Exploring Creation with Biology, 3rd Edition – Errata File

This file contains the corrections for the 3rd Printing: March 2021, of the **Textbook**. The printing for the Textbook may not be the same as for the Solutions and Tests Manual and Student Notebook. Corrections for the Solutions and Tests Manual and Student Notebook are in separate files. (Updated 2024)

Clarifications:

Page 10 – The answer to On Your Own question #1.1 can be found in the section "The Limitations of Science" following the questions.

Page 69 – in the paragraph following the definition of Amino acids, revise the first sentence to the following:

> "There are about 20 different amino acids in the proteins that make up life. The shape and function of a protein are determined by the type, number, and order of amino acids linked together."

Page 78 – Figure 2.36 was enhanced with labels and arrows to Phosphate group and Deoxyribose sugar. See the revised figure on the page at the end of this file.

Page 192 – Add the following clarification after the first full sentence:

> "…so it doesn't require energy. **Remember, this is called facilitated diffusion, a form of passive transport.** As ATP synthase rotates…"

Page 233 – labels were added to the graphic as shown on the page at the end of this file.

Page 268 – Insert the following clarification between the 3rd and 4th sentences of the first full paragraph as follows:

> "is dominant or recessive). **A shaded circle or square indicates the individual shows the genetic trait being studied.** Look at Figure 7.11…"

Page 298 – at the top of the page 'This' refers to '**Complementary base pairing**…'

Page 300 – at the end of the explanation to the OYO 7.5 answer, add the following:

> "This is a 1:1 (or 2:2) ratio, 1 purple-flower pea plant (*Ff*) for every 1 white-flower pea plant (*ff*) produced."

Page 358 – In Table 9.1, two lines were edited for clarity. (same edit for page 667)

1. Change the first line of #9 to: Does it have protective external plates **(exoskeleton)**? Phylum Arthropoda.
2. Change the 2nd line of #14 to: Does it have three pairs of **legs on the thorax**? Class Insecta.

Page 441 – In the 3rd paragraph, 1st sentence, add the word 'gametophyte' after …into a new plant…" so the sentence reads:

> Remember that, like spores of fungi, haploid spores of plants can develop into a new plant **gametophyte** without fusing with another spore.

Page 524 and 675 – In the list of materials for EXP 13.1, after Prepared slide: sponge, add "-**Grantia spicules**"

Page 649 – In the last sentence, change 'individual' to '**female**.'

Corrections:

Page 35 - #1 h. – the term should be Scientific theory.

Page 58 – In the paragraph beneath the definition of 'Organic molecules,' change the 5th sentence to read:

> By this definition, molecules like CH_4 and C_2H_4O are organic molecules (CH_4 contains only carbon and hydrogen and C_2H_4O contains only carbon, hydrogen, and oxygen),…

Page 66 – In the definition of Hydrophobic, change the word Latin to Greek.

Page 93 – In Figure 3.7, the orange box with 'decomposers' in it: move the comma so the number is: 5,060 not 50,60.

Page 234 – In Infographic 6.1 in the circle at the top of page, change note beneath the green Interphase bar to *DNA replicates during **S** phase.

Page 273 – In the Experiment step 5, the sample pedigree for earlobes can be found in Book Extras for this module, not in the Solutions Manual.

Page 284 – In the second paragraph, change misspelled word and pronunciation of pleiotrophy to **pleiotropy** (ply ´ah truh pee). [make the same spelling edit to page 706 in the index.]

Page 437 – Study Guide question 15. Change microscopic to **macroscopic (multicellular)**.

Page 531 – In Figure 13.20 – change egg to zygote, next to the small round purple object at the far right.

Page 568 – In Fig. 14.17 change poison gland to **venom** gland.

Page 569 – OYO question #14.10: change poison to venom (two times) and poisonous to venomous so the sentence reads:

> "Most spiders have **venom** glands and produce **venom** that they inject into their prey. Does that mean that we must fear most spiders because they are **venomous**?"

Page 574 – In Figure 14.26 the last two photos were replaced as shown on the page at the end of this file.

Page 583 – make the same changes to **venom** and **venomous** in the answer to OYO 14.10.

Page 603 – In Figure 15.27 the line for anterior cardinal vein should point to Blue blood. See attached diagram at the end of this file. (same edit for SNB page 334)

Page 629 – In Figure 15.60 the line for "a." should point to Blue blood. See attached diagram at the end of this file.

Nucleic Acids

Our discussion of the chemistry of life would not be complete, of course, without a brief description of DNA, the molecule that forms the basis of life. If you thought proteins were complex, you haven't seen anything until you have studied DNA! DNA is one of two macromolecules in the category of nucleic acids. RNA is the second important nucleic acid, and you'll learn more about both in Module 6, but for now this will be an overview. Nucleic acids contain carbon, hydrogen, oxygen, nitrogen, and phosphorus. Just like polysaccharides are composed of many monosaccharides, nucleic acids have building block molecules they're composed of. The building blocks of DNA and RNA are called **nucleotides** (noo' klee uh tides). Let's focus on DNA by studying Figure 2.36.

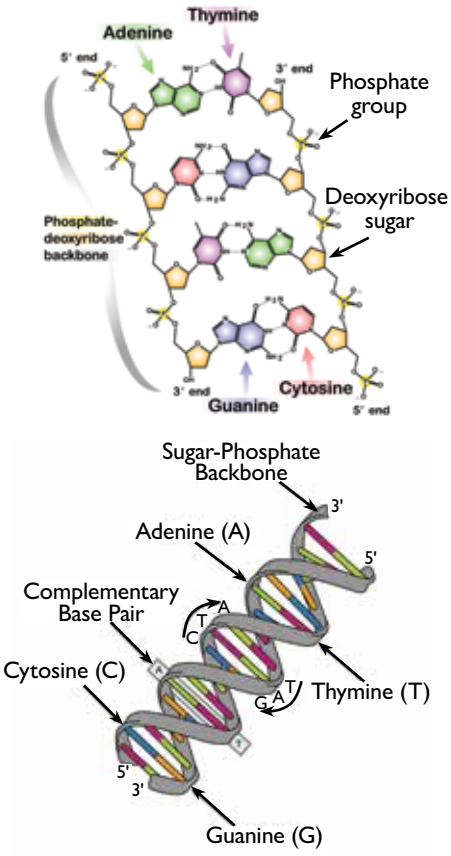


FIGURE 2.36
Schematic Representations of DNA

Nucleotides—The building blocks of DNA and RNA

DNA stands for deoxyribonucleic (dee' ox ee rye boh noo klay' ik) acid. It is a double chain of chemical units known as nucleotides. These two chains twist around one another in the double helix that is so familiar to most people who have studied any amount of biology. The nucleotides that make up these two chains are composed of three basic constituents: **deoxyribose** (a simple sugar that contains five carbons), a **phosphate group** (an arrangement of phosphorus, hydrogen, and oxygen atoms), and a **nitrogenous base**. A nucleotide's base can be one of four different types: **adenine** (ad' uh neen), **thymine** (thye' meen), **guanine** (gwah' neen), or **cytosine** (sye' toh seen).

In the top diagram of Figure 2.36, you can see that the phosphate groups link to the deoxyribose units, which support the bases. The two nucleotide chains are partially held together because the bases link together by hydrogen bonding in the same way water molecules form hydrogen bonds. (See the Chemical Bonds section in this module if you need to review this concept.) It is important to note that the attraction between the atoms in hydrogen bonding is about one-tenth as strong as the attraction between two atoms that have a true chemical bond (ionic or covalent) linking them. Notice that I said the weak hydrogen bonding is only partly responsible for holding the two nucleotide chains together. Recent research suggests that the fact that DNA nucleotides are hydrophobic and exist in the watery environment of the cell also plays a role in how the double helix maintains its shape. That is, until the cell needs it to separate. You'll learn more about that in Module 6.

Hydrogen bonding is important in DNA for another reason. Because hydrogen bonds are dependent on the molecules involved, only certain nucleotide bases can link together using hydrogen bonds. The nucleotide base adenine can only hydrogen bond to thymine. It cannot hydrogen bond to cytosine or guanine. In the same way, thymine can only hydrogen

remember this because synthesis means to make something and that's just what happens in DNA replication—two DNA molecules are synthesized from one. The cell then enters the second gap phase or G_2. Most scientists agree that the cell's organelles are duplicated at this phase so the dividing cell has enough organelles for two cells. Now that the DNA, the centrioles, and all other organelles are duplicated, the cell is ready to begin mitosis. At this point, the cell is called a **parent cell** and at the end of mitosis there will be two **daughter cells** with identical genetic information.

You may have noticed the G_0 stage on Figure 6.17. This phase is a duration in the cell cycle that some cells enter after mitosis. This is a non-dividing phase and is sometimes referred to as a rest phase. Some cells will never enter the G_0 phase and others will enter back into the G_1 phase after a period of time in the G_0 phase. Still other cells, like heart muscle cells and nerve cells, stay in the G_0 phase after they reach maturity. Once these types of cells are mature, they don't divide anymore. In other words, these cells never enter the cell cycle again but they continue to function as designed for the life of the organism. If you're wondering about the checkpoints on Figure 6.17, we'll talk about those at the end of the mitosis section.

Mitosis

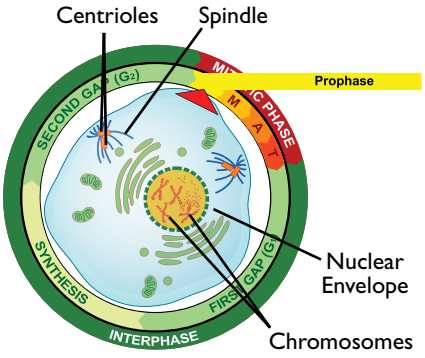
So, to summarize, the cell cycle is divided into two phases: interphase and the mitotic phase. The mitotic phase of the cell cycle is when the cell actually divides. Mitosis and **cytokinesis** both occur during the mitotic phase.

Cytokinesis—The process, usually following mitosis or meiosis, in which the cytoplasm of a cell is divided in two

Mitosis is the process where the genetic material and the nucleus divides. Cytokinesis is the process where the cytoplasm divides, forming two daughter cells. The mitotic phase is divided into four main stages that happen continuously but have specific things that occur in each stage. The stages are **prophase** (P), **metaphase** (M), **anaphase** (A), and **telophase** (T), followed by cytokinesis.

You can remember the stages of mitosis using the acronym PMAT. Infographic 6.1 shows you the stages of mitosis; follow along with it as you read the next paragraphs.

Prophase



The first stage of mitosis is called prophase. In prophase, several things happen. The duplicated chromosomes coil into their condensed form, and they attach to each other at the centromere. It's during prophase that the chromosomes are condensed enough to be seen with a microscope and take on the familiar X shape. Most of the time (interphase), chromosomes are uncoiled chromatin and aren't visible. Also during prophase, each set of centrosomes migrates toward one end of the cell. Remember from Module 4 that centrosomes contain the centrioles that organize the centrosomes and help with cell division. Microtubules extend from the centrosomes in all directions, forming the **aster**. As the centrosomes migrate, microtubules from the aster grow, forming **spindle fibers**,

chrysalis. What you might not have been aware of until now is that the vast majority of insects go through this transformation process. Flies, for example, go through the same process. When they are in their larva stage, they are called maggots; and when they are in their pupa stage, they do not use a cocoon or chrysalis but rather a shell of exoskeleton.

In fact, if an insect does not go through the metamorphosis process described above, it goes through a similar one that involves only three stages. Thus, biologists classify the development of an insect as either **complete metamorphosis** or **incomplete metamorphosis**. A diagram showing both types of metamorphosis appears in Figure 14.25.

Complete metamorphosis—Insect development consisting of four stages: egg, larva, pupa, and adult

Incomplete metamorphosis—Insect development consisting of three stages: egg, nymph, and adult

When an insect develops through incomplete metamorphosis, it hatches from its egg stage into its **nymph stage**. In this stage, the insect looks like a miniature version of its adult form, but the proportions seem wrong. It lacks wings and reproductive organs. It molts several times during the nymph stage and, when it finally develops wings and reproductive organs, it is considered an adult. See Figure 14.26 for photo examples of each type of metamorphosis.

Incomplete Metamorphosis | **Complete Metamorphosis**

Praying Mantis (nymph) | Praying Mantis (adult) | Monarch Caterpillar (larva) | Monarch Chrysalis (pupa) | Monarch Butterfly (adult)

FIGURE 14.26
Examples of Metamorphosis

Now please realize that there is nothing "incomplete" about incomplete metamorphosis. It is a full life cycle in which each stage of life is exquisitely designed. The term "incomplete" is simply used to signify that it has fewer stages than the other type of metamorphosis that is seen in class Insecta. Complete On Your Own questions 14.12–14.15 before reading on.

ON YOUR OWN

14.12 An insect's outer wings are incredibly tough. Most likely, what kind of wings are they?

14.13 You can suffocate an insect by wrapping up its body, except for the head, in plastic wrap. Why, if the mouth is exposed to air, does the insect still suffocate?

14.14 An insect cannot digest food in its stomach due to a lack of digestive enzymes. Which organ is most likely not working?

14.15 An insect goes through a nymph stage in its development. Does it undergo complete or incomplete metamorphosis?

urea ends up being taken out of the blood by the kidneys, and it leaves the body in the urine. Since God has designed animals so elegantly, their internal processes are efficient, recycling as much as possible. As a result, many of the toxic substances removed by the liver are integrated into the bile that the liver produces.

Most bony fish have an **air bladder**. This organ helps the fish to stay afloat in the water. You see, bony fish are heavier than water. Without an air bladder, most of them would simply sink to the bottom. However, the fish can direct gases from the blood and digestive system to diffuse into the air bladder. This increases the buoyancy of the fish, allowing it to float. If the fish wants to rise to a shallower depth in the water, it simply increases the amount of gases in its air bladder. This increases its buoyancy, allowing it to rise. Alternatively, if the fish wants to move to a lower depth, it simply releases gases from its air bladder, causing the fish to sink.

As with all vertebrates, the sexes are separate in fish. The gonad of a male fish is its testes, while the gonad of a female fish is its ovaries. Most bony fish are oviparous. The female lays eggs, and then the male covers them with **milt**, a milky-white substance that contains its sperm. Fertilization, therefore, is external in most bony fish. The eggs are then left to develop and hatch. When the female lays her eggs, we usually say that she is **spawning** (Figure 15.26).

FIGURE 15.26
Female anemone fish is spawning and the male (above) is waiting to fertilize.

The circulatory system of a fish is also instructive. Figure 15.27 is a sketch of the basic anatomy of a fish's circulatory system.

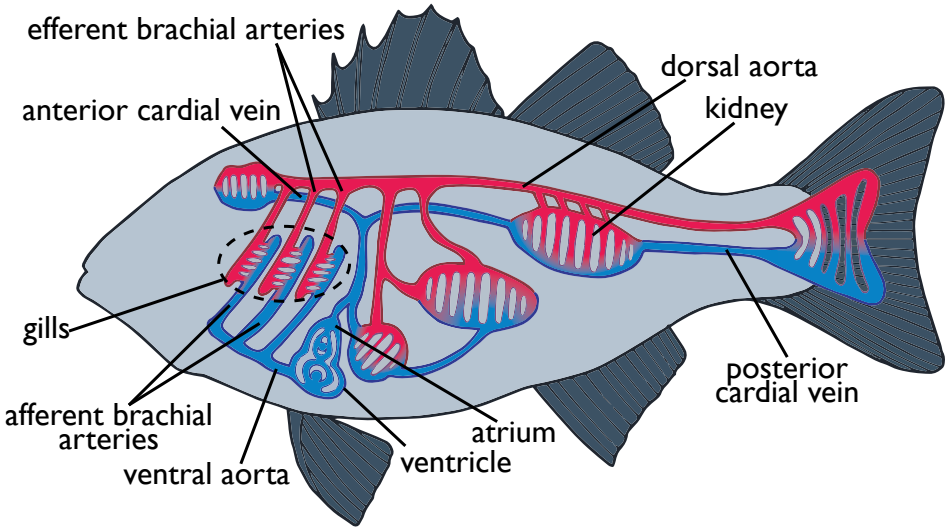


FIGURE 15.27
The Basic Circulatory System in a Fish

Notice that some of the blood vessels are colored blue and the rest red. This is the typical convention in biology. Red represents oxygen-rich blood, while blue represents oxygen-poor blood. To be accurate, the colors should really be bright red for oxygen-rich blood and dark red for oxygen-poor blood. It would be hard to tell those two colors apart, however, so red and blue are used instead. Also realize that the blood vessels drawn in Figure 15.27 are not all of the blood vessels in a fish. These are just the major blood vessels along with the capillaries that service the major structures in the body. In order to deliver nutrients and necessary gases to every cell in the body, there are obviously many capillaries that we just do not show.

The blood flow begins with a **two-chambered heart**. In most of the organisms that you

16. Identify the structures in Figure 15.59 and describe the basic function of each organ.

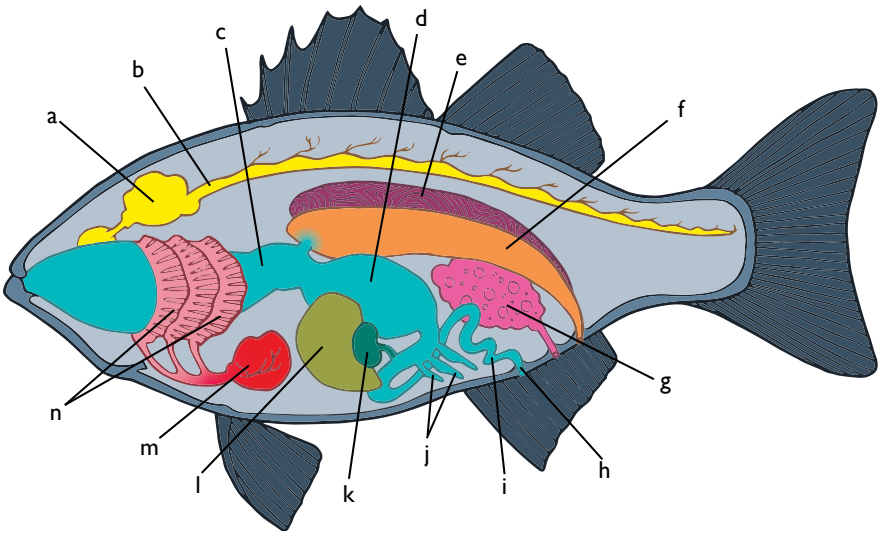


FIGURE 15.59

17. Identify the structures in Figure 15.60 and indicate which are veins, which are arteries, and which are neither.

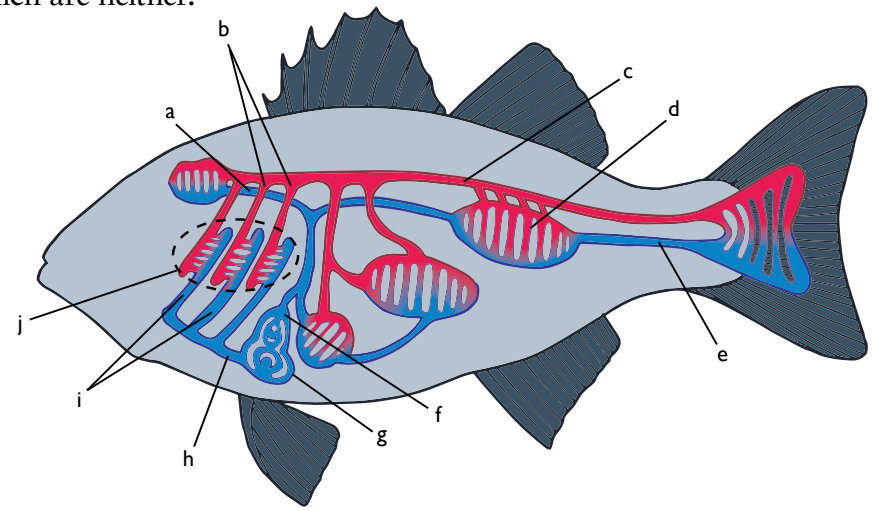


FIGURE 15.60

18. List the six common characteristics of amphibians.

19. What is the difference between a toad and a frog?

20. For most amphibians, what is the major respiratory organ?

21. State the five characteristics that set reptiles apart from other vertebrates.