**READING GUIDE:**

**General:**

* This study guide may seem long, but a lot of the text is to provide references to other online resources that are either short videos or short webpages. Overall, it still should not take long to watch all the required videos and read the sections in the textbook the first time through.
  + Remember, just reading the material and/or watching the videos isn’t enough. You need to actually study the material.
* Anything labled FYI means “for your information” and will not be on the quiz of that reading guide, though it may be on other quizzes or exams (but then it wouldn’t be labeled FYI anymore). Even though it is not required for the quiz, often it is included to help you understand the material better in general.
* The focus of this material is to help you understand how organisms are put together.
  + Typically, in a biology class we start with atoms and then cover molecules, then cells, etc. However, I am just doing a quick overview of this material and I don’t want to get into too much of the chemistry just yet.
* Please review section 1.3, which you have already read, to better understand the focus of this reading guide.
* Several videos are optional.
  + All videos in any reading guide are required unless it clearly states the video is optional.

**Videos and online resources related to Atoms and molecules:**

**General:** Make sure you watch all the required videos below and read the web page linked below.

**Videos**:

* <https://www.youtube.com/watch?v=4WR0_gEEZ9I> The science of macaroni salad: What's in a molecule? - Josh Kurz
  + Introduction to atoms and molecules, and some basic concepts important to understanding chemistry.
  + It is relatively short, but very well explained and should make sense at the conceptual level.
  + I won’t go into much chemistry in this unit, but I do want you to have a basic understanding since it can be hard to understand a cell without it.

**Questions on “Macoroni Salad” Video:**

1. What is the common “building block” of both amylose (starch) and cellulose found in wood?
2. What are all molecules made of?
3. How many different types of atoms make up most biological organisms?
4. What is similar between macaroni salad and gasoline?
   1. If macaroni salad and gasoline are similar in this way, what makes them so different?

* Optional video: <https://youtu.be/C0Qaf-UJ2XQ> What is a molecule by Stated Clearly.
  + This video is a bit longer and not as focused on biology but can help you better understand the relationship between atoms, molecules and elements which will be important later in the course.

**Videos and online resources related to cells, tissues, and organ systems:**

**General:** Make sure you watch all the required videos below and read the web page linked below.

**Videos**:

* The purpose of these videos are to help you get a better understanding of what a cell is and how they can be different.
  + Often the figures in textbooks make cells seem as if they are all the same shape and have the same parts, but that isn’t true.
* <https://youtu.be/gFuEo2ccTPA> Introduction to cells by Frank Gregorio
* <https://youtu.be/wNe6RuK0FfA> Specialized Cells: Significance and Examples by Amoeba Sisters
* <https://www.youtube.com/watch?v=I8uXewS9dJU> – this video is similar to the amoeba sisters video but it is pretty short and shows video and photos of real cells.

**Questions on Amoeba Sisters Video:**

1. According to the video, what is the function of plant epidermal cells?
2. According to the video, what are red blood cells specialized in?
3. What type of cell is specialized in sending and receiving signals and responding to stimuli?

* Optional video: <https://youtu.be/JufLDxmCwB0> The operating system of life by George Zaidan and Charles Morton
  + This optional video includes describes how a cell functions using using an analogy to a factory with robots.
  + This analogy is useful and I will often use a similar analogy, but please know that not all cells produce something, they can process materials for other cells, such as a recycling center, or sewage treatment plant, or can store material such as a public storage building.
    - As an example: A recycling center breaks down consumer containers into raw materials that can be used by other factories to build all sorts of different things similar to how cells in the digestive system work
    - A sewage processing plant filters sewage and then treats and cleans it so it can be used in the drinking water supply. Kidney cells filter blood and liver cells treats and cleans the blood by breaking down harmful molecules that enter the blood through the digestive system.

**Webpages (required)**: On cells, tissues and organ systems.

* <https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-body-structure-and-homeostasis/a/tissues-organs-organ-systems>
* Similar page to above, but slightly different information: <https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_Introductory_Biology_(CK-12)/13%3A_Human_Biology/13.1%3A_Organization_of_the_Human_Body>

**Questions on above webpage:**

1. Don’t worry about the terms: apical, basal, muscle subtypes (cardiac, skeletal, and smooth), or glia
2. What is the name of the fluid that surrounds cells and which cell exchange nutrients and waste products with?
   1. NOT ON QUIZ and purely optional: Try to google and figure out how nutrients get into this fluid.
3. What are the 4 main tissue types of the human body?
   1. What are the major functions of each of these tissue types?
4. Know at least 4 (there are 12) different organ systems and the major function of that system.
5. We will come back to the nervous and endocrine systems but the khan academy website gives a short intro that is a decent start. However, it may be difficult to fully understand their importance and how they work until we go over them later.

**Chapter 4: A Tour of the Cell**

1. Watch the videos on molecules and cells first to help you better understand the content in these sections.

**4.1 Microscopes reveal the world of the cell**

1. This section is not included in the reading assigned through the syllabus and I don’t want you to read the entire subsection, but I do want you to read the first several paragraphs.
   1. Read the chapter introduction (text before section 4.1) and read the first 4 full paragraphs of section 4.1 (the paragraph with the term cell theory highlighted).
      1. This helps give you a somewhat better foundation for what a cell is and how small they are.
   2. You may find the rest of this section interesting because it discusses several different kinds of microscopes and how we have come to know what we do about things so much tinier than we can see with the naked eye.

**4.2 The small size of cells relates to the need to exchange materials**

**across the plasma membrane**

1. An important concept in this section is that cell size and shape is related to the important functions of the cell and often determined by the **ratio of surface to volume** (total surface area divided by total volume) .
   1. The surface to volume ratio can be difficult to understand on your own, so I won’t put anything difficult about this topic on the quiz. We will cover it in more detail in class.
2. What is the name of the structure that makes up the surface of ALL cells?
   1. NOTE: Many of the terms that come up in the section are related to chemistry which are covered in chapters 2 and 3, so don’t worry if you don’t fully understand the details of its structure and function right now.
   2. The big picture concept about this structure is that as major function is to determine what can get in and out of the cell. The book uses the analogy of a traffic cop.
   3. What are the molecules that make up this structure. Hint: They have heads and tails.
3. *FYI: Larger objects with the same shape as something smaller will have both more surface area and greater volume, however, the surface to volume ratio will be less. Refer to Figure 4.2A for more.*

**4.3 Prokaryotic cells are structurally simpler than eukaryotic cells**

1. I will not expect you remember many of the details about the structures presented in the next 2 sections, 4.3 and 4.4, so the main goal should be to:
   1. Understand the structures that are common to all cells.
   2. Understand the major differences between prokaryotic cells and eukaryotic cells.
   3. Understand what an organelle is.
2. Which type of cell is simpler, prokaryotic cells or eukaryotic cells?
   1. What is the most important difference about these 2 different kinds of cells?
      1. HINT: it isn’t size
3. Each biological domain has organisms made up only of prokaryotic cells or eukaryotic cells.
   1. Which domains are prokaryotic?
   2. Which are eukaryotic?
4. What are the 4 structural features that all cells have?
   1. NOTE: 1 is not in bold font, 2 of the bolded terms can for the most part be considered the same.
      1. NOTE: Cytosol and cytoplasm can be considered the same thing for the purposes of this class.
      2. HINT: one of them was first introduced in the previous section and isn’t in bold in this section.
5. What is the function of a ribosome?
6. I will not quiz you on the specific structures found only in prokaryotes but it is still important to read the section as it helps you to understand more about prokaryotes in general.
   1. *FYI: What is the structure that is affected by penicillin that bacteria have that humans do not?*

**4.4 Eukaryotic cells are partitioned into functional compartments**

1. What is an organelle?
2. NOTE: Again, you will not have to remember specific organelles for their functions for this quiz, however, reading about the different types of organelles can help you understand what an organelle is.
3. What is outside of a plant cell is not found in animal cells?
   1. HINT: It is outside of the plasma membrane and much thicker. See figure 4.4 B.
      1. NOTE: Since the plasma membrane is so much thinner, it is often difficult to distinguish it in both figures and pictures. In this figure there is only one section where you can see the plasma membrane.

**MANY OPTIONAL VIDEOS**

* <https://ed.ted.com/search?qs=cells> – Ted Ed site with a search on cells
  + This is a reputable site with many interesting topics. I have not viewed all the videos yet, but most that I have viewed are really good.
  + Most of the videos are on topics that are not central to what we cover but are interesting extensions to topics we do cover and may have been things you have wondered about or heard in the news or other sources.
* Not all online videos are of the same quality and many unfortunately have incorrect information and/or do not cover the material at an appropriate depths, many include too many details and not enough focus on important concepts.
  + Other good resources for our class:
    - Amoeba sisters: <https://www.youtube.com/user/AmoebaSisters>
    - Bozeman science: <https://www.youtube.com/user/bozemanbiology>
    - The above channels have videos that tend to have the correct focus and depth for our class
    - Stated Clearly: <https://www.youtube.com/user/sciencestatedclearly>
      * This channel includes topics other than biology and some biology videos on topics we will not get a chance to get into deeply, but overall each video is well made and has a good depth and focus.
  + Another alternative:
    - Khan Academy: <https://www.khanacademy.org/>
    - This has a mixture of videos, some of which are way too detailed since they are for biology majors, but some videos are good for this class.
      * Some students taking my class still find the more detailed explanations helpful, so I wanted to include it as a good resource.
      * Other students can find the videos with more details more confusing overwhelming and can end up losing focus on what is most important