Lecture 5 Learning Objectives

- 3 lipid classes were discussed: know the names and their function or purpose
- Know the structure of the fatty acid (two parts) and be able to understand the basic chemistry
- Unsaturated and saturated FAs: what it means to structure and what role it plays in the cell membrane
- What does this mean: C16:0 or C18:1?
- The molecule glycerol: what role does it play? A triglyceride is composed of glycerol and 3 fatty acids. What role do TGs play in cell/organismal biology?
- If asked what a "polar lipid" is, could you simply describe it?
- What is a phospholipid? How does it differ from the chemical nature of a triglyceride?
- Be able to simple describe what a phospholipid bilayer is
- Know how to describe a micelle and a liposome
- Understand what cholesterol does for cell membranes
- Lipoproteins: where are they found? Know the composition of their three layers: where are the triglycerides, esters of cholesterol apolipoproteins, phospholipids, free (i.e. unesterified) cholesterol
- Know the different lipoproteins: chylomicron, VLDL, …, HDL. Know the relationship in size and why size goes down (you don't need to know the actual size in numbers)
- Lipoprotein lipase: know where it is found and what it does to affect the density of lipoproteins
- Know that apoliprotein B is on the LDL and it binds to cells with LDL receptors that take it in a break it down
- HDL: know why it is "good"→ it is because it can collect TGs and cholesterol from cells, and transport them back to the liver, where the lipids are exported to bile and excreted
- Atherosclerosis: understand the injury hypothesis: (1) endothelial cells get injured (2) immune cells (granulocytes like neutrophils) come in and create harsh chemicals, and these harsh chemicals reacts with the molecules in LDL to oxidize the lipids, causing them to be deposited to vessel walls, creating a clog

In none of the concepts above do you really need to draw chemical structures, but rather explain what chemical components make up things that are formed by being bonded together. If you can draw chemical structures, great, but it's not required.

Lecture 6 Learning Objectives

- Be able to describe the "fluid mosaic" model of the cell membrane. What is the "fluid" part? What is the "mosaic" part?
- What are the 3 major lipids of the animal cell membrane?
- Know that flipping of a phospholipid occurs rarely, but there are enzymes that can restore phospholipids to the correct place (facing the cytoplasm or facing the outside)
- Be able to describe the parts of a glycolipid (oligosaccharide attached to glycerol, with two fatty acids attached to the other two glycerol carbons) and that it is a polar lipid and that it has two purposes. In the membrane bilayer, the glycolipids are positioned on the layer that is NOT the layer that contacts the cytoplasm (the intracellular layer)…they are on the extracytoplasmic layer…the layer opposite the cytoplasm (slide corrected)
- Cholesterol: 20% of lipid of membrane, has a single polar group in the molecular structure, and it makes the membrane less fluid ("hardens" it)
- Proteins in the membrane: half of the membrane mass, diffuse in the membrane in the plane of the membrane, and classed in two ways (what are they?)
- What is an integral membrane protein? Describe the transmembrane segment.
- What is a peripheral membrane protein? In what way can it hold itself to the membrane if it does not penetrate the membrane bilayer?
- Be able to define/describe at least three of the five membrane protein types discussed
- Glycoproteins are made of two types of molecules in their total molecular structure: oligosaccharide and a polypeptide
- What makes up the glycocalyx (two components of the membrane)?
- How would simply describe/define lipid rafts?
- Be able to list at least 3 purposes of the cell membrane

Lecture 7 Learning Objectives

- There are 5 "communication paradigms" in signaling. Can you describe them briefly?
- Signals or hormones were described as having three possible natures: can you list them?
- Be able to explain what a receptor is, and the two ends or parts of its function: one binding to a signal, the other causing a ____
- For membrane receptors, they have three domains: be able to list and describe them
- What is involved in signal amplification? What goal does it achieve? Why don't signals/ligands not just go around and "activate" or touch each molecule to be changed?
- What's the 1st messenger? What's the 2nd messenger?
- What are the important parts of a G-protein signal pathway? When the signal binds to the receptor, where do the G proteins come into play? What's the important of GTP in G proteins? What's the importance of the complexes G_{α}-GTP and $G_{\beta\gamma}$? How does the signal get turned off (what things happen)? What is adenyl cyclase in relation to this G protein system and what non-protein product does it make? What does the product do downstream with other proteins in the cell (slide 23 is helpful too)
- Receptor Tyrosine Kinases: what are their ligands? When ligands bind, what happens to activate the RTKs? What cellular process do RTKs bound to their ligands start? What is the general structure of an RTK? What amino acids are affected on RTKs and on what part of the RTKs are they found? What happens to those amino acids? Can you describe what autophosphorylation is? How does the binding of downstream proteins or complex to RTK propagate one or more other pathways that make up the signal that changes cellular processes?
- Why is steroid hormone signal action different from growth factors or ligands binding G proteins? Where can the receptor for the hormone be found (two possible locations)? What is the steroid hormone receptor bound to before binding the steroid hormone, and why do you think it's bound to this? What does the steroid hormone + receptor complex do?
- What is the time period between signal->G protein, signal->RTK, and signal->steroid hormone receptor and their responses? Which are milliseconds to seconds versus minutes to hours? Can you explain why time periods from signal -> response vary?
- What happens in phosphorylation? What gets phosphorylated? What does the phosphorylating (what type of enzyme)? What important molecule is used in phosphorylation?
- Same set of questions for dephosphorylation
- What does the phosphorylation state (having phosphate or not having phosphate) do in cell signaling?

Lecture 8 Learning Objectives

- Cell junctions are classed in 3 ways: can you describe them?
- Desmosomes: in what ways do they link cells and can you give ONE example of cell types where they would be found?
- Desmosome details: what are the names of the components that do the linking between and through the cells? What would an electron microscopist look for when it is looking for this kind of cell junction?
- What is an adherens junction (AJ) and compare and contrast the AJ to the desmosome
- Tight junctions: can you explain their purpose? Where are they likely to be found? What pathway do they control? What pathway do they not control? What are the names of the two proteins that are important to TJs, and where are they found? What is a 10 nm particle and where is it found? Are TJs porous or block everything? A mutation in a claudin can affect imbalances in two important ions: can you name one of them?
- Gap junctions: what purpose do gap junctions serve? Gap junctions are clusters of a protein complex: what is the name of that protein complex? What single type of protein forms that complex, and how many polypeptides are necessary to form that complex? In building the complex that is fully functional in the gap junction, what does "hemichannel" mean and what must happen with the hemichannel to create the fully functioning gap junction?
- What instrument was important in establishing cell junctions?