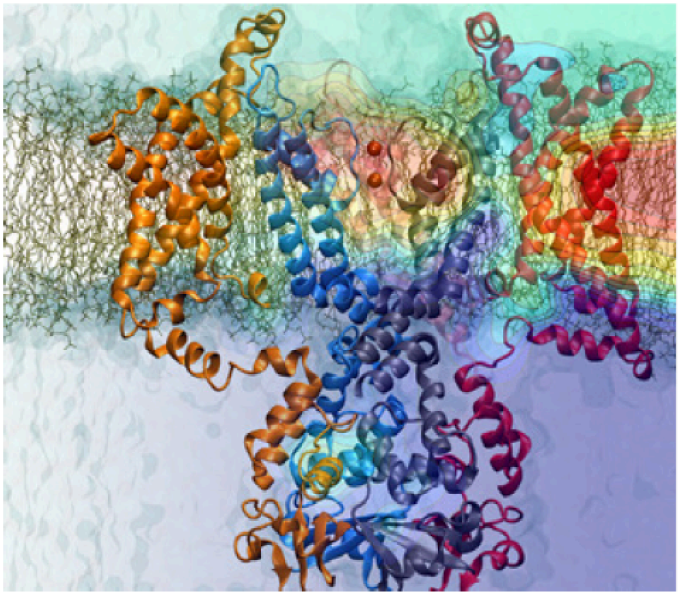
Biology 205, Study Guide: Chapter 11-12

The Big Picture



Cells exchange many molecules with their environment and the current focus of our attention will be on the variety of mechanisms that constitute membrane transport. We will learn about channels, transporters, and pumps.

We will address how a membrane potential is generated and maintained. Amazingly, it represents a significant charge difference across the 5 nm thick lipid bilayer and it is maintained without measureable change to the overall charge of the cytoplasm because the cytoplasm is so large relative to the number of ions that cross the membrane. We will also learn about how action potentials are generated in nerve cells and how changes in the membrane potential are used in nerve cell signaling.

Finally, we will learn the fundamental concepts of synaptic biology - how one nerve cell signals another through the use of chemical neurotransmitters.

Study Tip: Specific figures are highlighted for your review while reading the textbook. Drawing the figures yourself and explaining them to someone else and/or putting labels on them is a good way to check your understanding.

Study Tip: When a textbook problem is assigned (see next page), work through the problem on your own first. Devise the best answer you are able to give, with a closed textbook. Perhaps your first attempt will be insufficient. However, before looking at the answer in the back of the book, open your book to Chapter 12 and use any lecture notes you have and try to enhance your answer until you are satisfied that it is the best you can do. Now, after these two attempts, open the back of the book and read the authors' answer and compare your answer to it. At this point, if you are missing specific information or explanation, see if you can find more it in the textbook. If you cannot, discuss your answer with a study partner, a Cell Biology Tutor or Dr. Hunter. If you simply rush to look at the author's answer first, you will never benefit from the practice of wrestling with the question yourself and with the learning that comes from practicing your use of new concepts and information. Give yourself time to work through the problem before peeking at answers!

Some focus questions to guide your reading of Chapter 11

1. What is the barrier function of the membrane?

2. How thick is the plasma membrane (know the units too)?

3. What is an amphipathic molecule? Why is this critical to the structure of the membrane?

4. Know the general structure of a phospholipid and what it looks like in different representations (Figure 11-6 A-D)

5. Understand the concept of membrane fluidity. How is it influenced by the structure of the phospholipids? How is it influenced by cholesterol?

6. What does it mean to say that the plasma membrane is asymmetrical? Provide an example to clarify your answer.

7. What are the different types of membrane proteins (see Figure 11-20) and how do they associate with the lipid bilayer (Figure 11-21).

8. Why are alpha helices common in the secondary structure of trans-membrane proteins?

9. Why is a detergent useful in separating (removing) trans-membrane proteins from the lipid bilayer?

10. Are membrane proteins mobile or immobile within the lipid bilayer? Describe two experiments that try to answer this question. Do you think that one set of results provides stronger evidence than the other result? (See pages 379-382)

11. Describe two basic functions of sugars on the surface of the plasma membrane.
Specific Reading Assignments

Some focus questions to guide your reading of Chapter 12

1. Although we focus mostly on molecules that cannot freely diffuse across the lipid bilayer, what molecules are able to diffuse freely?

2. How does water move across membranes?

3. What are the typical concentrations of K+ and Na+ inside and outside a mammalian cell?

4. How does a cell maintain these concentrations at steady-state?

5. Distinguish between each of the following terms:
- Ion channel, ion transporter
- (Simple) diffusion, facilitated diffusion
- Symporter, Antiporter
- Passive transport, active transport
- Neurotransmitter (chemically, ligand) gated channel, Voltage-gated channel

6. Why do molecules tend to move down their concentration gradients? (Note: phrase your answer without using the words “want” or “need”! Molecules have no wants or needs.)

7. The Na+/K+ ATPase pump is central to an understanding of membrane transport. Figure 12-11 and the movie 12.1A are good ways to check your understanding.

8. How does the cell use the sodium gradient to do work? Provide at least one specific example of how this is used by the cell membrane.

9. What is the role of calcium ions in nerve signaling?

10. Describe how acetylcholine functions as an excitatory neurotransmitter whereas GABA functions as an inhibitory neurotransmitter.

Specific Reading Assignments and Homework Problems

Finish if you have not

- Read Chapter 11.
- Do the following problems to check your understanding: Question 11-4 (p 375),
- Question 11-7 (p 379)
- End of Chapter questions: 11-8, 11-9 11-11, 11-17, 11-19, 11- 20
- You also have a Written Assignment #3 Due Tuesday, Feb. 12 (see Bb)

For Feb 7-12

- Read Chapter 12 , pages 387- 400 and pay attention to the focus questions.
- Pay particular attention to these figures: 12-2,12-3, 12-4, 12-6, 12-7, 12-8, 12-9, 12-
- 11, 12-17, 12-18, and Table 12-1A on page 388.
- Answer Question 12-1 on page 392.

For , Feb 12-14

- Finish reading Chapter 12 (pages 400-421) and use the focus questions.
- Answer Questions 12-5 (page 409), 12-6 (page 414).
- Be able to draw and explain Figures 12-35 and 12-39A (I will give a better example in
- Lecture Slides)
- Complete the following end- of-chapter questions (see Study Tip on previous page):
- 12-8, 12-9, 12-10, 12-11, 12-16, 12-18.

Written Assignment #3 is due