LEcTUrE 1
January 3, 2005
Lecture Title: **Biological Membranes: Composition and Basic Principles**
Lecturer: Dr. Steven Fliesler
Office: ABI 506; Phone: 256-3252; Email: fliesler@slu.edu

Reading: 1. Alberts et al., *Molecular Biology of the Cell* (4th Ed., 2002)- Chapt. 1, p. 11; Fig. 1-31 (p. 29); Chapt. 2, pp. 61-62; Chapt. 10, pp. 583-590, 592-593.
2. Lecture handout

**Additional References** (not required reading):


**Main concepts**: Compartmentalization in eukaryotic cells; functions of biological membranes; classes of molecular constituents of membranes; chemical structures and nomenclature of lipids; the "hydrophobic effect" and spontaneous assembly of ordered lipid-water systems.

LEcTUrE 2
January 4, 2005
Lecture Title: **Biological Membranes: Historical Perspective and the “Fluid Mosaic” Model**
Lecturer: Dr. Steven Fliesler

Reading: 1. Lecture handout
Main concepts: Membrane models: theory, methods, and historical development; the “fluid mosaic” model; asymmetry of membrane lipids and proteins; dynamics of membrane lipids and proteins (part 1).

LECTURE 3
January 5, 2005
Lecture Title: Biological Membranes: Higher-order structure, and modern biophysical approaches to membrane dynamics
Lecturer: Dr. Steven Fliesler

Reading: 1. Lecture handout.

Additional References (not required reading):


Main concepts: RBC “ghosts”-- composition and architecture; dynamics of membrane lipids and proteins (part 2): restrictions to lateral mobility of lipids and proteins (how “fluid” is fluid?); membrane microdomains (part 1).

LECTURE 4
January 6, 2005
Lecture Title: Biological Membranes: Membrane Domains and Methods of Membrane Isolation and Characterization
Lecturer: Dr. Steven Fliesler

Reading: 1. Lecture handout
2. Alberts et al., Molecular Biology of the Cell (4th Ed., 2002)- Chapt. 10, pp. 589-590; Chapt. 13, Fig. 13-63 (p. 764) and pp. 748-749; Chapt. 8, pp. 478-491.

Additional References (not required reading):

Main concepts: Caveolae and “rafts”; techniques and practical considerations for isolation and characterization of subcellular membrane fractions and membrane microdomains.

LECTURE 5
January 7, 2005
Lecture Title: Cellular Ultrastructure- An Overview
Lecturer: Dr. Jan Ryerse
Office: R514 Doisy; Phone: 977-7848; Email: ryersejs@slu.edu

Reading: Lecture handout (to be distributed in class)

Additional References (not required reading):

Main concepts: Review of the ultrastructure and function of the major cellular organelles and structures as a prelude to the cell membrane and cell signaling lectures to follow.
OPTIONAL  Electron Microscope Demonstration

‘ed, students can schedule an individual session with Dr. Ryerse at the transmission electron microscope and the scanning electron microscope. With supervision, students can turn on the microscopes, insert samples and observe first-hand some of the organelles and cell structures described in class. Contact Dr. Ryerse if interested.

LECTURE 6
January 10, 2005
Lecture title: Organelle membrane dynamics visualized in living cells
Lecturer: Dr. Peggy Weidman
Office: Schvitalla M176; Phone: 977-9284; e-mail: weidmanp@slu.edu


Additional References (not required reading):

Main concepts: Expression of green fluorescent protein chimeras allows direct observation of membrane dynamics in living cells; The extension, retraction and detachment of membranous tubules is a prominent feature of organelle membrane dynamics; Organelle membrane dynamics are intimately-linked to cytoskeletal elements and molecular motors; Membrane fusion events are more complex than simple docking and fusion: the “hover, kiss and run” phenomena.

LECTURE 7
January 11, 2005
Lecture title: The role of lipid modifications in membrane dynamics
Lecturer: Dr. Peggy Weidman

Additional References (not required reading):

Main concepts: Phosphatidylinositol (PI), PI-transfer proteins, and PI-kinases/phosphatases are key regulators of membrane trafficking; Modification of phospholipids by phospholipase D, phospholipase A2, and phospholipid acyltransferases are directly implicated in modulation of bilayer curvature.

LECTURE 8
January 12, 2005
Lecture: Membrane Transport
Lecturer: Dr. W.K. Samson
Office: C207A; Phone: 977-8677; Email: samsonwk@slu.edu

Required reading: Guyton and Hall: Textbook of Medical Physiology (Tenth Edition), Chapter 4 “Transport of Substances Through the Cell Membrane”, pp. 40-50

Main Concepts:
• Understand the chemical composition of the intra- and extracellular spaces
• Understand the following basic mechanisms of transport  
  o Simple and facilitated diffusion
  o Primary and secondary active transport
  o Transport across tissue sheets

LECTURE 9
January 13, 2005
Lecture: Body Fluid Compartments and Fluid Shifts
Lecturer: Dr. W.K. Samson


Main Concepts:
  o Where is the water?
  o Understand how fluid is exchanged between intra- and extracellular spaces.
  o Be able to compute fluid shifts during resuscitation.
**LECTURE 10**  
January 14, 2005  
Lecture title: The Resting Membrane Potential  
Lecturer: Dr. Terry Egan  
Office: M364; Phone: 977-6429; E-mail: egantm@slu.edu  
Main concepts: Permeability, Separation of Solutes and Charges, Nernst Potential, Goldr Hodgkin-Katz Equation  

**NOTE:** NO LECTURE Mon. JAN. 17 - Martin Luther King Day- HOLIDAY

**LECTURE 11**  
January 18, 2005  
Lecture title: Ion Channels and Electrophysiological Techniques  
Lecturer: Dr. Terry Egan  
Main concepts: Characteristics of Ion Channels, Gating Kinetics, Basic Structure, Techniques (extracellular, microelectrode, patch electrode) and Preparations (neuromuscular junction, axon, squid giant synapse); Macroscopic versus single channel currents.

**LECTURE 12**  
January 19, 2005  
Lecture title: Local Signaling: Electrical Properties of the Neuron  
Lecturer: Dr. Terry Egan  
Main concepts: Equilibrium potential; Passive membrane properties; Input resistance, capacitance, myelination

**LECTURE 13**  
January 20, 2005  
Lecture title: The Action Potential and The Presynaptic Element  
Lecturer: Dr. Terry Egan  
Reading: Kandel, Schwartz, Jessell (eds.) *Principles of Neural Science*, Fourth Edition,

Main concepts: Ion conductances underlying the action potential; Regenerative current; Distribution of ion channels; Role of calcium; Fluorescent probes for direct measurement intracellular calcium; Modulation of the shape of the action potential; Electrical versus chemical synapses

LECTURE 14
January 21, 2005
Lecture title: Structure and function of ion channels
Lecturer: Dr. Terry Egan


Main concepts: Atomic structure and function of a potassium selective ion channel.

LECTURE 15
January 24, 2005
Lecture title: Synaptic Transmission (Part I)
Lecturer: Dr. Terry Egan


Main concepts: Neurosecretion; Synaptic vesicles; Exocytosis; Techniques (capacitance, electrochemical detection, fluorescent probes); Synaptic transfer; Postsynaptic current; Reversal potential; Relationship between transmitter release and calcium current; “On” and “Off” responses

LECTURE 16
January 25, 2005
Lecture Title: Post-Synaptic Function (Part I)
Lecturer: Dr. Mickey Ariel
Office: M407; Phone: 977-8050; E-mail: arielm@slu.edu


Main concepts: Anatomy of the synapse: electrical versus chemical boutons and/or varicosities, axodendritic but also dendrodendritic, dense-core versus clear (flat and round) vesicles; Physiology of synapse: Review of presynaptic release, synaptic delay: electric synapse versus chemical synapse; Postsynaptic sequence of action

LECTURE 17
January 26, 2005
Lecture Title: Post-Synaptic Function (Part II)
Lecturer: Dr. Mickey Ariel


Main concepts: Neurotransmitters and cessation of their effect; Gated-gated ionotropic cell surface receptors; Metabotropic receptors; Review of synaptic reversal potentials

LECTURE 18
January 27, 2005
Lecture Title: Post-Synaptic Function (Part III)
Lecturer: Dr. Mickey Ariel


Main concepts: Excitatory versus inhibitory synapses; Synaptic integration; Review of membrane properties; Temporal summation; Spatial summation

LECTURE 19
January 28, 2005
Lecture Title: Post-Synaptic Function (Part IV)
Lecturer: Dr. Mickey Ariel


Main concepts: Synaptic plasticity; normal instantaneous variability in time; short-term changes in postsynaptic responsiveness; long-term changes in synaptic strength; retrograde signaling and long-term presynaptic changes

MONDAY, JANUARY 31--- SECTION 6 EXAMINATION
(9:00am- 12 noon) LRC Classrooms 105A/B & 106A