Lecture 9 Learning Objectives

Understand, know, focus on, or note:

- the meaning of passive transport (simple passive diffusion
- that substances try to disperse in a solution from a local high concentration to a lower even concentration
- that high concentrations on one side of a membrane will flow to the other side as part of a dispersal to an equilibrium
- that permeability of substances across a membrane is dependent on their chemistry: polar & charged substances do not cross, but lipophilic do
- pH dependence: some substances can acquire or lose charge (by taking on or losing H^+ ions) depending on solution pH, and this affects their permeability across a membran
- the properties of H_2O, and how it moves (osmosis) to surround and keep dissolved polar and charged substances
- what the tonicity of a solution is, and why it is related to osmosis, what hypertonic and hypotonic solutions can do to cells if rapid osmosis occurs in either direction
- what simple passive transport/diffusion is
- what facilitated passive transport/diffusion is
- what a channel protein is
- what a carrier protein is
- how proteins can be gated and controlled by membrane voltages or by ligands

Lecture 10 Learning Objectives

Understand, know, focus on, or note:

- the fundamental concept of active transport and how ATP is involved
- direct versus coupled (indirect) active transport
- what substances are transported this way
- types of pumps (ATPases): where they are and what role they play
- what the ABC-type ATPases are & what they do
- the mechanism of the Na/K ATPase (P-type protein) and what regulates it

Lecture 11 Learning Objectives

Understand, know, focus on, or note:

- what a resting membrane voltage is, how it is generated in all cells by the pumping and transport of ions across cell membranes
- how both a chemical potential (chemical concentration difference) creates an electrical potential (voltage) across a cell membrane
- how an action potential in excitable cells is made possible by the resting membrane potential and the movement of ions across the membrane
- how the action potential radiates over the surface of a membrane to create the nerve impulse
- the importance of the Na/K pump in secondary (coupled) transport, with Na/glucose and Na/Ca transporters as examples
- the role of calcium in the cell and why calcium regulation depends on the Na/K pump
- diseases and disorders that can be observed clinically that are related ultimately to poor function of the Na/K pump

Midterm Example Questions

Which kind of transport mechanism works on a substance dispersing itself from high concentration to low but requires a transport protein to get through the membrane?

a. Simple passive diffusion/transport
b. Facilitated diffusion/transport
c. Coupled active transport
d. Direct active transport
e. None of the above

Consider the Na+/K+ ATPase pump:
(a) How many Na^+ ions does it pump in one cycle and in what direction across the membrane?
(b) How many K^+ ions does it pump in one cycle and in what direction across the membrane?
(c) How many ATP molecules does it use in one cycle and from which side of the membrane does it use it?
(d) Why does it pump these ions and what is the role of ATP?