

PowerLecture:  
Chapter 5  
A Closer Look at Cell Membranes

Section 5.0: Weblinks and InfoTrac

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

- Section 5.0 : Cystic Fibrosis Web Ring
- Section 5.0 : Cystic Fibrosis Foundation
- Section 5.0 : The Cystic Fibrosis Page
- Section 5.0 : Cystic Fibrosis (seminar). Felix Ratjen et al. *The Lancet*, Feb. 22, 2003.
- Section 5.0 : Structure and Function of the CFTR Chloride Channel. David Sheppard et al. *Physiological Reviews*, Jan. 1999.
- Section 5.0 : Cystic Fibrosis: Towards the Ultimate Therapy, Slowly. *The Lancet*, Nov. 17, 1990.

How Would You Vote?

The following is the question for this chapter. See national results below.

Should we encourage all prospective parents to be screened for the CF gene?

Impacts, Issues: One Bad Transporter and Cystic Fibrosis

- CFTR is a protein channel for chloride ions
- CFTR is a type of ABC transporter in all prokaryotic and eukaryotic cells

Impacts, Issues: One Bad Transporter and Cystic Fibrosis

- Cystic fibrosis, the most common fatal genetic disorder in the U.S., results from a mutation in CFTR gene

Section 5.1: Weblinks and InfoTrac

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

- Section 5.1: Biology Project: Cell Membrane Tutorial
- Section 5.1: NetBioChem: Membranes

➤ Section 5.1: The Role of Lipid Physical Properties in Lipid Barriers. Allen Gibbs. *American Zoologist*, Apr. 1998.

➤ Section 5.1: Revisiting the Fluid Mosaic Model of Membranes. *Science*, June 9, 1995.

Lipid Bilayer

- Cell membranes consist of a lipid bilayer containing different proteins
- Membrane is a continuous boundary layer that selectively controls the flow of substances across it

Lipid Bilayer

Fluid Mosaic Model

- Every cell membrane has a mixed composition of phospholipids, glycolipids, sterols, and proteins

Fluid Mosaic Model

Studying Membranes

Studying Membranes

Section 5.2: Weblinks and InfoTrac

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

➤ Section 5.2: Membrane Proteins of Known Structure

➤ Section 5.2: Controlling Life's Gateway; Opening and Closing Cell Membranes on Demand. Richard Lipkin. *Science News*, Sept. 24, 1994.

➤ Section 5.2: Membrane Protein Holds Photosynthetic Secrets. Roger Lewin. *Science*, Nov. 4, 1988.

Overview of  
Membrane Proteins

Overview of  
Membrane Proteins

Transport Proteins

- Span the lipid bilayer
- Interior is able to open to both sides
- Change shape when they interact with solute
- Play roles in active and passive transport

Section 5.3: Weblinks and InfoTrac

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

➤ Section 5.3: Lab Books: Diffusion, Osmosis, and the Nernst Equation

➤ Section 5.3: Diffusion, Osmosis, and Cell Membranes

➤ Section 5.3: Regulating Cell Volume. Florian Lang et al. *American Scientist*, Sept.–Oct. 1997.

➤ Section 5.3: Life Puts Random Motions to Work. Ronald Fox. *World and I*, Oct. 2001.

#### Concentration Gradient

➤ Means the number of molecules or ions in one region is different than the number in another region

➤ In the absence of other forces, a substance moves from a region where it is more concentrated to one where it's less concentrated - "down" gradient

#### Diffusion

➤ The net movement of like molecules or ions down a concentration gradient

➤ Although molecules collide randomly, the net movement is away from the place with the most collisions (down gradient)

#### Diffusion

#### Diffusion

#### Factors Affecting

#### Diffusion Rate

➤ Steepness of concentration gradient

- Steeper gradient, faster diffusion

➤ Molecular size

- Smaller molecules, faster diffusion

➤ Temperature

- Higher temperature, faster diffusion

➤ Electrical or pressure gradients

#### Membrane Crossing Mechanisms

#### Diffusion across lipid bilayer

#### Passive transport

#### Active transport

#### Endocytosis

#### Exocytosis

#### Cell Membranes Show Selective Permeability

#### Membrane Crossing: Overview I

#### Membrane Crossing: Overview II

#### Section 5.4: Weblinks and InfoTrac

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

➤ Section 5.4: Nobel Prize, 1991, Phys. & Medicine

➤ Section 5.4: Ion Channels, Patch Clamp, & Electrophysiology Resources

➤ Section 5.4: Ion Channels: This Year's Nobel Prize in Physiology or Medicine. David Colquhoun. *British Medical Journal*, Oct. 19, 1991.

➤ Section 5.4: Border Control. James Kingsland. *New Scientist*, July 15, 2000.

#### Passive Transport

➤ Flow of solutes through the interior of passive transport proteins down their concentration gradients

➤ Passive transport proteins allow solutes to move both ways

➤ Does not require any energy input

#### Passive Transport

#### Active Transport

➤ Net diffusion of solute is against concentration gradient

➤ Transport protein must be activated

➤ ATP gives up phosphate to activate protein

➤ Binding of ATP changes protein shape and affinity for solute

#### Active Transport

➤ ATP gives up phosphate to activate protein

➤ Binding of ATP changes protein shape and affinity for solute

#### Active Transport

#### Section 5.5: Weblinks and InfoTrac

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

➤ Section 5.5: Scientists Identify Filtering Agents in Cells. Stem Cell Week, Jan 7 2002 p5.

#### Osmosis

➤ Diffusion of water molecules across a selectively permeable membrane

#### Tonicity

Refers to *relative* solute concentration of two fluids

Hypotonic - having fewer solutes

Hypertonic - having more solutes

Isotonic - having same amount

#### Tonicity and Osmosis

#### Pressure and Osmosis

➤ Hydrostatic pressure

● Pressure exerted by fluid on the walls that contain it

● The greater the solute concentration of the fluid, the greater the hydrostatic pressure

- Osmotic pressure
  - Amount of pressure necessary to prevent further increase of a solution's volume

Increase in Fluid Volume

Section 5.6: Weblinks and InfoTrac

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

- Section 5.6: Receptor Mediated Endocytosis
- Section 5.6: The Ins and Outs of Endocytosis
- Section 5.6: Cellular Secretion: It's in the Pits. Michelle Hoffman. *American Scientist*, March–April 1997.
- Section 5.6: Phagocytosis and the Inflammatory Response (macrophages). Alan Aderem. *Journal of Infectious Diseases*, June 15, 2003.
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#### Endocytosis and Exocytosis

- Exocytosis: A cytoplasmic vesicle fuses with the plasma membrane and contents are released outside the cell
- Endocytosis: A small patch of plasma membrane sinks inward and seals back on itself, forming a vesicle inside the cytoplasm – membrane receptors often mediate this process

Endocytosis of cholesterol  
Macrophage engulfing *Leishmania mexicana*

How Proteins Get to the Surface  
Contractile Vacuole