Homeostasis:

Definition: the steady-state environment of the body.

In particular, we are interested in how this steady-state is maintained.

If the internal environment changes too much, it can be fatal.

Example - you're thirsty. Why? Some receptor somewhere senses your need for water. Why? Because your body needs water to maintain a steady salt balance.

Example - you're hot. Response? Take off excess clothes, sweat, fan yourself, etc. Why? Because an increase in body temperature can be dangerous.

Obviously, there are many other examples. Most of what we'll do here is to look at temperature regulation. Other examples are interspersed throughout the rest of the "organ systems" we'll be looking at.

Temperature regulation:

Heat can be exchanged by **[Fig. 25.2, p. 506]**

- conduction. Heat is conducted from one structure to another.
  Example: getting into a hot bathtub. Heat goes from water to you. Similarly, picking up heat from surrounding structures such as a hot rock.

- convection. Movement of air or water past body surface.
  Example: Wind-chill is caused by wind sucking heat out body **[Fig., not in book]**.

- radiation. Electro-magnetic waves coming from a warm substance to body.
  Example: it's hotter in the sun than in the shade.

- evaporation. Evaporation of water from body surface causes cooling.
  Example: Feeling cold coming out of a pool or shower. Humans are very efficient at this - one of the few animals with sweat glands over most of the body surface (horses are another example).

Some terminology describing how an animal adapts to or regulates temperatures.

ectotherm - heat is absorbed from environment. Little or no internal mechanism for controlling body temperature.

endotherm - heat is generated by organism. Organism can (within limits) control internal body temperature regardless of environmental temperature.

poikilotherm - body temperature varies a lot.

homeotherm - body temperature is reasonably steady.

In general, cold-blooded and warm-blooded are terms that everyone understands right away, even though they may not be that accurate.

Some behavioral and physiological methods to adapt to temperature changes:

Behavioral - kind of obvious (if hot, get out of the sun, or be active at night, etc.)

- don't underestimate the importance of this.

Physiological:

- regulate blood flow to skin
- sweat
- shiver
- counter current systems (this will be explained later)

Here is a specific example of some of the above in endotherms:

[Fig. 20.15, p. 426] - hypothalamus reacts to small changes in body temperature.

response to cold - constrict skin capillaries and start shivering.

response to heat - dilate skin capillaries and activate sweat glands.

Some specific methods by which animals adapt to hostile temperatures:

If endothermic, animal will need a consistent supply of high-energy food even in bad climates. One reason so many animals may starve during winter.

Another possibility - hibernate. When an endotherm hibernates, it's body temperature and metabolism drop drastically. Thus it needs very little food and can usually survive off of stored energy reserves (fat). Incidentally, a surprising conservation problem is bats in winter (explain)!

Bears - not true hibernation state (e.g., their body temperature doesn't drop that much), but do have many of the physiological adaptations that allow them to survive, including a high tolerance for metabolic wastes in the blood.

If ectothermic, animal enters a "hibernation" stage almost automatically. When temperatures drop below a certain level, metabolism and food requirements are lowered automatically. There comes a point when behavioral adjustments are no longer adequate, and the animal will seek out a sheltered location in which to spend the winter.