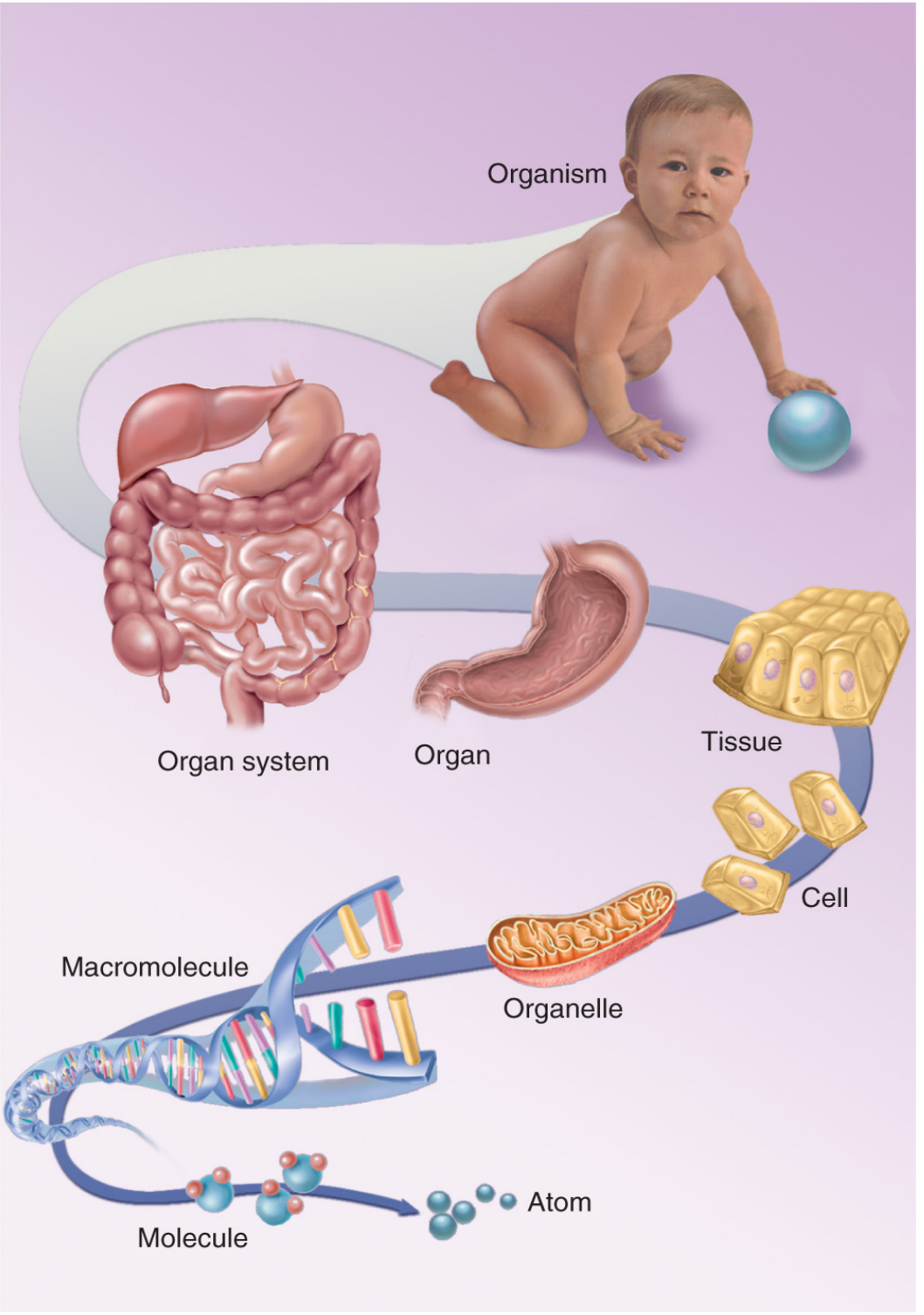
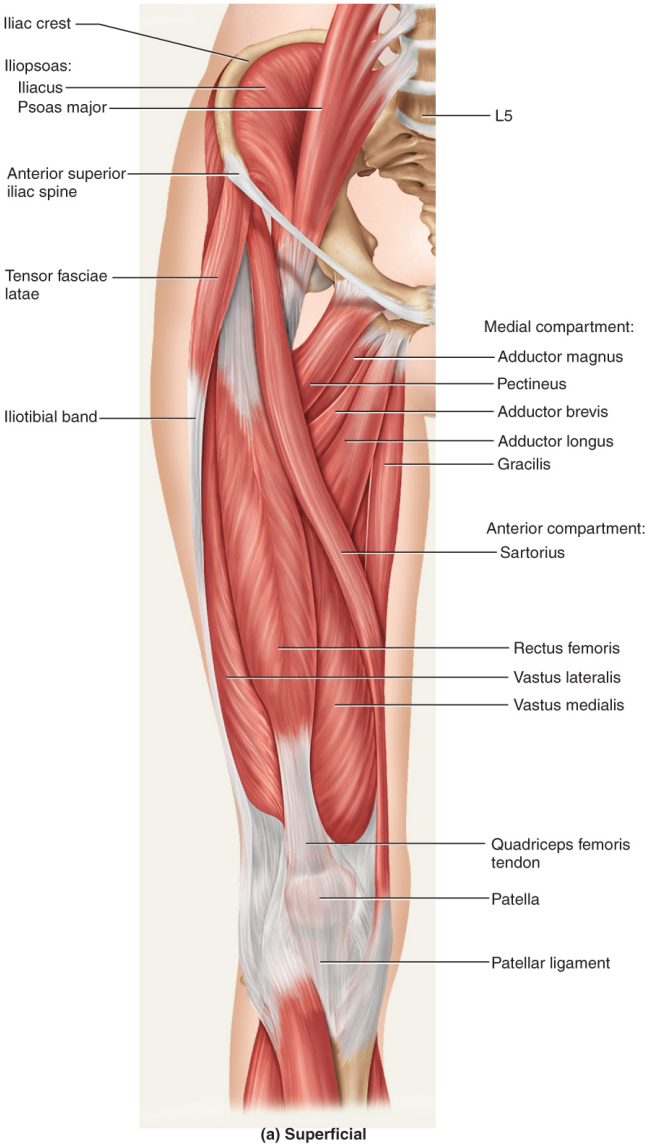
Anatomy and Physiology

- Anatomy
  - The study of form
    - Gross anatomy
    - Histology – tissues
    - Cytology – cell structure
    - Ultrastructure – molecular structure
- Physiology
  - The study of function

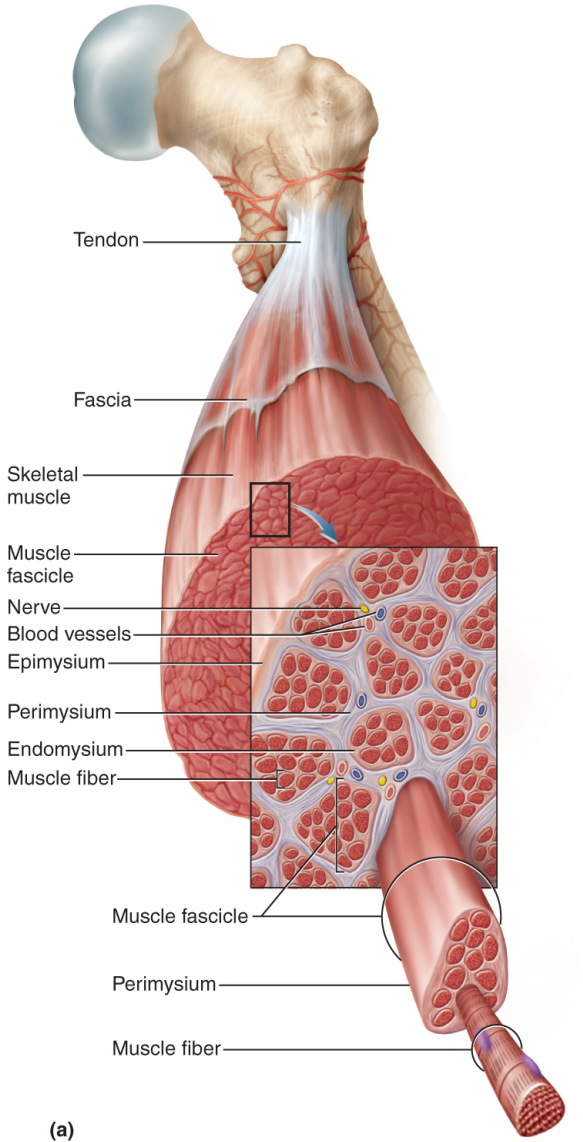
Structural Hierarchy



Muscle Anatomy

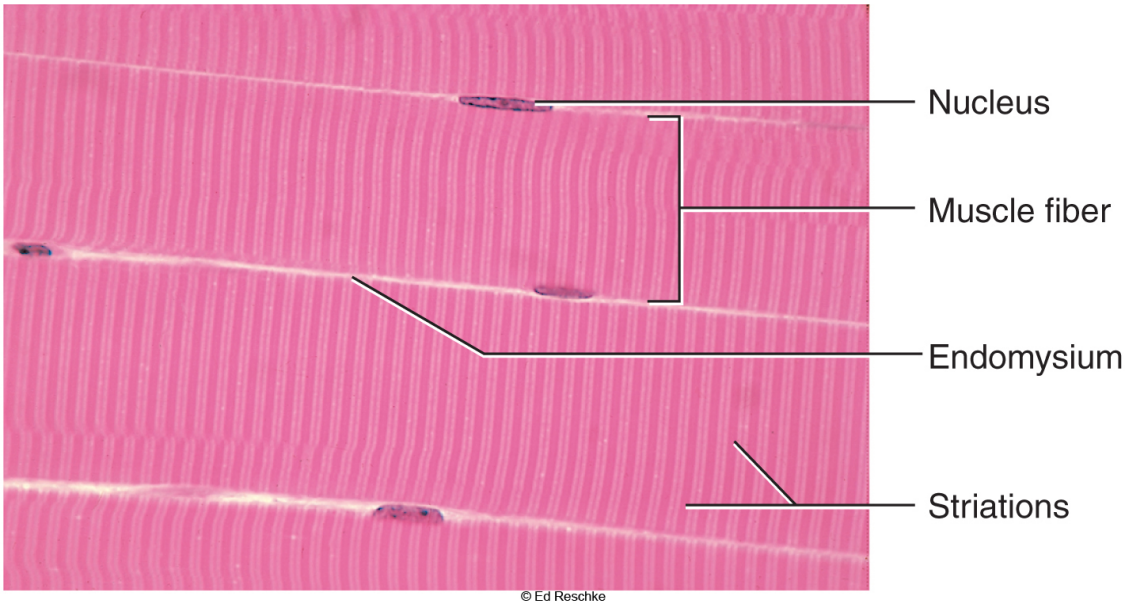


(a) Superficial



(a)

Muscle Anatomy



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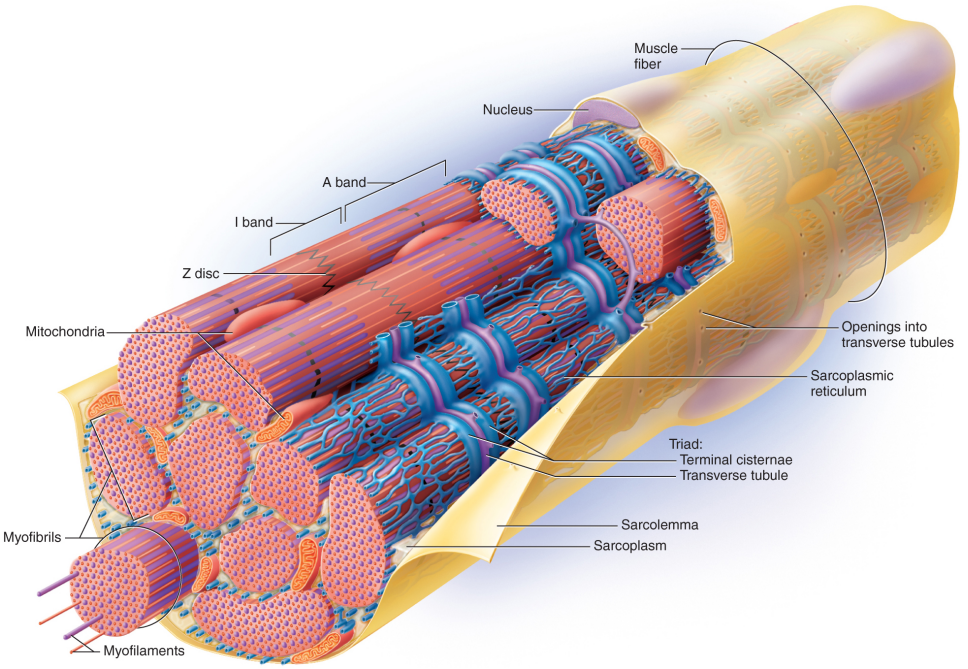
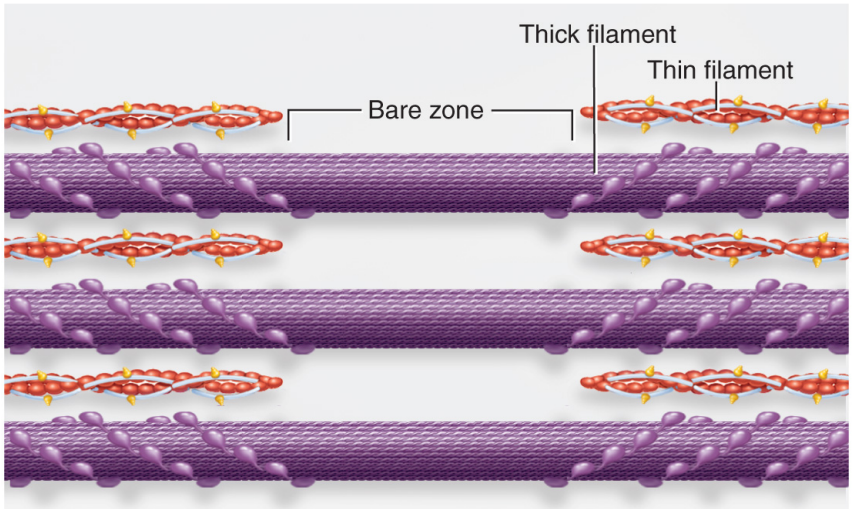
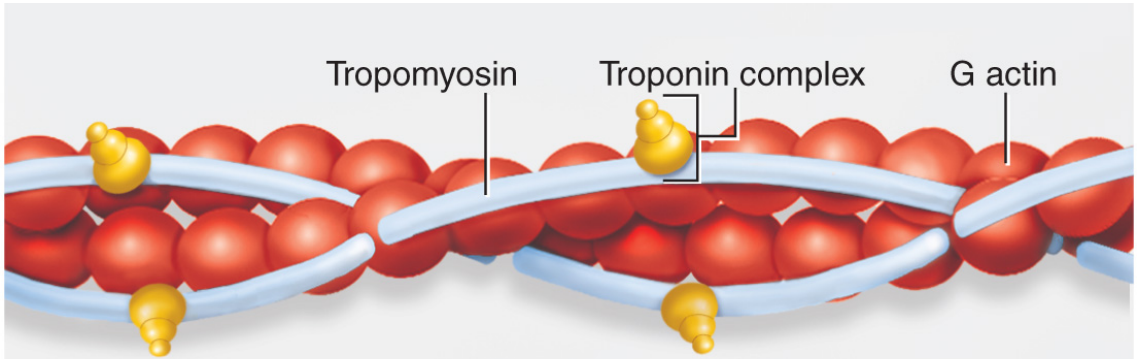


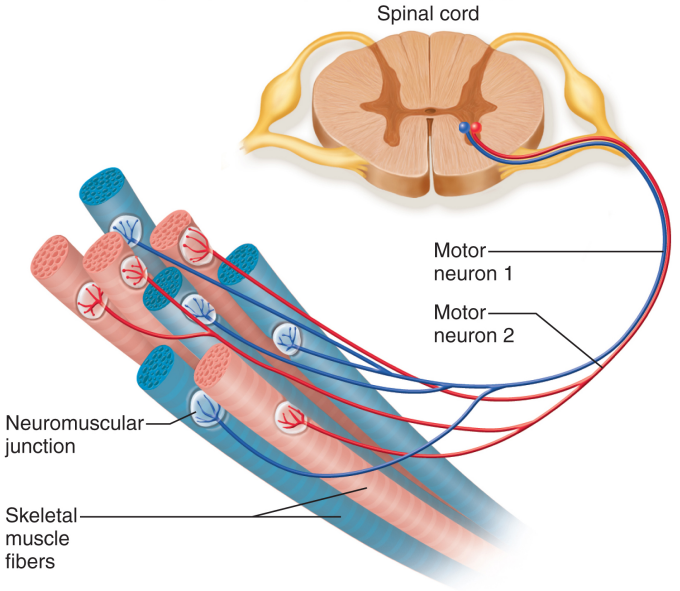


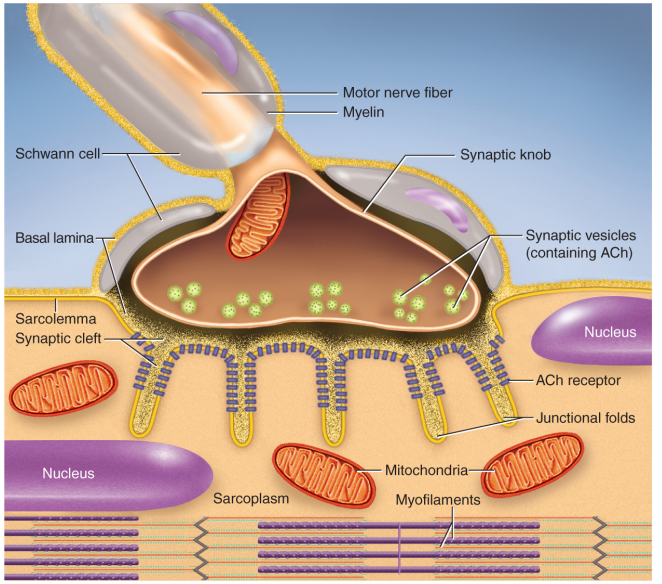
(d) Portion of a sarcomere showing the overlap of thick and thin filaments



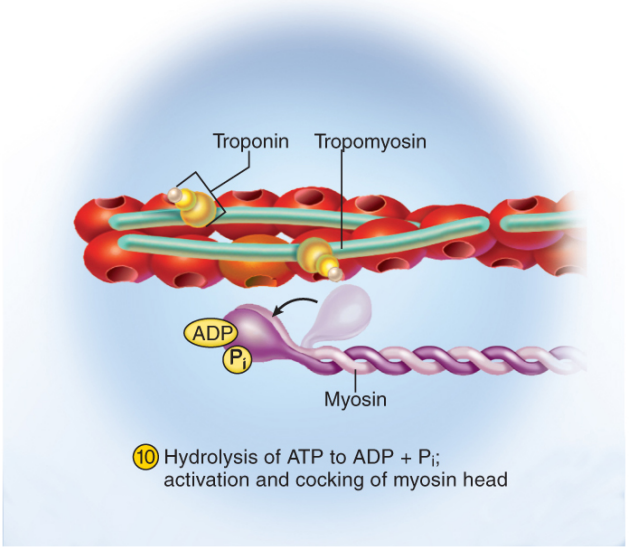
(c) Thin filament

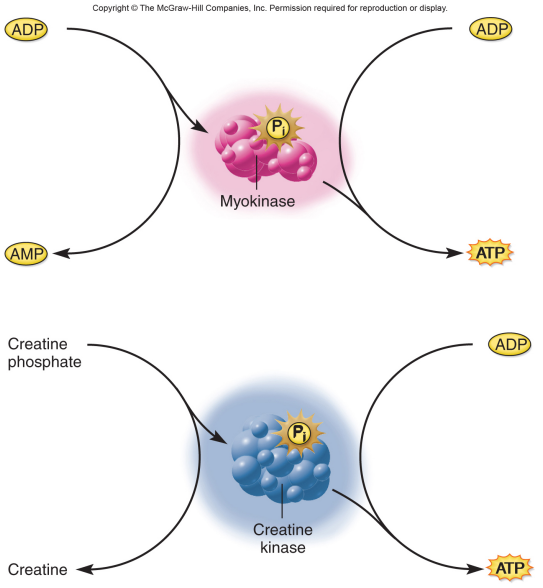
Muscle Physiology





(b)





Homeostasis

- **Homeostasis** – the body's ability to detect change, activate mechanisms that oppose it, and thereby maintain relatively stable internal conditions
  - Constant internal conditions regardless of external conditions
    - internal body temperature ranges from 97 to 99 degrees despite variations in external temperature
  - State of the body fluctuates (**dynamic equilibrium**) within limited range around a **set point**
  - **Negative feedback** keeps variable close to the set point
- **Loss of homeostatic control causes illness or death**

Negative Feedback Loop

- Body senses a change and activates mechanisms to reverse it - dynamic equilibrium

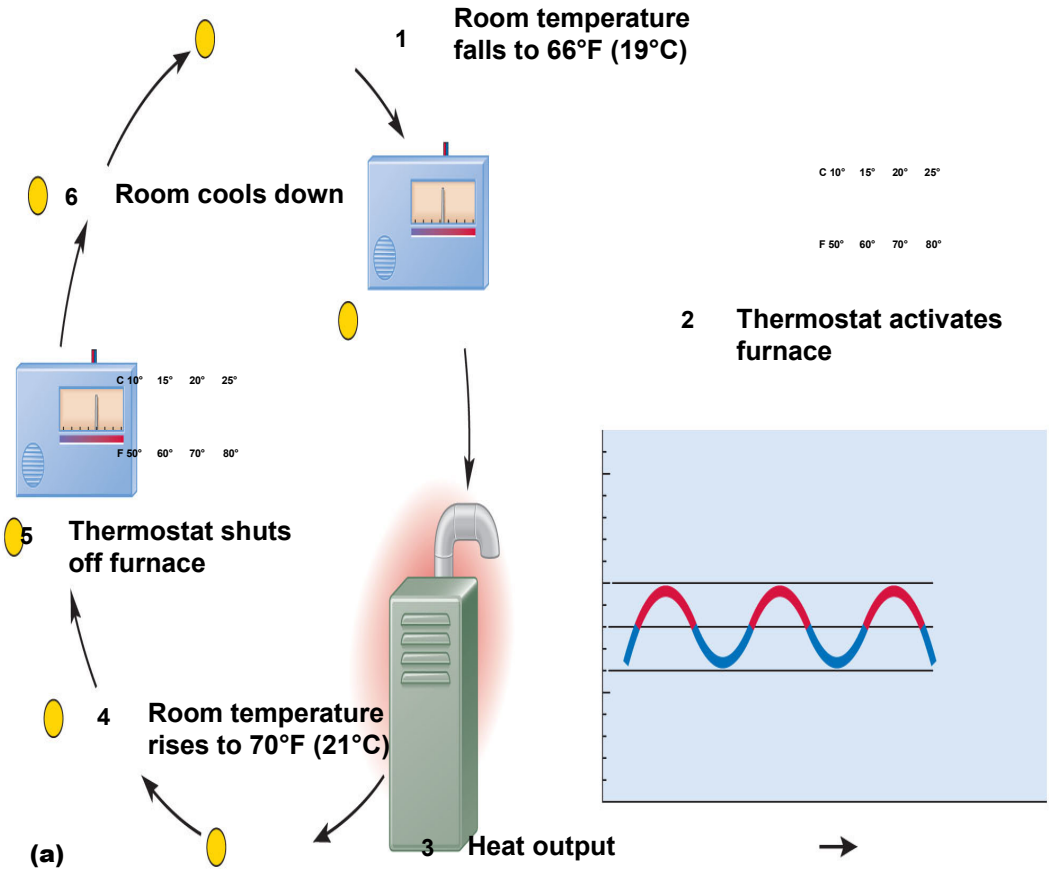


Figure 1.9a

Negative Feedback, Set Point

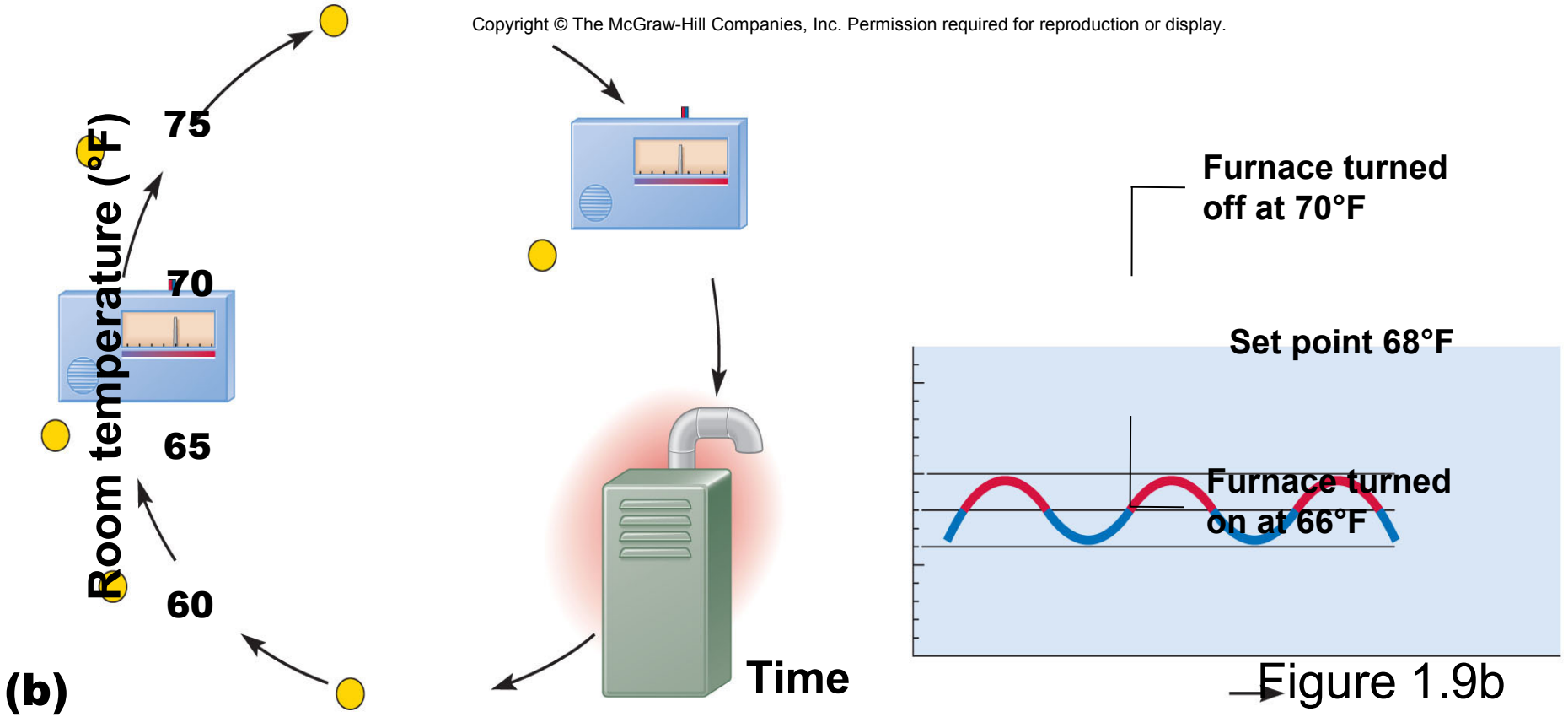


Figure 1.9b

- Room temperature does not stay at set point of 68 degrees -- it only averages 68 degrees

Negative Feedback in Human Thermoregulation

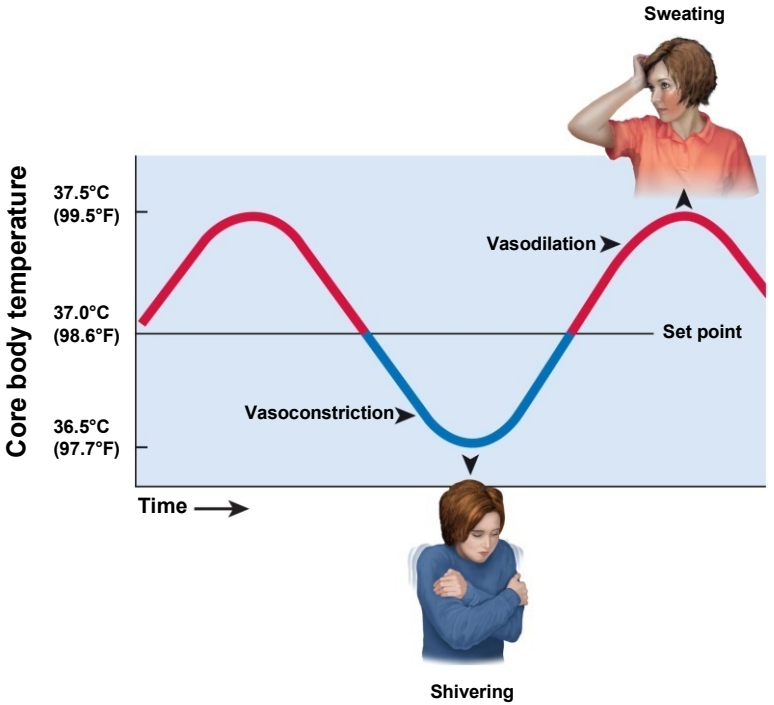


Figure 1.10

- **Brain senses change in blood temperature**
  - if to warm, vessels dilate (**vasodilation**) in the skin and sweating begins (heat losing mechanisms)
  - if too cold, vessels in the skin constrict (**vasoconstriction**) and shivering begins (heat gaining mechanism)

Negative Feedback Control of Blood Pressure

- Sitting up in bed causes a drop in blood pressure in the head and upper thorax
- **Baroreceptors** in the arteries near the heart alert the cardiac center in the brainstem
- **Cardiac center** sends nerve signals that increase the heart rate and return the blood pressure to normal
- Failure of this to feedback loop may produce dizziness in the elderly

Control of Blood Pressure

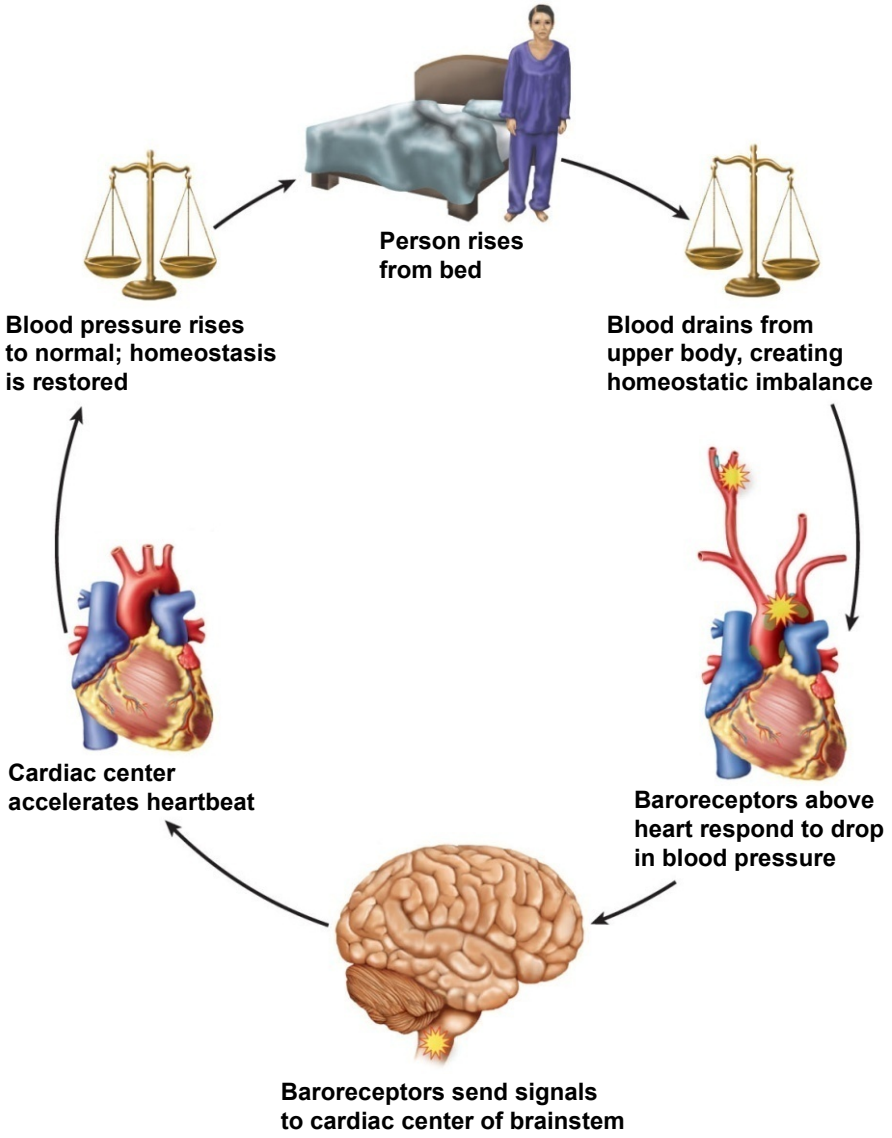


Figure 1.11

3 Components of a Feedback Loop

- **Receptor** - senses change in the body
- **Integrating (Control) Center -** control center that processes the sensory information, 'makes a decision', and directs the response
- **Effector –** carries out the final corrective action to restore homeostasis

Positive Feedback Loops

- **Self-amplifying cycle**
  - leads to greater change in the same direction
  - feedback loop is repeated – change produces more change
- **Normal way of producing rapid changes**
  - occurs with childbirth, blood clotting, protein digestion, fever, and generation of nerve signals

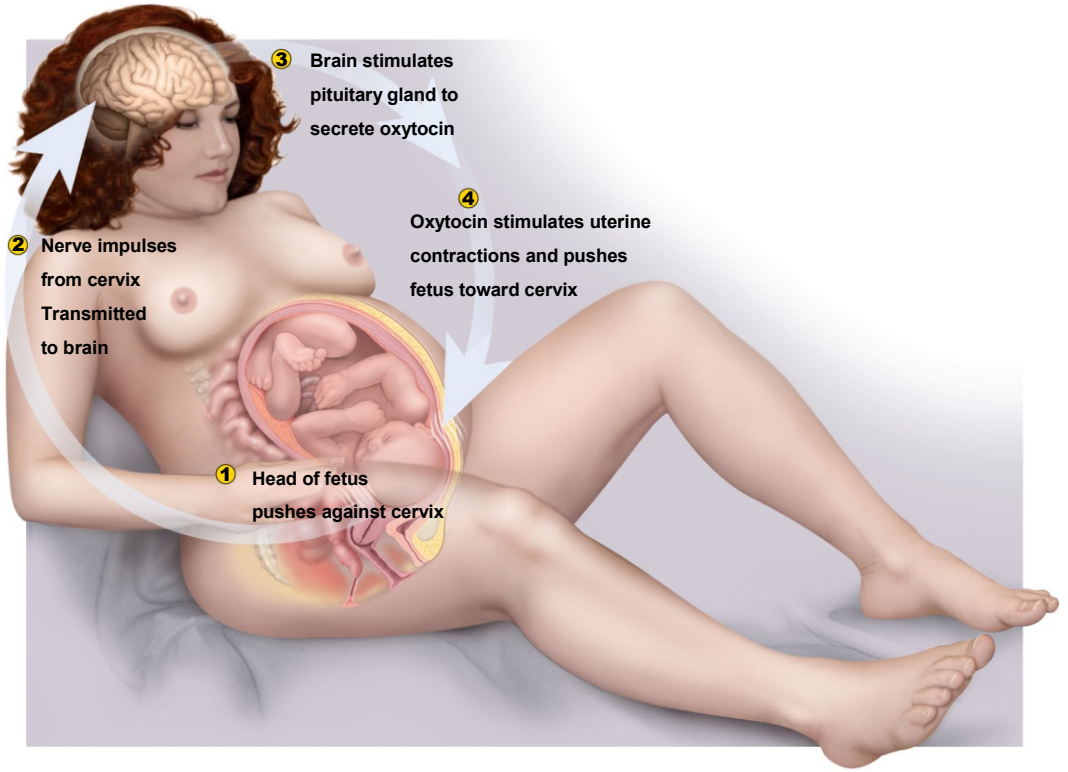


Figure 1.12

Harmful Positive Feedback Loop

- **Fever > 104 degrees F**
  - metabolic rate increases
  - body produces heat even faster
  - body temperature continues to rise
  - further increasing metabolic rate
- Cycle continues to reinforce itself
- Can becomes fatal