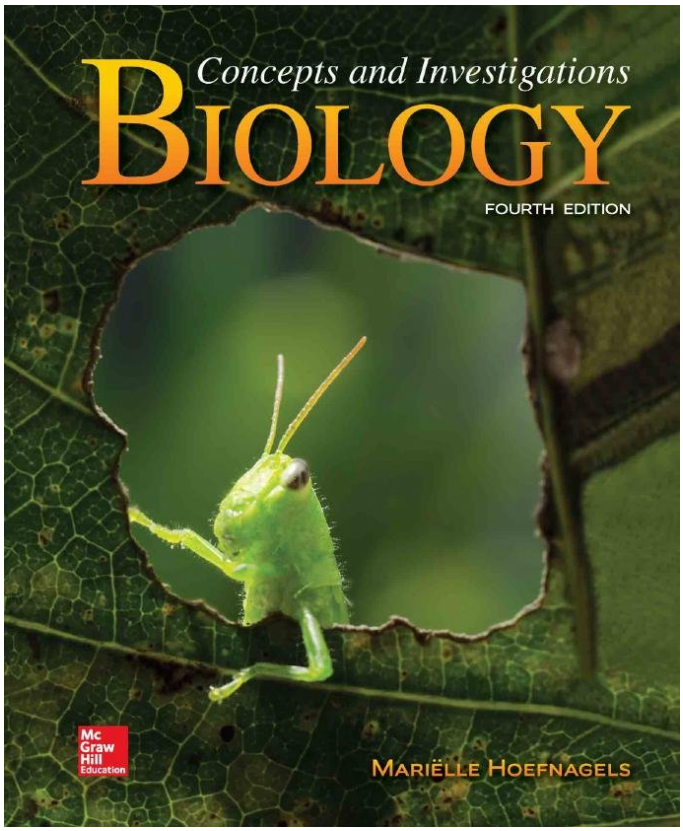
Required Readings in *Biology: Concepts and Investigations* 4th Edition

The readings listed under each scenario are those that will help you understand the concepts and processes introduced during that scenario. You should read them to deepen and strengthen your understanding of what is discussed in lecture. The order in which you read them will depend on how and when the concepts are discussed in lecture. It will also depend on your needs. If, for example, you encounter a term or concept that does not make sense to you while reading about topic or process, you should seek out the reading that explains what you do not understand before continuing.



Psychics and Scientists
Fire and Ice
Out of the Rainforest
Chemical Defenses
Marooned in the Galapagos
The Rainbow Connection
Emerging Diseases
Family Reunion
Hogs, Chickens and More
Why do we Care About Fat?

Some very nice features of this 4th edition Smartbook/eBook

- Each chapter starts with "Learning how to Learn." These are short suggestions are consistent with the research from the cognitive sciences and education on practices that lead to better long term recall and deeper understanding. Read them – including the ones at the beginning of chapters that we don't require in this course.
- Every chapter has a brief concept map at the end that provides a visual summary of how the topics in that chapter fit together. While we may not cover every component of each chapter, most will still be useful in helping you recall and identify connections.
- Every chapter has Questions embedded in the text that you can use to test your understanding and recall and provide you and answer that you can't see without clicking or hovering
- Embedded in the Smartbook or eBook are excellent narrated animations discussing the concepts.
- The ebook can also be run off-line with a free app for your phone/tablet
- The Smartbook has been tweaked to provide you interleaved and spaced practice with concepts while also guiding you to the textbook and pointing to multimedia resources. Start by reading relevant sections. After you have read for a while, the Smartbook will prompt you to start testing yourself on what you have read, click the practice icon and it will start providing guided practice and suggest what to reread.

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Psychics%20and%20Scientists1.pdf

Psychics and Scientists

A series of short scenarios will center on the basic question of "What is Science?", including measurement of psychic phenomena, a faculty research question, a breath holding experiment, analysis of class score data, and a discussion of what is a theory?

Section 1.3 Scientists Study the Natural World (pp. 10-14) contains the readings for this scenario.

- If you are not sure what a **hypothesis** is or how it differs from a **prediction** or a **theory**, read page 10
- If you are not sure what we mean by a **control variable**, read about standardized variables on page 11
- If you are having trouble distinguishing between **independent** (manipulated, predictor) and **dependent** (response) variables, read page 11
- If you are having trouble understanding what is meant by a control or **control group**, read page 12
- If you are not sure what a **theory** is and how it differs from **fact** or **law**, read page 12
- For a nice example of a **controlled experiment** and an explanation of why no one experiment leads to a complete answer, see the box on page 14

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Fire%20and%20Ice.pdf

Fire and Ice

The scenario focuses on surviving in desert and tundra biomes and adaptations for thermoregulation and osmoregulation (water retention).

Readings about **Biomes** can be found in **Chapter 39.**

If you want to learn more about the **tundra**, read page 799

If you want to learn more about the **desert**, read page 797

Readings about **Thermoregulation and Osmoregulation** are found in **Chapter 33**

- **Thermoregulation**
  - To learn **why** Animals Must Regulate Their Internal Temperature read page 666.
    - If you don't know what is meant by **denaturation**, read page 34
      - We will talk about **proteins** many times and you can read about them starting on page 32, you won't need to know about their composition till later, but denaturation might make more sense if you learn a little about their structure on pp. 32-33
    - If you are not sure what we mean by **metabolism**, you should read "Whole-Body Metabolism: Energy on an Organismal level" on page 71 and the intro paragraph to 4.2 Networks of Chemicals Sustain Life on p. 74
    - If you are not sure what the **Laws of Thermodynamics** are, read pages 72-73
    - If you are not sure what is meant by **homeostasis**, you can find an introductory explanation on pp. 6-7
      - To learn more about how **Water Regulates Temperature**, read page 27
  - If you can't differentiate an **endotherm** from an **ectotherm**, read pp. 666-667
  - If you don't understand what is meant by **poikilotherm** or **homeotherm**, you better check your notes because it is not in the text!
  - If you need to review the **adaptations** that help animals themoregulate, such as **counter-current exchange**, read p. 667-668
  - A **negative feedback loop** that controls temperature is described on p. 528
- **Osmoregulation (+ diffusion and active transport)**
  - To understand more about **why animals osmoregulate**, read 33.2 Animals Regulate Water Ions in Body Fluids
  - If you want to know more about what the kidney is filtering besides water and ions, read 33.3 **Nitrogenous Wastes Include Ammonia, Urea**, and Uric Acid on page 670
  - If you need more description of **urinary system**, which contains the kidney, read 33.4 The Urinary System Produces, Stores and Eliminates Urine on page 671
  - If you need to review the **parts of a nephron**, read page 672 – 673

- If you are not sure what the **glomerulus** is, read The Glomerular Capsule Filters Blood on page 674
- If you are not sure what the **nephron loop** is or what it does, read pp. 674-675, and pay special attention to the diagram on page 674
    - If you are not sure what is meant by **selectively permeable**, look on page 80.
        - If you want more information about the **structure of a cell membrane**, read section 3.3 A membrane separates each cell from its surroundings pp. 54-55, but don't worry about the details of lipid bilayers or the various types of protein embedded in them yet.
        - If you don't know what makes up **a solution (solute, solvent)** read 2.3B Many Substances Dissolve in Water pp. 26-27
        - If you are not sure what **ions** are, read p. 23
    - If you are not sure what **passive transport** is or how **diffusion** works or how to distinguish diffusion from **osmosis**, read pp. 80-81
- If you are not sure what the **collecting duct** is or what it does, read pp. 674-675, and pay special attention to the diagram on page 674
    - If you are not sure how the collecting duct can become more or less permeable to water, read about **facilitated diffusion** on page 82
    - If you need an explanation of **active transport**, read page 83
    - If you want to compare **mechanisms of membrane transport**, look at Table 4.2 on page 82
- If you need more information about how **hormones** control the kidney function, read p 675 and review the **feedback loop** diagram carefully

Some nice examples that will help you understand how these processes work in real situations (like those you sometimes see on our exams) see:

- How temperature and concentrated solutions prevent food spoilage in "Why does food get moldy? page 401
- A great example of **thermoregulatory behavior** is found in "A day in the life of a marine iguana" on page 665.

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Out%20of%20the%20Rainforest.pdf

Out of the Rainforest

An aboriginal fishing expedition in the rain forest is explored in terms of the action of a toxin produced by plants. Pesticides, coevolution, cell membrane function and cell respiration are discussed.

Readings about **Natural Selection** can be found in **Chapter 12.**

- We introduced the term **adaptation**, when we discussed the mechanisms by which organisms thermoregulate and osmoregulate during Fire & Ice. You can review a definition on p. 8 as part of a nice introduction to **Evolution and Natural Selection** on pp. 7-8 and again or on p. 244 as your read about natural selection.
- The **Concept of Natural Selection** is described on p. 241 in the context of Darwin's voyage and the observations that supported his ideas. The definition given on that page includes the word genotype, which Darwin would not have known. If that is true for you too, then perhaps you should read pp. 190-191. For now, we will focus on the effect of natural selection on variation in a population (not sure what a population is? See pp. 238 or 750).
    - We will discuss natural selection and other mechanisms of evolution when we are "Marooned in the Galapagos" later this semester. However, we want to introduce you to natural selection now because it such an important concept. You can read how **natural selection** works on **pp. 244-245**.
    - If you are not sure what is meant by **phenotype**, see p. 190
    - If you are confused by our constant reminder that natural selection (and evolution in general) has no **purpose, goa**l, does not result from **need** or a **desire** to survive and is not a way for species to survive, read the explanation on p. 246.
    - If you want to see the importance of understanding evolution and natural selection on human welfare decisions, you might want to read "**The Unending War with Bacteria**" (p. 237) and "**Investigating Life: Size Matters in Fishing Frenzy**" (p. 256). These also provide good practice with the types of scenarios that appear on our exams!

Readings about **Coevolution** can be found in **Chapter 38.**

- For an explanation of **coevolution**, see p. 771.
- For examples of coevolution, with the concepts defined specifically, read about **competition** (p. 768); symbiosis, including **mutualism**, commensalism, and **parasitism** (p. 769-770); and herbivory and **predation** (p. 770)
    - An elegant example of coevolution among **a plant, a fungus and a virus in Oklahoma** can be found in "Investigating Life: Two Kingdoms and a Virus Team Up to Beat the Heat" p. 784-785

Readings about **Cellular Respiration** can be found in **Chapter 6.**
Readings about **energy, biochemical reactions, and enzymes** can be found in **Chapter 4.**

- To formulate an answer to " **Why do we undergo cellular respiration?**", read "Cells Use Energy in Food to Make ATP" on p. 106
- For an **overview** of the three main processes aerobic cellular respiration, read p. 107 and the summary in Figure 6.2. This overview can be pretty valuable because it defines terms such as **NADH**, **$FADH_2$**, and **pyruvate**. Figures 6.16 and 6.17 on pp. 118 and 119 also summarize and review processes nicely.
    - You will commonly see the terms **oxidation**, **reduction**, and **redox**. These are explained on p. 75. We do not require you to remember these terms (although you may want to if you plan on taking more life or physical science courses) on exams, but knowing what they mean will help with reading the textbook.
    - If you have forgotten how **protons** and **electrons** are organized in **atoms** and **molecules**, read pp. 20-22.
    - If you are unfamiliar with (or need to review) chemical **bonds**, read pp. 22-24. The molecules involved in cellular respiration are assembled by **covalent** bonds (p. 24). That said, we will also refer to hydrogen **ions** quite often, so if you are not sure to what that refers, read p. 23.
- For an **introduction** to the roll of **mitochondria** in cellular respiration (and to learn about their **structure**), read p. 108 and be sure to examine **Figure 6.3** and find the **matrix**. When you look at figure 6.3, the structure of the inner and outer membranes may not be familiar to you. if not, consider comparing them to cell **membranes** on pp. 54-55.
    - More **details** about mitochondria and also be found on p. 60.
    - You should also find **mitochondria in the diagrams of cells** on pp. 52 (Figure 3.8) and 53 (Figure 3.9). Pay special attention to that second figure – students get many questions about cellular respiration in whole organisms because they forget what they should have learned from this figure! While you are there, you can read about **cytoplasm** if you are not sure what (p. 49) and where it is found.
- The details of **Glycolysis** can be found on p. 109. This can appear daunting to some, but that is because you are worried about all the steps – don't. Concentrate on what chemicals (molecules) start and are input into the reactions and which are produced (output) during the reactions.
    - Each of the steps in glycolysis and later steps are catalyzed by **enzymes**. What enzymes are and how they work is explained on pp. 78-79.
    - **HINT**: When you are examining **Figure** 6.4 (and later ones), each **grey ball** represents a carbon atom + either two hydrogen or one Oxygen and one Hydrogen atom. Counting them at each step will help you answer some questions we ask. **Don't** try to remember how many are there at each step.
    - If you are not sure what **ATP** is or how it is made, read p. 76 or what it is used for, read p. 77
    - If you are not sure what **glucose** or **carbohydrates** are, read p. 31. When you look at the green pentagons and hexagons in **figure 2.17**, you may be confused. This might help – each letter represents an atom (C=carbon, O = Oxygen, H = Hydrogen) and each "----"

represents a chemical bond between those atoms. When they leave out the letters, it means that at the junction of the two lines is a carbon atom. You will see the terms **monosaccharide**, **disaccharide**, and **polysaccharides** used from time to time. Again they are not something that will appear on tests, but knowing what they are (single, paired, and many sugar chains) can be useful in reading.

- If you are not sure what constitutes **Aerobic Respiration**, read p. 110
    - If you are not sure what happens in the **transition step** between glycolysis and the Krebs cycle, read about how **pyruvate is oxidized to Acetyl CoA**, on p. 110 (summarized in figure 6.5). By now, we hope you are using the words oxidized and reduced as specialized forms of "is made into."
    - For an explanation of the **Krebs Cycle**, read p. 110 and review Figure 6.6. As in glycolysis, don't be concerned about the name of all the intermediate compounds. Instead focus on the overall process and the inputs and outputs.
    - For an explanation of the **Electron Transport Chain**, or **chemiosmosis** read p. 110 and study figure 6.7.
- **Not sure which step contributes the most ATP**? Reading about "How Many ATPs Can One Glucose Molecule Yield?" on p. 112 can help you understand how all the steps are related, how important this process is to life, and how important oxygen is.
- To learn about **anaerobic respiration** or **fermentation**, read pp. 114-115

STUDY TIP: These processes can seem overwhelming, but you will learn them quite well and be able to answer our most challenging questions if you **rehearse** describing the process like this:

1. Put away your book, notes, videos, images, computer, cell phone or other aids
2. Draw a simple figure to represent ALL the steps of cellular respiration. Keep it simple so you can draw it on an exam quickly.
3. Start at the beginning the whole process or each of the major steps and describe clearly (using the terms)
    a. what molecules are used (input),
    b. what happens to each,
    c. what molecules are produced (output).
    d. be sure you are confident on how the steps are related – each produces materials for the other!
4. If you wrote them out – compare your description to the textbook, note your mistakes or omissions, throw away your drawing, and try again.
5. If you said them out loud – listen to a recording while comparing your description to the textbook OR have your study partner tell you what you missed by following along in the textbook.
6. When you feel confident, test your ability to apply your knowledge by using your diagram to
    a. predict/explain all the effects of the poisons on p. 112.
    b. answer test questions from old tests.

For a challenge to your ideas about **endotherms**, some insight into how **thermogenesis** works, and another interesting possible example of **coevolution**, read "**Investigating Life: Hot Plants offer heat reward**" on p. 117. Pretty good practice for exam questions too!

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Chemical%20Defenses.pdf

Chemical Defenses

A Nigerian child eats a poisonous bean, which requires extraordinary treatment by the local physician, framing investigation of cell membrane structure, secretion, intercellular communication, and neurons.

Readings about the **Nervous System** can be found in **Chapter 26.**

- To learn about the **structure of a neuron**, read p. 538. Figures 26.4 and 26.5 show how neurons connect to neurons or to muscles.
- To learn about **resting potential**, read p. 540.
- If you are not sure how the **sodium-potassium pumps** work, see p. 83 and Figure 4.19
- If you need some help distinguishing **passive transport, simple diffusion, facilitated diffusion,** and **active transport**, read pp. 83 with special attention to the summary in Table 4.2.
- To learn about **action potentials**, read pp. 540-542. Figure 26.6 steps through Resting and action potentials.
- To learn about **neurotransmitters, synapses,** and **synaptic transmission**, read pp. 544-545.
- If you are not sure what we mean by **receptor proteins**, review p. 55
- Table 26.1 will provide you a glimpse of the **variety of neurotansmitters** and their roles. You don't need to memorize them, but they help you learn about the symptoms that appear when they are in excess or deficiency.
- More information about **acetylcholine** and neuromuscular junctions can be found on pp. 600-601
- If you want to learn more about **exocytosis**, see pp. 83-84.
- To learn how **drugs** affect synaptic transmission and action potential, take a look at the table on p. 553.
- For an excellent example of how mutations and natural selection lead to **differences in susceptibility to the effects of a neurotoxin**, study the *Investigating Life: The Nerve of those Clams*, found in your Connect Assignments for Chemical Defenses.

Readings about **Cellular Secretion** and **Organelles** can be found in **Chapter 3.**

- Not sure what the steps of **cellular secretion** are? They are listed in Figure 3.13 and described more fully on pp. 57-58, along with the roles of the **nucleus, ribosomes, rough endoplasmic reticulum, smooth endoplasmic reticulum, and Golgi apparatus**.
- **Lysosomes, Vacuoles,** and **Peroxisomes** are described on pp. 59-60
- Table 3.3 summarizes the structures found in **eukaryotes** can found on p 66.
- If you want to compare those, to the structures found in **prokaryotes**, see Figures 3.5 & 3.6 on p. 50- 51.

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Marroned%20in%20galapagos.pdf

Marooned in the Galapagos

This trip raises questions about what makes a species or organism successful. Attention to the physical character of these desert islands and animals living there highlights natural selection in action, and how natural selection and other processes lead to speciation, coevolution and adaptive radiation.

Readings about **Evolutionary Processes** can be found in **Chapter 12, 13, & 14.**

Readings about **Natural Selection** can be found in **Chapter 12.**

These first readings should be a REVIEW for you

- We introduced the term adaptation, when we discussed the mechanisms by which organisms thermoregulate and osmoregulate during Fire & Ice. You can review a definition on p. 8 as part of a nice introduction to Evolution and Natural Selection on pp. 7-8 and again or on p. 244 as your read about natural selection.
- We introduced the Concept of Natural Selection at the beginning of Out of the Rainforest. You should have read the description on p. 241 in the context of Darwin's voyage and the observations that supported his ideas. The definition given on that page includes the word genotype, which Darwin would not have known. If that is true for you too, then perhaps you should read pp. 190-191. For now, we will focus on the effect of natural selection on variation in a population.
- It's time to be really sure how natural selection works, so read pp. 244-245.
    - To learn more about what constitutes a population, read p. 750 (we will discuss more about population characteristics and growth later in Emerging Diseases).
    - If you are not sure what is meant by phenotype, see p. 190
    - If you are not sure what an allele is, read p. 169. We are going to discuss them much more in Family Reunion, so don't worry too much about them now, the thing to remember is that alleles are different forms of a gene. So when we say we all have different genes, we really mean we have different forms of the same genes, or alleles.
    - If you are confused by our constant reminder that natural selection (and evolution in general) has no purpose, goal, does not result from need or a desire to survive and is not a way for species to survive, read the explanation on p. 246.
    - If you want to see the importance of understanding evolution and natural selection on human welfare decisions, you might want to read "The Unending War with Bacteria" (p. 237) and "Investigating Life: Size Matters in Fishing Frenzy" (p. 256). These also provide good practice with the types of scenarios that appear on our exams!

Now for the new readings

- If you are not sure what is meant by the statement "**evolution occurs in populations not individuals**", read p. 238

- If you are not sure how natural selection and **artificial selection** compare, read p. 241 and the Apply it now box on p. 242.
- If you are not what we mean by **fitness** or why "survival of the fittest" is so misleading, read pp.246-247.
- To understand how **mutations** contribute to evolution by increasing genetic variation in a population, read p. 253
- Not sure of the difference between **founder effect** and natural selection? Read p. 254
    - While you will <u>not</u> be asked to compare founder effect to other forms of genetic drift, it might help to read about genetic drift on p. 253 or about the bottleneck effect on p. 254 .
- You might hear or read about Hardy-Weinberg Equilibrium and be especially concerned about the math – don't be. The best use of this concept for us is to say that when all the conditions for HWE are met, then no evolution is occurring, But when any processes or events occur that change the genetic variation in a population occur, then evolution has occurred. This is best summarized in **Figure 12.23 on p. 258**

Readings about **Speciation** and **Adaptive Radiation** can be found in **Chapter 14.**

- If you want more explanation about how **plate tectonics** led to formation of islands and continents and contributed to speciation and biodiversity, read pp. 268-270
- If you are not sure what a **species** is, read pp. 282-283
- If you are not sure what **speciation** is or how **reproductive barriers** play a role in the separation of species, read pp. 284-285.
- To learn more about **how speciation occurs**, read pp. 286-289. But don't worry whether you can distinguish among the different types of speciation. Concentrate on allopatic speciation as our model and how **geographic barriers** play a role.
- A nice example of experiments leading to speciation can be found in Investigating Life"**Plant Protection Racket May Stimulate Speciation**" on pp. 300-301
- If you keep asking the question "What is the difference between speciation and **adaptive radiation**?" you will find the answer on p. 290-292.
- And remember that evolution does not always result in population differences, adaptations and new species, it can also result in **extinction**, as you can read about on pp. 292-294.

Readings about **Coevolution** can be found in **Chapter 38.**

If you did not read this for *Out of the Rainforest*, or just want to review, then:

- For an explanation of **coevolution**, see p. 771.
- For examples of coevolution, with the concepts defined specifically, read about **competition** (p. 768); symbiosis, including **mutualism**, commensalism, and **parasitism** (p. 769-770); and herbivory and **predation** (p. 770)

- An elegant example of coevolution among **a plant, a fungus and a virus in Oklahoma** can be found in “Investigating Life: Two Kingdoms and a Virus Team Up to Beat the Heat” p. 784-785

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Rainbow%20Connection.pdf

Rainbow Connection

A scuba diving botanist is sent by the Smithsonian to collect algae. Blood is spilled and the biological uses of colored light, including photosynthesis, are explored.

As you participate in the discussions in class and try to answer the questions posed in this scenario, you should realize that there are many connections to material we discussed previously. Hopefully you see the similarities between **mitochondria** and chloroplasts, between the **chemiosmosis** that occurs in each, how **action potentials** are involved in the perception of light,

- Review Readings about **Cellular Respiration** can be found in **Chapter 6.**
- Review Readings about **energy, biochemical reactions, and enzymes** can be found in **Chapter 5.**
- Review Readings about **Natural Selection** can be found in **Chapter 12.**
- Review Readings about the **Nervous System** can be found in **Chapter 26.**

Readings about **Senses** and the **Eye,** can be found in **Chapter 27.**
Readings about **Photosynthesis** can be found in **Chapter 5.**

- If you are not sure what we mean when we talk about **light spectrum** or **visible light**, read pp. 92-93.
    - For a visualization of what happens when colored objects **reflects light**, study Figure 5.4
- To learn about **how we see light & color**, read pp. 565-567.
    - Not sure what **rhodopsin** is? read p. 565
    - Can't differentiate between **rods** and **cones**? read p. 566
    - Not sure how light **reception triggers action potentials**, read p. 566
    - Need more explanation of how **sensory receptors** work (or are lost when you encounter words like transduction or **receptor potential** in your readings) see pp. 560-561.
- If you are not sure what **accessory pigments** are, read p. 92 including Table 5.1
- If you need clarification on **chlorophyll structure**, including the difference between **stroma**, **grana**, **thylakoid**, and **thylakoid space**, read p. 60-61 & 93-94.
    - If you are not sure what the **reaction centers** or **antenna pigments** are, read p. 94
- For an **OVERVIEW OF PHOTOSYNTHESIS**, which introduces **NADPH** and explains the connection between the **light reactions** and the carbon reactions (**Calvin** or Calvin-Bensen cycle) read p. 95
    - For the details of the light reactions, read pp. 96-97 including:
        - **Photosystem II** on p. 96
        - **Photosystem I** on p. 97
        - **Electron Transport Chains** on pp. 96 & 97
        - **Water-splitting complex** on p. 97
        - **Chemiomosis** on p. 97.
    - For a **graphical summary** of the light reactions, pay close attention to figure 5.8

- To test your understanding of the **effect of poisons** on photosynthesis, read Apply it now: Weed Killers on p. 97
- If you want more explanation of the **Calvin Cycle**, read p. 98, but be careful! Don't focus on the details, focus on what the process does, what goes in (reactants) and what comes out (products), and the relationship between the light reactions and the Calvin cycle (hint: calling the Calvin cycle the light independent reactions is VERY misleading even though you will read that in many other places)
- Not sure why those **red algae** are able to live in deep water and don't appear red in deep water, read p. 366
- For a nice example of **coevolution** between animals and algae, read *Is It Easier Being Green* (p. 89) and *Solar Powered Sea Slugs* (p. 101)

Items you may have to review while reading about Photosynthesis

- You will commonly see the terms oxidation, reduction, and redox. These are explained on p. 75. We do not require you to remember these terms (although you may want to if you plan on taking more life or physical science courses) on exams, but knowing what they mean will help with reading the textbook.
- If you have forgotten how protons and electrons are organized in atoms and molecules, read pp. 20-22.
- If you are unfamiliar with (or need to review) chemical bonds, read pp. 22-24. The molecules involved in photosynthesis are assembled by covalent bonds (p. 24). That said, we will also refer to hydrogen ions quite often, so if you are not sure to what that
- HINT: When you are examining Figure 5.9 (and later ones), each grey ball represents a carbon atom + either two hydrogen or one Oxygen and one Hydrogen atom. Counting them at each step will help you answer some questions we ask. Don't try to remember how many are there at each step.
- If you are not sure what glucose, sucrose or carbohydrates are, read p. 31. When you look at the green pentagons and hexagons in figure 31, you may be confused. This might help – each letter represents an atom (C=carbon, O = Oxygen, H = Hydrogen) and each "----" represents a chemical bond between those atoms. When they leave out the letters, it means that at the junction of the two lines is a carbon atom. You will see the terms monosaccharide, disaccharide, and polysaccharides used from time to time. Again they are not something that will appear on tests, but knowing what they are (single, paired, and many sugar chains) can be useful in reading.

STUDY TIP: These processes can seem overwhelming, but you will learn them quite well and be able to answer our most challenging questions if you **rehearse** describing the process like this:

7. Put away your book, notes, videos, images, computer, cell phone or other aids
8. Draw a simple figure to represent ALL the steps of photosynthesis. Keep it simple so you can draw it on an exam quickly.

9. Start at the beginning the whole process or each of the major steps and describe clearly (using the terms)
    a. what molecules are used (input),
    b. what happens to each,
    c. what molecules are produced (output).
    d. be sure you are confident on how the steps are related – each produces materials for the other!
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https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Emerging%20Diseases.pdf

Emerging Diseases

A Nigerian child eats a poisonous bean, which requires extraordinary treatment by the local physician, framing investigation of cell membrane structure, secretion, intercellular communication, and neurons.

Readings about the **Population Growth** can be found in **Chapter 37.**
Readings about the **Immunity** can be found in **Chapter 34.**
Readings about the **Endosymbiosis** can be found in **Chapter 15.**

Population characteristics and change.

- If you are not sure what a **population** is, read pp. 750-751.
- If you are not sure what a **population density** is, read pp. 750.
- Readings about **population growth** start on p. 752.
    - To learn about **birth and death rates**, see p. 752
    - If you need help understanding **exponential growth**, read p. 754
    - If you need help understanding **logistic growth**, read pp. 755-757.
    - If you are having trouble distinguishing **dependent** from **independent factors affecting population growth**, see p. 757
    - If you are curious about survivorship curves and want to learn more, see pp. 753-754
- Readings about human population growth are found on pp. 759-761
    - To learn about the factors that slowed **birth rates** in humans, see p. 760
    - To learn about the factors that slowed **death rates** in humans, see p. 760

Immunity.

- For an overview of all the systems involved in defending your body against disease, see p. 682
- If you are not sure what **white blood cells** are or do, read pp. 682-683.
- **Adaptive immunity** is discussed on pp. 686-691.
    - If you are not sure of the role of **macrophages**, see p. 686-687.
    - If you are not sure what **B-cells** are or what they do, see p. 687.
    - If you are not sure what **antibodies** are or what they do, see p. 688.
        - If you are not yet sure what **proteins** are, see p. 55.
        - Producing and releasing antibodies is done by **cellular secretion**, which you can review in Figure 3.13 and by reading pp. 57-58
    - You can learn more about how your body can produce so many different antibodies and the details about the process by which specific B-cells are produced on pp. 688-690.
        - The summary of **B-cell activation and activity** can be found on p. 689 in Fig 34.9
    - Figure 34.11 will help you understand when & **why antibody production stops**.
    - If you are having trouble distinguishing between active and passive immunity, see p. 690 and Fig. 34.1
    - If you don't know what **memory cells** do, see p. 689 & 691

    - If you are not sure how **primary and secondary immune responses** differ, read pp. 690-691.
- To learn how **antibiotic resistance evolves** in bacteria, see p. 253
    - The problem with the **evolution of antibiotic resistance** is nicely described on p. 237 (The unending war with bacteria)
    - If you mistakenly think **bacteria become resistant** to antibiotics because overuse of antibiotics exposes them to antibiotics, see p. 253, 140
    - To learn more about **how specific antibiotics work**, see p. 350 (Apply it now), 51, 79, 131, 347
    - …and why they don't work against viruses on p. 338
- Not sure how **vaccination** works, see p. 692
    - To learn more about **vaccination and viruses**, see p. 337)
- **Have you heard that vaccines are dangerous or don't work?** That is NOT the case, see p. 681.
- If you would like to learn more about **viruses**, read pp. 332-338.

Theory of Endosymbiosis

- If you are not sure what **evidence** there is that certain organelles evolved from prokaryotes, read pp. 311-312 & pp. 362-363.
- If you are unsure of how this **applies to chloroplasts**, see p. 61
- If you want to see how this theory explains aspects of **photosynthesis and cellular respiratio**n, see p. 116.
- be sure to read material on link on **this Scenario's Study guide page**: Endosymbiosis and The Origin of Eukaryotes
- or just search using the term "evidence for the endosymbiotic theory of eukaryotic cell evolution" for more information)
- If this theory is correct, **why can't these organelles live outside of cells**? See p. 313

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Family%20Reunion.pdf

Family Reunion

A family reunion opens the door to talk about cancer, DNA, protein synthesis, genetically determined diseases and biotechnology.

Readings about the **Protein and Nucleic Acid Structure** can be found in **Chapter 2.**
Readings about **DNA & RNA Structure, Transcription, Translation, & Mutations** are found in **Chapter 7.**
Readings about **Mitosis, Cell Cycle, and Cancer** can be found in **Chapter 8.**
Readings about **Mitosis** can be found in **Chapter 9.**
Readings about **Mendelian, X-linked, and co-dominant genetics** can be found in **Chapter 10.**

Cell Cycle and Cancer

- The **cell cycle (G1, S, G2, M)** is summarized in Figure 8.10 p. 153
    - The cell cycle is **described** on p. 154
    - **Mitosis** is part of the cell cycle and described in detail on pp. 155-156
        - You do **not** need to know the phases of mitosis, just the input and output.
        - If you are not sure what the **checkpoints** are, read p. 157.
    - If you are not sure what causes **cancer**, read pp. 157-158.
- Confused about **when DNA (chromosomes) replicate**? Read pp. 150-151

Nucleic Acid Structure

- The **structure of DNA** is explained on p. 34-35
- If you are not sure what a **nucleotide** is, see p. 35 and Fig. 7.5 on p. 124
- If you are not sure what is the relationship between a molecule of **DNA**, **nucleotide**, and a **nitrogenous base** (**A**denine, **C**ytosine, **T**hymine, **G**uanine), see p. 35
- Need to review how DNA and RNA differ? See Fig. 2.24 and 7.9
- Don't remember the **types of RNA** (mRNA, tRNA, rRNA)? See p. 125
- Not sure how bases **pair**? See p. 125
- Want to know more about **how DNA is made (replicates)?** See Fig 8.4 or Read pp 150-151 for more detail
- Want to know more about **when DNA is made (replicates)?** See p. 150

Protein Synthesis, Transcription and Translation

- Not sure what an **amino acid** is? See p. 32
- Need to learn more about **protein structure**? See p. 32
- Not sure what a **polypeptide** is? See p. 32
- For an **explanation** of how DNA and RNA determine protein structure, see p. 126
- Need more explanation of **Transcription**, see p. 128
- Need more explanation of **Translation**, see pp. 130-133 (don't worry about details of steps)
    - Not sure what a **codon** is? See p. 130

    - Need to see the mRNA-Codon-Amino Acid **Table**? Go to p. 130
    - Not sure what **start** and **stop** codons are? See p. 130
- Need more explanation of the role of **ribosomes**? See p. 131-132 (don't worry about the structure details)

Mutations

- Need a **basic** explanation of mutation? see p. 138
- Can't distinguish between **substitution**, **addition**, and **deletion** mutations? See pp. 138-139
    - Not sure **when mutations make a difference** and when they don't (**silent**, **missense**, and **nonsense** mutations)? See pp. 138-139
    - Need an example of **how mutations make a difference**? See Fig. 7.21 on p. 139 about **sickle-cell anemia**
    - Not sure what is meant by **frameshift** mutations? See Fig 7.22 on p. 139
- Need to know more about **what causes a mutation**? Read pp. 139-140 & p. 151

Chromosomes

- For a **terrific summary** relationship among **chromosome, diploid, haploid, gene, allele, homologous pair, autosome, sex-chromosome** and more, Read p. 188 carefully
- Your understanding of how **DNA and chromosomes** are related might be helped by reviewing Fig 8.9 on p. 153
- Not sure **how many molecules of DNA there are in a chromosome?** Read p. 154
- Not sure why, If all cells contain the same genes and chromosomes, **some cells are different than others**? Read p. 135
- Not sure what we mean by **homologous** chromosomes? Read p. 169
- Confused between **autosomal** and **sex** chromosomes? Read p. 169
- Need some idea about **how many genes there are on a chromosome**? Read p. 169
- Do all organisms have the same number of chromosomes? See p. 153
- Want to know why you always see chromosomes as little X's? Read p. 152-153

Meiosis

- Not sure what **gametes** are? See p. 170
- Not sure what is meant by **haploid**? See P. 170
- Not sure where meiosis occurs? See p. 170
    - Seen the terms **somatic** and **germ** cells, but not sure what those are? See p. 170
- Not sure what the **function** of meiosis is? See p. 171
- Need to check on the **outcome** of meiosis? See p. 171
- For a brief **overview of the steps** of meiosis, see Fig. 9.6
    - If you really want the details of the steps, read pp. 172-173
- If you read or hear the term, "crossing-over", but don't know what it is, read p. 174
    - As you are reading, you might need to know what a chromatid is, so look on p. 153
- Not sure how meiosis can lead to so many **different genetic combinations** in gametes (and why siblings don't look alike)? See p. 175, especially Fig. 9.9

Inheritance

- Want a good review of High School genetics or an intro to the basics of genetics through **Mendel's experiments on Peas**? Read pp. 189 – 194
    - Brief definitions of relevant **genetics terms** are in Table 10.1 on p. 191
        - If you are unsure of the difference between **dominant** and **recessive**, go to p. 189
        - If you are unfamiliar with the terms **true-breeding**, **self-fertilization**, and **cross-fertilization**, go to p. 189
        - If you are confusing the words **gene and allele**, go back and look at p. 169
        - If you are unsure how **homozygous** and **heterozygous** differ, go to p. 190
        - If you are unsure of the difference between **genotype** and **phenotype**, go to p. 190
        - If you encounter the terms wild-type and mutant and don't know what they are, see p. 190
        - If you can't explain **how meiosis, crosses, and Punnet squares are related**, read p 193-194, especially Fig 10.9
        - To see how **cystic fibrosis** inheritance can be predicted, see Fig 10.10
        - You may have created **Punnet Squares** to determine the genotypes of offspring in High-school, so to review or learn about them, read pp. 192-193.
- Unsure about **codominance**? Read pp. 199-200.
    - To learn about **Blood Types**, read p. 199-200 especially Fig. 10.18
        - Be sure to review which antigens are produced in each phenotype
        - Not sure which blood types produce which **antibodies** or can **receive or give** blood from which others, or what happens when they are incompatible? Read p. 613
        - We use the designations A, B, and o for the alleles instead of i^A, i^B, and i
        - This is also the place to learn about incomplete dominance if you wish
- Confused about **X-linked traits**? Read pp. 201 – 203
    - Want to review how **sex is determined**? See p. 201
    - Not sure why **males are more likely to express** X-linked traits? Read p. 202
    - Need to know more about **hemophilia**? See p. 203
    - Need to know more about **color-blindness**? See p. 203
    - Table 10.2 provides a nice **list of X-linked dominant and recessive traits**
- To learn more about the connection between genotype and phenotypic expression in the example of **phenylketonuria (PKU),** read "Burning Question - Why does diet soda have a warning label?" on p. 191.
- Not sure **what affects the frequency of a trait** or allele in a population?
    - Read about **cystic fibrosis** in "Investigating Life: Does Natural Selection Maintain Some Genetic Illnesses?", found in your Connect Assignments for Family Reunion.
    - Read about **sickle cell anemia** on pp. 251 & 373

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Hogs%20and%20Chickens.pdf

Hogs & Chickens

Statistics about concentrated animal feeding operations raise questions about nutrients in biogeochemical cycles, the effects of livestock and people on aquatic systems.

Readings about **Nutrient Cycles and Energy Flow** can be found in **Chapter 37 & 38.**

Readings about **Biodiversity and Bioaccumulation** can be found in **Chapter 40.**

Review Readings about **Cellular Respiration** can be found in **Chapter 6**.

Review Readings about **Photosynthesis** can be found in **Chapter 5.**

Review Readings about **Population Growth** can be found in **Chapter 37.**

The role of decomposers

- Not sure what a **decomposer** is? See p. 6 and 774.
- Need to know about their role in **water treatment**, see p. 356
    - See: What happens when you flush p. 774/779.

Eutrophication and Algal Blooms

- Need a quick summary of the **relationship between algae and eutrophication**, see the burning question on page 365
- Need an explanation of the relationship between **N & P and eutrophication**? Read pp. 782-783 and review figure 38.3
- Need a more detailed comparison of the role of **Organic** and **Inorganic** aquatic pollution and algal blooms? Read p. 813-814
- Not sure **from where plants get there C,H,O,N,P**? See pp. 485-486
- Need to learn more about **commercial fertilizer** and what it contains? See p. 486
- Not sure what is meant by **nitrogen-fixing** bacteria? See p. 486
- Curious of what **elements** plants are made? See p. 484.
- Need more of an explanation of **environmental impact** (ecological footprint)? Read pp. 761-762

Energy Flow in Ecosystem

- Not sure what **primary producers, consumers, autotroph,** or **heterotrophs** are? Read p. 774
- Not sure what **ecosystems** or **food webs** are? Read pp. 774-775
- Not sure **how energy is lost at each trophic level** or what the **10% rule** is? Read p. 775-776.
    - You might also want to review the **Laws of Thermodynamics** on p. 72
- Not sure to what the term **net primary productivity** refers? See p. 775
- Not sure how **biomagnification** (bioaccumulation) works? Read p. 777.

Biogeochemical Cycles

- Don't know the difference between **biotic and abiotic**? See p. 768
- Need a description of what **biogeochemical cycles** are? Read p. 778
    - The **water** cycle is on p. 778-779
    - The **carbon** cycle on pp. 780-781
    - The **nitrogen** cycle on pp. 781-782
    - The **phosphorus** cycle on p. 782

Biodiversity

- Need some basic information about **biodiversity**? See p. 810

https://bioweb-cfs.cas.okstate.edu/info/requiredreadings/Why%20Do%20We%20Care%20About%20Fat.pdf

Why do we care about fat?

Our contemporary preoccupation with fat sets the scene for a discussion of fat metabolism, its genetic, nervous and hormonal control, and behavioral implications.

Readings about **Sexual Selection** can be found in **Chapter 12 & 36.**

Readings about **Diet, Nutrition and Body Weight** can be found in **Chapter 32.**

Readings about **Hormones** can be found in **Chapter 28.**

Review Readings about **Cellular Respiration** can be found in **Chapter 6**.

Review Readings about **Mendelian Genetics** can be found in **Chapter 10.**

Review Readings about **Mutations** can be found in **Chapter 7.**

Sexual Selection

- Not sure what the functions of **courtship behaviors** can be? Read p. 738
- Not sure what is meant by **sexual selection**? Read pp. 252 and738
- Not sure why sexual selection can lead to **sexual dimorphism**? See p. 738
- Need an explanation of **why females are more commonly "choosier"** about mates? See p. 738
- Need an example of the **handicap** hypothesis? See p. 739
- Not sure what conditions lead to **monogamy** and which to **polygamy**? Read p. 739
- Where can you learn more about sexual selection in **humans**? Read p. 740-741
- Want to know more about the link between **genes, hormones, and monogamy**? Read *Addicted to Affection* on p. 586-587.
- For a great example of a **sneaky male/female mimic**, see *Cross-dressers of the Reef*, p. 744-745

Weight Control

- For a discussion of the relationship among weight gain, **diet, and exercise,** read pp. 658-660.
- For the role of **Leptin** in the control of weight gain, see pp. 207 and 660
- Not sure how **proteins and lipids enter cellular respiration**? Read p. 113 and fig. 6.9
- Not sure how **metabolic poisons** can result in weight loss? Read pp. 111-112 & 114.

Endocrine System

- Not sure what a **hormone**, what produces it and what they do? See p. 576-577.
- Not sure what is meant by a **target cell**? See p. 578.
- Need to know more about **peptide hormones**? See p. 578

- Want to know more about how **steroid hormones** work? Read p. 579
- Not sure how a **negative feedback loop** works? See p. 528-529 and 577
- Not sure how the **hypothalamus** and **pituitary** are involved in metabolic control? Read pp. 580-581
- Not sure of the role of the **thyroid** in metabolic control? Read p. 582-583