Review of *Exploring Creation With Biology, 3rd Edition*
Dr. Jay L. Wile

Exploring Creation With Biology, Third Edition was published this year. The first two editions were written by me, but the third edition was crafted from the second by Vickie Dincher, who holds an earned Master of Science degree in Biology. After reviewing the course, I cannot recommend it to homeschoolers who are working independently. It is really a classroom textbook or a textbook for a homeschool co-op in which the leader knows biology.

Like the author's other book, this one has a softcover student text. I do not like softcover student texts, as they are not as durable. If you are going to offer a softcover student text, it should at least be sold at a softcover price so you can replace it after a couple of students. The listed price for this book is not a softcover price!

Of all the new editions from this publisher, this one is the most like a traditional classroom text. This is best illustrated by its emphasis on infographics. Infographics stuff an enormous amount of information into a small space, which is precisely what this course does. It barrages the student with lots and lots of facts, and for most students, those facts will be overwhelming. Ironically enough, the author admits this on page 439 when she says, "It is easy to be overwhelmed by the facts in a science textbook…" Actually, it is easy to write a science textbook that overwhelms the student. It is hard, but very possible, to write a science textbook that teaches students what they need to know without overwhelming them with facts! Because of the huge amount of information in this text, most students will need a teacher who can separate the essential material from the non-essential material.

I did like the fact that the student notebook is not at all necessary for the course. It is rarely mentioned in the text, and it is only mentioned once in the introduction to the student text. There are a few other things I liked about the course. The discussion of Semmelweis and his work was excellent, as was the story the author used to illustrate how trees grow. She also had a very clever analogy in which she compared glucose and ATP to a gold nugget and a dollar bill, pointing out that like the gold nugget, glucose is worth a lot (in terms of energy), but like the dollar bill, ATP is worth less and easier to spend (use).

Unlike her physical science text, there are few serious errors in this text. The author was fooled by a Photoshopped *Time* magazine cover on the internet, and she doesn't properly explain how the earth's tilt affects temperature. In addition, she overstates the effect that the reintroduced wolves are having on Yellowstone. There are some minor errors in the text as well, but none of them will result in long-term problems for the students.

There are several places that I think will cause confusion for students who are learning independently, but if the student is in a school or a co-op situation in which the leader knows biology, that shouldn't be a problem. There are also several things I just didn't like about the text, but that is more a reflection of how my teaching style is very different from the author's.

In the end, I do not recommend this course for homeschooled students unless they are in a co-op setting where the leader knows biology. This book is much better suited to a classroom.

The details of the errors in the text, the sources of confusion, what I liked, and what I didn't like are given below:

Serious Errors in the Text

(1) **Page 101**: "When I took high school biology in 1977, the *Time* magazine headline read 'How to Survive the Coming Ice Age' because scientists believed we were in the midst of a global cooling event." *Time* never, ever ran a magazine with that title anywhere in it. The author probably saw the Photoshopped image of *Time*'s April 9, 2007 cover in which the date was changed and the actual headline "Global Warming Survival Guide" was replaced with the false title she mentions. While it is true that there were several scientists who feared we were heading into a global cooling event in the mid-70s, there was no *Time* article with the title she mentions, and the scientific discussion was not covered much in the popular media. It was mostly confined to the scientific literature.

(2) **Page 111**: Figure 3.19 illustrates the tilt of the earth and how that affects temperature. The figure shows the equator receiving sunlight from the "Shortest distance and most direct sun's rays." It shows the poles receiving sunlight from the "Longer distance and low angle of the sun's rays." The angle is the only thing that matters. The small change in distance does not affect the temperature in any way. This can lead to problems in the future, since many students think the distance between the earth and the sun affects the seasons. The figure reinforces that misconception.

(3) **Page 122**: The author has a discussion of how the reintroduction of wolves into Yellowstone has dramatically changed not only the populations and behaviors of other animals, but also physical characteristics of the park. This is based on a couple of popular reports, which got made into a very emotional YouTube video. However, it is false. As Dr. Tom Hobbs, a Colorado State University ecology professor who actually studies Yellowstone has said, "This idea that wolves have caused rapid and widespread restoration of the ecosystem is just bunk…It's just absolutely a fairytale." (https://www.usatoday.com/story/tech/science/2018/09/07/wolves-reintroduction-yellowstone-ecosystem/973658002/).

Minor Errors in the Text

(1) **Page 24**: The author makes the same mistake about units that she made in her physical science book. She defines the International System of Units (SI) as the metric system. It is not. The SI lists a single metric unit for each quantity. For example, the SI unit for mass is the kilogram. All other metric units for mass (gram, milligram, etc.) are not SI units.

(2) **Page 44**: The ozone molecule is drawn with all three oxygen atoms linking together, forming a triangle. That is wrong. It is a bent molecule, with one O double-bonded to the central O and the other O single-bonded to the central O. The double and single bonds technically resonate, but the key is that a triangle of three bonds is never formed. In addition, there is no distinction in the figure between single, double, and triple bonds.

(3) **Page 63**: "Organic bases also have a group of atoms in common, which is often called the amino group." While this is true for *most* organic bases, it is not true for all of them. Ethers, pyridines, and pyrroles can act as organic bases, and they do not have an amine group.

(4) **Page 104**: The first bullet point in the discussion of global climate change says that evidence shows that there were very high levels of CO_2 in the past, before the Industrial Revolution. CO_2 levels were supposedly higher about 5 million years ago or so and throughout most of the rest of "deep time." However, I assume Apologia is still a young-earth creationist organization, so I assume they reject the assumptions upon which such a statement is built. Regardless, the statement makes it sound like the author is discussing human history, since she references the Industrial Revolution. There is no time in human history when CO_2 levels were higher, at least based on all the data we know. There were times when *global temperatures* were higher than they are now (the Medieval Warm Period), but not CO_2 levels.

(5) **Page 105**: The illustration for the oxygen cycle has ocean photosynthesis both adding oxygen to the atmosphere and removing it. The arrow that indicates oxygen being removed from the atmosphere and put into the ocean belongs under the word "Respiration," not "Photosynthesis."

(6) **Page 160**: "Even the simplest single-celled organisms must have these essential organelles to survive." Bacterial cells don't have those organelles, and they survive. The author should add "eukaryotic" before "single-celled."

(7) **Page 161**: The author says that CO_2 and O_2 diffuse through the plasma membrane because they are small. That's not true. They diffuse through because they are nonpolar. Large, nonpolar molecules, like steroids, diffuse through the plasma membrane as well.

(8) **Page 190**: "Photosynthesis is the only naturally occurring way to split water." This is not true. Natural radioactivity can do it, and in fact, there is a species of bacteria (*Desulforudis audaxviator*) that lives on the hydrogen produced by that process.

(9) **Page 351**: "Linnaeus categorized organisms into a total of seven levels called taxons." He used only 5: kingdom, class, order, genus, and species. The other two were added later.

(10) **Page 439**: The "signs of life" discussion is trying to make the point that we will never fully understand how life happens. The verse given is Mark 4:28, which says nothing about that. Mark 4:27 is the verse that references a man's lack of knowledge. I also don't see how either verse indicates that we will never fully understand how life happens. The verse is talking about a single man, not humankind in general.

Sources of Confusion

(1) **Page ix**: Here, the author tells the student how to document the experiments in a lab notebook. I actually like the method she describes here. Unfortunately, it is not what is used in the student notebook that accompanies the course. That notebook has a place for the student to document experiments, and it doesn't follow the format described here. There is also a course

website, and its discussion of documenting the experiments is different from both this discussion and the student notebook, as is the sample lab that is given on the course website.

(3) **Page 68**: Up to this point, the student has seen molecules with the atoms drawn explicitly. Here, the students see a condensed drawing, where most of the carbons and hydrogens are not drawn explicitly. The student is simply told that the carbon atoms in the rings aren't shown, but they exist at each point in the ring. It makes no mention of the fact that the H's aren't shown. These condensed drawings need to be explained so that students can understand them.

(4) Some of the drawings are so small that the student cannot see what needs to be seen. On **page 78**, for example, the hydrogen bonds are very important, but they are very hard to see because the dashes that make them up are so small. On **page 145**, the cells are so small that the student can't see the difference between smooth and rough endoplasmic reticulum. On **page 217**, the figure is so small that the student cannot make out the colors of the base pairs inside the DNA double helix. On **page 361** the student is supposed to use a biological key for several organisms, including grape and corn plants. However, they need to see the veins on the leaves, and the pictures are too small for that. The plant on **page 479** is so small, you can't see many of the things that are pointed out. In addition, the labels are smashed together because the figure is so small.

(5) **Page 92**: Figure 3.5 is used in the discussion of how energy flows through creation. The unit "kcal" is used with no explanation. The student has no idea what a kcal is unless he or she learned it in a previous course. You could accomplish the same goal by listing the percentage of the grasshopper's energy instead of a unit. Students understand percentages.

(6) **Page 143**: "About 2,000 cells can fit across your fingernail and up to 100,000 bacteria can fit on the head of a pin." Bacteria are individual cells, so this is confusing. What the author means is that 2,000 *eukaryotic* cells can fit across your fingernail and up to 100,000 *prokaryotic* cells can fit on the head of a pin.

(7) **Page 168**: Experiment 4.3 calls for *Elodea* leaf and refers to a note that I cannot find. This plant has become illegal in many states. The experiment should have been updated to call for a thin slice from the inside of a red onion.

(8) **Page 170**: The figure on this page has the very popular notation of ATP $\rightarrow$ ADP + P, with the arrow being curved. While the author explains what ATP is, she doesn't explain what ADP is or what it means when ATP becomes ADP and P until page 182. Thus, the student has no idea what it means in the figure.

(9) **Page 184**: The author uses "nm" before she spells out "nanometers," and she doesn't explain what a nanometer is.

(10) **Page 225**: Epigenetics is mentioned near the bottom of the page, but I don't recall it being discussed or explained anywhere in the text. It is not in the index, either.

(11) **Page 315**: Figure 8.7 is supposed to be showing natural selection and how it affects the variations seen in a population. It is not explained in the text, and I can't understand what it is trying to show. If I can't understand it, I doubt that a student can.

(12) **Page 395**: The sketch of the amoeba has a pointer labelled "Food vacuole (digests food)," but it doesn't seem to be pointing near any structure. This could be the result of the drawing being too small to see the structure, or it could be that the pointer is simply not pointing at the correct place.

(13) **Page 530**: The bottom picture is of a crab living on coral. The crab is hard to see because of its camouflage and is not pointed out.

(14) **Page 598**: Figure 15.17 is supposed to show a shark's lateral line. I don't see it.

(15) **Page 604**: The figure is of a shark's heart, but the book is talking about bony fishes in this section. Cartilaginous fishes are in the previous section. Yes, their hearts are the same, so why not use a bony fish's heart here? At least then, it goes with the rest of the section.

(16) **Index**: The index is sparse and needs a lot of work. There are major words in the text, like epigenetics, that are not in the index. In addition, at least some references are incomplete. For example, the palisade and spongy mesophyll cells are discussed on p. 188 and then again on pp. 490-492. In the index, "mesophyll" references only p. 188, and "spongy mesophyll" (with the s's) references only pp. 490-492, as does "palisade mesophyll" (with the p's). Also, many subheadings are not indented, so the student doesn't know they are subheadings. For example, on **page 693**, "algae" has subheadings "flamecolored," "golden (diatoms)," "green algae," and "red algae." However, they are not indented, so they each look like their own entry and like they do not belong with the a's. This doesn't happen all the time. Many subheadings are indented properly.

Things I Liked

(1) **Page 7**: There is an excellent discussion of how Semmelweis realized the need for sanitation in a medical setting, and the graph is a great way of showing how effective his reasoning was.

(2) **Page 183**: The author has a great analogy for glucose and ATP, based on how easy it is to spend a nugget of gold compared to a dollar bill. Very good!

(3) **Page 488**: There is an excellent discussion of looking for a tree carving her father made 60 years ago. It really shows how a tree grows!

Things I Didn't Like

(1) There is way too much information presented in this text. While I could list a lot of things that I think pack way too much info into the text, here are the major examples:

a. Infographics are used throughout the text. They pack so much information into such a small area that they should be used sparingly, if at all.
b. **Pages 189-195**: The author covers the major cycles in photosynthesis and then does the major cycles in cellular respiration. In my experience, this is too much for a high school student. The students understand respiration better, and it is best to cover just that. Later on, a more detailed course can cover the cycles of photosynthesis. In addition, the author references NADP+, NADPH, $FADH_2$ and FAD+ but cannot devote enough space to properly explain them. I usually leave them out, because you can understand the basics of respiration without referencing such chemicals specifically.
c. **Pages 219-220**: DNA replication is discussed in detail. The book tries to cover too much in too little space.
d. **Pages 231-233**: The details of the cell cycle (G1, S, G2, M) are discussed before mitosis and meiosis. Mitosis and Meiosis are confusing enough to students. We shouldn't clutter the discussion with more things to confuse them.
e. **Pages 294-299**: The gene technologies are cool, but once again, it's an enormous amount of information. I think it is too much when added to the rest of the material in the module.
f. **Pages 382-383**: In addition to the lytic cycle, the lysogenic cycle is also discussed. I don't see that the student gains anything from the discussion, but it adds to the total information, which makes everything more difficult to digest.
g. **Pages 412-415**: In order to try to cram everything in, this experiment has the students examine multiple prepared slides and then multiple slides they make themselves. In the old edition, this was three separate experiments spread out over two weeks!
h. **Pages 651-659**: The animal behavior sections are interesting, but once again, represent way too much information for a first-year high-school biology course.

(2) Crediting the pictures and illustrations is haphazard. I recognize several of the drawings and pictures and know who produced them. However, many of them have no credit at all. Some do have credit, which is good, but in my mind, every illustration that is not in the public domain should have a credit.

(3) **Page 16**: The book lists 6 criteria for life. There is nothing wrong about them, but I see them as redundant. The first one says life contains cells. It really should say "one or more cells," but that's not a big deal, because unicellular life is eventually explained. However, if it contains one or more cells, then it has the other criteria! This is demonstrated on **page 141**, where the characteristics that are listed for cells include four of the five other criteria listed in page 16.

(4) **Page 40**: "But wait – isn't the number of protons and electrons equal? In a neutral atom, they are; but not all atoms are neutral." Yes, all atoms are neutral. When an atom gains or loses electrons, it is no longer an atom. It is an ion. This is just a semantic thing, but it is important to students when they first learn chemistry, so that there is a clear distinction between atoms and ions. You need a clear distinction, since the atom chlorine is completely different from its ion, chloride.

(5) **Page 46:** The definition of ion is inconsistent with polyatomic ions, since the definition refers to only one atom.

(6) Some of the experiments have excellent explanations of how they work. However, others have no explanation at all. A teacher or co-op leader who understands biology could explain them.

(7) **Page 51**: The illustration of ions dissolved in water makes it look like the water molecules are bonded to the ions that are being dissolved, because the lines that connect them are solid. This is misleading, as they are not bonded to the water molecules.

(8) **Page 64**: Experiment 2.2 requires pH strips, but they are not sold with the kits for the course. Appendix B, **page 670**, lists them as "household items." I don't know a household that has them, unless the household has a pool. Also, there is no indication of where you can buy them.

(9) **Page 67**: The diagram contrasts saturated fats and unsaturated fats. That part is correct, but it shows butter and oil. The molecules shown are not a part of butter or oil. Somewhere, it should be noted that the molecules shown are simpler than what you find in real butter and oil.

(10) **Page 79**: The number given for how much information DNA can store is pretty old. We now know it can store even more information. If you are going to update a book, you should update numbers like this one!

(11) **Page 86**: The definition of ecology is "The study of the interactions between living and nonliving things." I consider that incomplete, since it is also the study of the interactions among living things.

(12) **Page 123**: In discussing parasitism, the author makes it sound like parasites can be good. She references a shark study that shows one kind of parasite helps the sharks tolerate higher levels of toxic metals. Those kinds of parasites are rare. Most parasitic relationships are all bad. I think the author is trying to justify the existence of parasites in a world made by an all-good, all-powerful God. The best way to handle that is to suggest that parasitic relationships started out commensal or mutualistic and then once sin entered the world, mutations caused some to become parasitic. Unfortunately, I didn't see that suggestion at all.

(13) **Page 225**: The "think about this" section discusses "junk DNA," but the landmark results of the ENCODE study that shows there is little or no junk DNA in the human genome are not discussed. This is another example of something that should have been updated with the latest information but is not.

(14) **Pages 308-345**: The discussion of evolution was not updated much at all. The quotes are mostly from the second edition, and almost none of the data that have emerged since then are discussed. Newer studies of *Australopithecus* and *Archaeopteryx* make the creationist case even better, but they are not mentioned. The book is still comparing proteins, which is valid, but since the second edition was written, enough data has emerged to discuss comparing genomes, which is probably the most damning evidence against evolution. Why isn't any of that discussed?

(15) **Pages 624-625**: There is a discussion of dinosaurs here, but there is nothing about all the new information regarding soft dinosaur tissues. Why not? Also, why not discuss where they belong in the Bible?