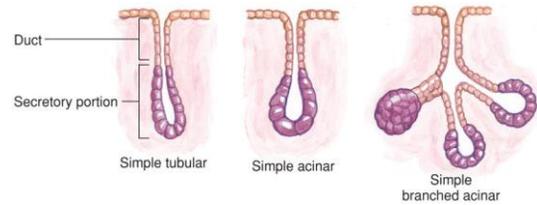
## Epithelial Tissue

- ▶ **Simple membranes** are one cell thick
  - ▶ Specialized for transport
- ▶ **Stratified** has a number of layers
  - ▶ Specialized for protection

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## Exocrine Glands

- ▶ Derived from epithelial cells
- ▶ Have ducts
- ▶ Can be **simple tubes** or clusters called **acini**
  - ▶ secretion is controlled by surrounding myoepithelial cells



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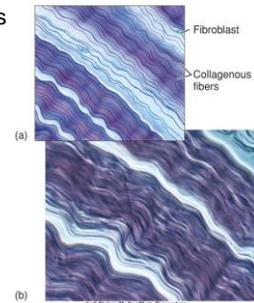
## Connective Tissue

- ▶ Characteristics?
- ▶ Includes connective tissue proper, cartilage, bone and blood
- ▶ **Loose connective tissue** consists of **collagen** (fibrous proteins) and tissue fluid
  - ▶ e.g. dermis of skin

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## Connective Tissue Proper -

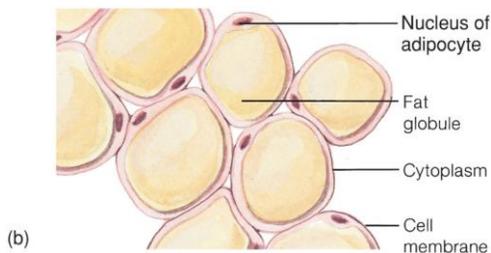
- ▶ Matrix is protein fibers and gel-like ground substance
  - ▶ Dense CT
  - ▶ Regular/irregular
  - ▶ Loose CT



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## Connective Tissue - Adipose

- ▶ Specialized for fat synthesis, breakdown and storage



(b)

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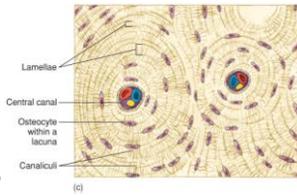
## Connective Tissue - Cartilage

- ▶ Specialized for support, protection
- ▶ Made of chondrocytes and elastic extracellular material
- ▶ Serves as precursor for bone
- ▶ Forms articular surfaces for joints

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## Connective Tissue - Bone

- ▶ Formed as concentric layers of calcified material
- ▶ Contains 3 cell types:
  - ▶ **Osteoblasts**: bone-forming cells
  - ▶ **Osteocytes**: trapped, inactive osteoblasts
  - ▶ **Osteoclasts**: the bone resorbing cells



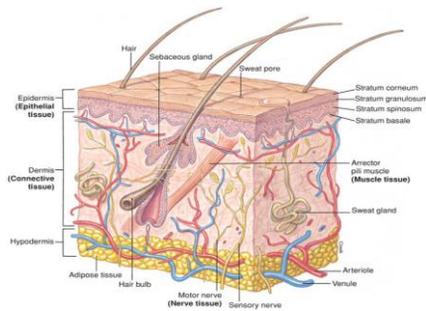
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## Organs and Systems

??

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## Skin — Organ?????



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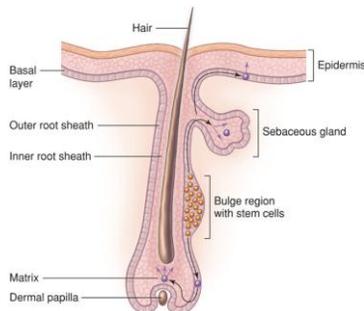
## Stem Cells

- ▶ Most cells in organs are highly specialized or differentiated
- ▶ Many organs retain small populations of adult stem cells
  - ▶ Undifferentiated cells; can become many cell types
    - ▶ e.g. bone marrow stem cells give rise to all different blood cell types

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## Stem Cells

Hair follicle stem cells can form the hair shaft, root sheath, sebaceous glands and epidermis



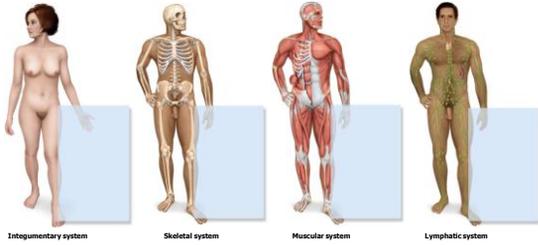
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## Body-Fluid Compartments

- ▶ Body has intracellular and extracellular compartments
  - ▶ Intracellular = inside cells
  - ▶ Extracellular = outside cells
  - ▶ What separates these two compartments??
- ▶ Extracellular is composed of
  1. blood plasma
  2. interstitial fluid or tissue fluid

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### Organ Systems



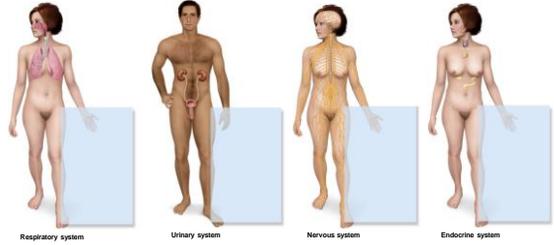
Integumentary system

Skeletal system

Muscular system

Lymphatic system

### Organ Systems



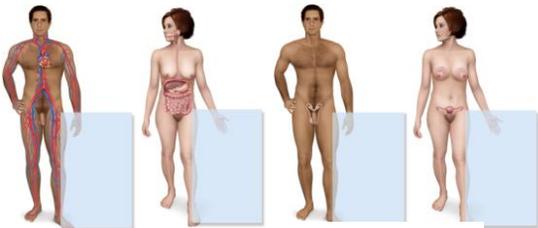
Respiratory system

Urinary system

Nervous system

Endocrine system

### Organ Systems



Circulatory system

Digestive system

Male reproductive system

Female reproductive system