


Uca panacea; by M. Wicksten

Animal form and function

Interdependent essentials

Lecture outline

- Overview + tissues
- Homeostasis
- Thermoregulation
- Size vs. metabolism

Macrochelys temminckii; by R. Barnes

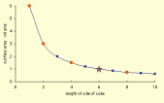
Interacting with the environment

- Being "successful" biologically requires organisms to relate to their environment
- They must
  - Collect essential resources
  - Get rid of wastes
  - Maintain a balance between gains and losses
- Evolution has shaped these interactions by selecting for structures and modifying physiological processes that increase fitness

Opportunities for exchange–small

- Being small or "exposed" has some advantages when interacting with the environment

	Small	Large
SA / Vol.	Hi or Low?	Hi or Low?



http://www.tiem.utk.edu/~gross/bioed/bealsmodules/area_volume.html

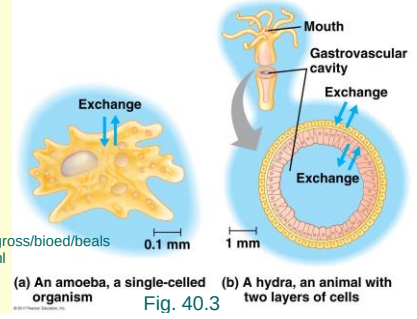


Fig. 40.3

Opportunities for exchange–big

- Internal exchanges
- **Tissues** and systems

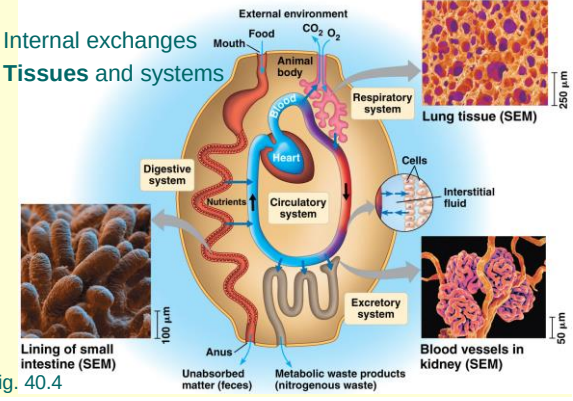


Fig. 40.4

Types of tissues

- **Epithelial**
  - Sheets of cells covering body and lining organs and body cavities—an important barrier and site of exchange
- **Connective**
  - Bind and support other tissues
- **Muscle**
  - Contract to allow movement
- **Nervous**
  - Sense the environment and transmit these stimuli in body

Epithelial tissue

- Sheets of tightly packed cells attached to a basement membrane
- Classified based on
  - Cell shape
    - Cuboidal
    - Columnar
    - Squamous
  - Number of layers
    - Simple: one
    - Stratified: multiple
    - Pseudostratified: one of varying height



Epithelium

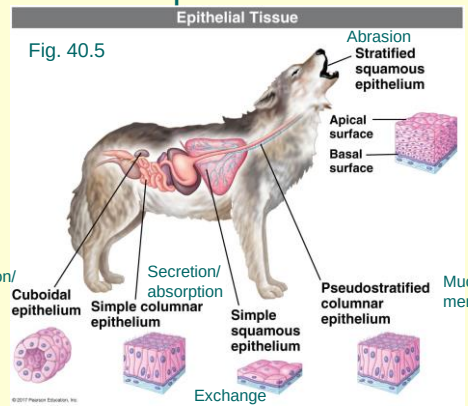


Fig. 40.5

Connective tissues

- Sparse cells scattered in an extracellular matrix
- Types
  - Loose connective tissue (hold organs in place)
  - Fibrous connective tissue (tendon, ligaments)
  - Mineralized connective tissue (bone)
  - Cartilage
  - Adipose (fat)
  - Blood

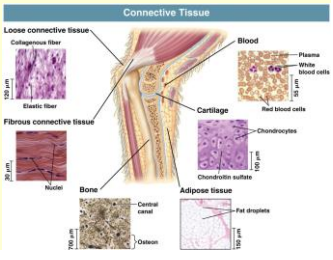


Fig. 40.5

Muscle tissue

- Filaments of the proteins actin and myosin that allow for movement by contracting
- Three types differing in structure and control

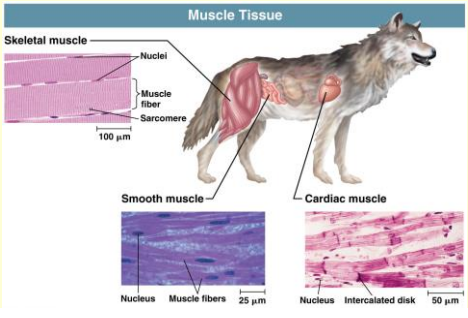


Fig. 40.5

Nervous tissue

- Brain, nerve cord, and nerves receive and transmit stimuli
- Neurons made of axon, cell body, dendrites
- Glial cells support neuron activity

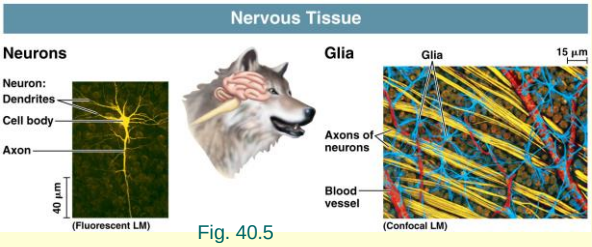


Fig. 40.5

Homeostasis and thermoregulation

- Maintaining internal conditions in a "*steady state*" in the face of environmental change is a major task of life
- One way to think about it:
  - **Regulators** vs. **conformers**
- What does each group have to do to be successful?

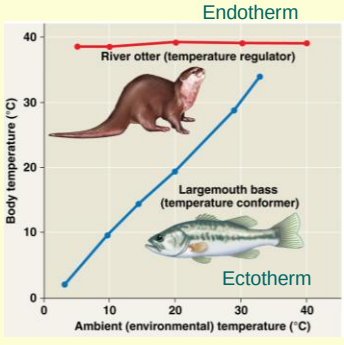


Fig. 40.7

Regulation: negative feedback

- A very common system to keep relatively constant internal conditions
- Negative feedbacks refer to?
- What is a positive feedback?
- Which type *diminishes* the stimulus and which type *amplifies* the stimulus?

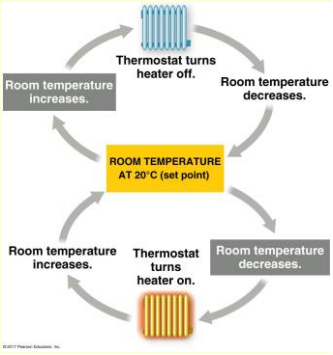


Fig. 40.8

Balancing gains and losses

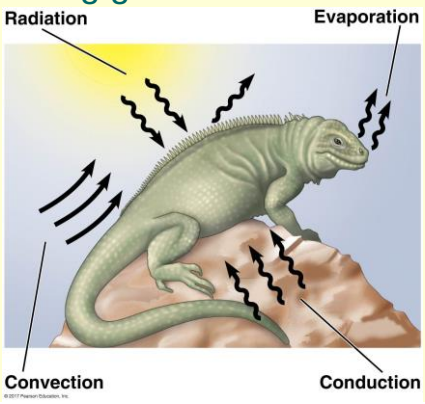


Fig. 40.12

Some adaptations (1)

- Behavioral

Fig. 40.15

Male emperor penguins in Antarctica

Some adaptations (2)

- Countercurrent heat exchanger

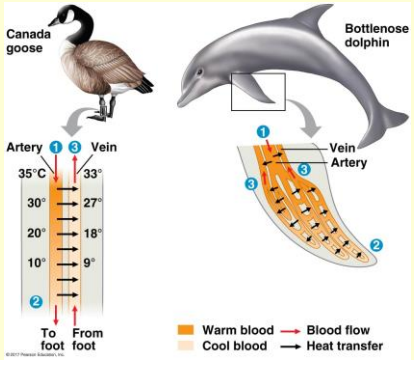


Fig. 40.13

Humans

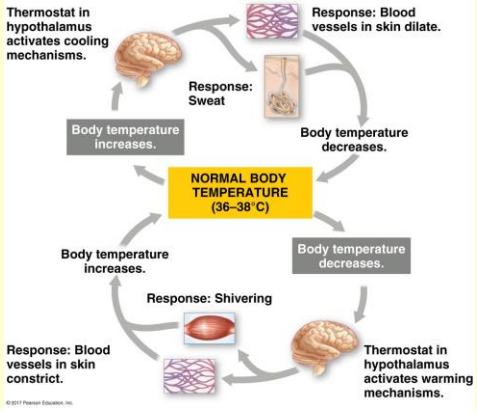


Fig. 40.18

Metabolism produces heat

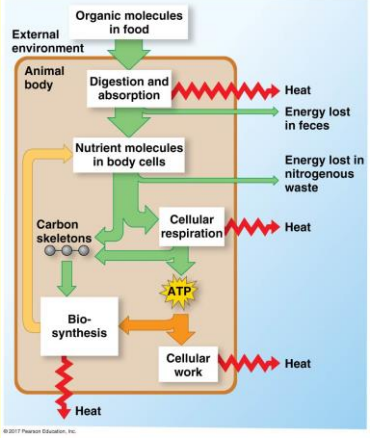


Fig. 40.19

Size vs. basal metabolic rate (1)

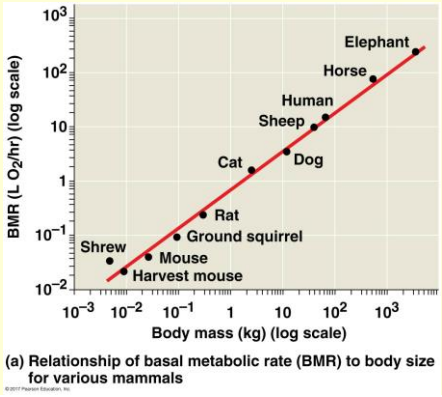


Fig. 40.21a

Size vs. basal metabolic rate (2)

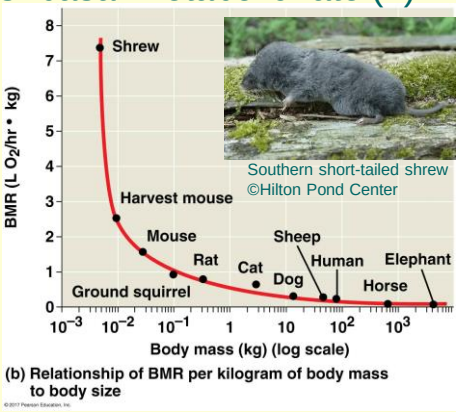


Fig. 40.21b

Energy budgets reveal costs of life