

PowerLecture:  
Chapter 28  
Plants and Animals – Common Challenges  
Section 28.0: Weblinks and InfoTrac

**See the latest Weblinks and InfoTrac articles for this chapter online or click highlighted articles below (articles subject to change)**

- Section 28.0: Consumer Focus—Beat the Heat
  - Section 28.0: Heat Illness—A Handbook for Medical Officers
  - Section 28.0: Heat Relief: How to Keep Cool When the Sun Is Melting the Rocks. Tom Shealey. *Backpacker*, Aug. 1993.
- How Would You Vote?
- The following is the question for this chapter. See national results below.
- Should a Coach Be Held Responsible if a Player Dies of Heatstroke?

Impacts, Issues: Too Hot To Handle

- Homeostasis – state in which the body’s internal environment is kept within a range that its cells can tolerate
- Understanding of homeostasis is crucial to our health

Impacts, Issues: Too Hot To Handle

- 2001 – Korey Stringer, a football player for the Minnesota Vikings, collapsed from heat stroke
- He had been practicing in full uniform in extremely hot, humid weather
- His temperature control mechanisms were overwhelmed causing his bodily functions to falter

Impacts, Issues: Too Hot To Handle

- Anatomy – the study of body form
- Physiology - the study of how an individual survives and reproduces in the environment
- Relationship: regardless of species, a body part almost always gives rise to a present or past function

Section 28.1: Weblinks and InfoTrac

See the **latest Weblinks** and **InfoTrac articles** for this chapter online or click highlighted articles below (articles subject to change)

- Section 28.1: [American Society of Plant Biologists](#)
- Section 28.1: [Virtual Foliage Image Collections](#)
- Section 28.1: [Dream Anatomy](#)
- Section 28.1: [The Relationship of Cell and Organism in Vascular Plants. Donald Kaplan et al. \*BioScience\*, Nov. 1991.](#)
- Section 28.1: [Follow That Food \(plant roots\). Gail Vines. \*New Scientist\*, May 27, 2000.](#)

#### Living the High Life

- At high elevations, oxygen is scarce
- Barheaded goose has hemoglobin that binds oxygen more tightly than human hemoglobin
- What's the difference? A single amino acid substitution

#### Living the High Life

- At high elevations, UV radiation and winds are intense
- *Leontopodium alpinum* forms short, tight, cushions
- Flowers are covered with wooly hairs that protect against UV and help retain moisture

#### Anatomy and Physiology

- Anatomy is the study of an organism's form
- Physiology is the study of how the body functions
- Some aspects of anatomy and physiology are adaptations to past or present environmental conditions

#### Levels of Organization

Bodies of multicelled organisms  
show division of labor

- Tissues
- Organs
- Organ system

#### Growth and Development

- Growth is an increase in the number, size, and volume of cells
  - Quantitative
- Development refers to successive stages in the formation of specialized tissues, organs, and organ systems
  - Qualitative

### Evolutionary History

- Land plants and land animals arose from aquatic ancestors
- Both face new challenges in the drier environment
- Their form and physiology are answers to these challenges

### Homeostasis

- Maintaining a stable internal environment
- Cells are filled with and bathed in fluid
- Extracellular fluids are an internal environment
- Both plants and animals must maintain stable fluid environments for all living cells

### Section 28.2: Weblinks and InfoTrac

**See the latest Weblinks and InfoTrac articles for this chapter online or click highlighted articles below (articles subject to change)**

- Section 28.2: College Physics for Students of Biology and Chemistry
- Section 28.2: Biomechanics
- Section 28.2: Plants, Animals, and the Evolutionary Path
- Section 28.2: Built to Scale (organisms). Peter Weiss. *Science News*, Oct. 16, 1999.
- Section 28.2: An Engineer's Eye Helps Biologists Understand Nature. Bruce Fellman. *Smithsonian*, July 1989.
- Section 28.2: Principles of Design of Fluid Transport Systems in Zoology. Michael LaBarbera. *Science*, Aug. 31, 1990.

### Recurring Challenges

- All plants and animals must accomplish certain tasks
- Gas exchange
- Internal transport
- Maintaining solute-water balance
- Integrating signals

### Long-Term Adaptation

- A heritable aspect of form, function, behavior, or development that contributes to the fit between an individual and its environment
- Salt-tolerant tomatoes
- Desert oryx

### Adaptation to What?

- Not all traits are adaptations to present environment
- Camel and llama have hemoglobin with high affinity for oxygen
- Only the llama lives at high altitudes
- Hemoglobin is not an adaptation to high altitude

#### Surface-To-Volume Ratio

- Internal transport in large bodies
- As multicelled species grow, their volume increases in three dimensions, but their surface area only increases in two

#### Defining Fluids

- Fluid inside and outside of animal cells
- Fluid outside of cells is extracellular fluid
  - Interstitial fluid lies between cells
  - Plasma is the fluid portion of the blood

#### Fluid Balance

- Changes in extracellular fluid cause changes in cells
- The component parts of every animal work to maintain a stable fluid environment for living cells

#### Variations

- Challenges differ among habitats
- Physical resources vary
  - Water
  - Nutrients
  - Temperature
- Biological components vary
  - Predators
  - Competition

#### Variations

Despite all this diversity, we still see similar responses to similar challenges

#### Section 28.3: Weblinks and InfoTrac

**See the latest Weblinks and InfoTrac articles for this chapter online or click highlighted articles below (articles subject to change)**

- Section 28.3: Regulation of Biological Systems
- Section 28.3: Body Fluids
- Section 28.3: Blood, the Ocean within
- Section 28.3: What's up with Biofeedback? Richard Holicky. *Paraplegia News*. Feb. 1998.

- Section 28.3: The Doctrine of the Three Humors in Traditional Indian Medicine. Hartmut Scharfe. *The Journal of the American Oriental Society*, Oct.–Dec. 1999.

#### Homeostasis

- Stable operating conditions in the internal environment
- Three components interact

#### Negative Feedback

- Some activity alters a condition in the internal environment
- Alteration triggers a response
- Response reverses the altered condition

#### Positive Feedback

- Some activity alters the internal environment
- The alteration triggers a response
- The response intensifies the change in the internal condition

#### Section 28.4: Weblinks and InfoTrac

**See the latest Weblinks and InfoTrac articles for this chapter online or click highlighted articles below (articles subject to change)**

- Section 28.4: NOVA—Methuselah Tree
- Section 28.4: Tree Decay—An Expanded Concept
- Section 28.4: Plants in Motion
- Section 28.4: Lucid Gems of Ancient Life. Louis Werner. *Americas (English Edition)*, Sept. 2000
- Section 28.4: Plants Bite Back. Ingfei Chen. *Science News*, Dec. 22, 1990.
- Section 28.4: The Chemistry of Conifers Is Complex and Challenging. John Manville. *Canadian Chemical News*, Apr. 1992.

#### Compartmentalization

- Plant response to a wound or pathogen
- Walls around area thicken
- Toxins and resins are produced at site
- Tree species vary in their responses
- Strong response can stop an infection

### Leaf-Folding in Lupine

- Leaves of the yellow bush lupine make a homeostatic response to environment
- Leaves fold during strong winds and during hottest part of day
- Folding reduces evaporative water loss

### Rhythmic Leaf Folding

- A circadian rhythm
- Bean plant spreads leaves during day, folds them in at night
- Leaf movements persist even in complete darkness
- May help plant maintain temperature at night

### Section 28.5: Weblinks and InfoTrac

**See the latest Weblinks and InfoTrac articles for this chapter online or click highlighted articles below (articles subject to change)**

- Section 28.5: Focus on Cell Death
- Section 28.5: Apoptosis—Dance of Death
- Section 28.5: Apoptosis in the Pathogenesis and Treatment of Disease. Craig Thompson. *Science*, Mar. 10, 1995.

### Cell Communication

- Molecular mechanisms
- Activation of a receptor
  - Usually membrane protein
- Transduction of the signal
- Functional response

### ABC Model

- Three groups of genes are master switches for floral development
- Genes encode factors that govern transcription of other genes
- Products of those genes reprogram the mass of dividing cells to form floral components

### Apoptosis

- The process of programmed cell death

### Apoptosis

- When Apoptosis fails:

## Vertebrate Nervous System

- When receptors on neurons bind a signaling molecule, ion channels open
- Ions flow across the membrane, changing the charge
- Signal is self-propagating
- Multiple sclerosis interferes with signaling