

# **EVOLUTION ADDENDA**

For chapters 15,16,17,18

For the Textbook

# **ASKING ABOUT LIFE**

Second edition

by

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## Why An Addendum?

An addendum is necessary because the authors have written the text around the idea that evolution is an essential part of biology. It should be remembered that biology is the study of living things. It is not necessary to know about an organism's origin: to determine how it functions internally and externally, to how it relates to other organisms and to make predictions about other organisms. Origin of and similarity to other organisms, while interesting, is not necessary to understand the detail functioning of a specific organism.

The term evolution has more than one meaning which leads to many misunderstandings and unsupported conclusions. Sometimes "evolution" means evidence for small-scale changes within species which we can observe in the present day. At other times, claims of "evolution" are based upon extrapolation and speculation about the deep past. Read the first section on Chapter 15 of this addendum for an understanding of the problem

This presentation will provide additional facts concerning evolution so that the student can clearly see problems not answered by the theory of evolution. This addendum presents facts that the student should consider when judging the soundness of the theory of evolution.

Should the student learn about the theory of evolution? Definitely! It is the dominant thinking of today in the fields related to biology.

This paper presents information only on the sections of the text where it is felt that additional information would be helpful. The information is presented as simply and briefly as possible since time is crucial in the classroom. Reference to the textbook will be necessary to completely understand this material.

## Chapter 15

### What is Evolution? Page 320, column 1, lines 6-11

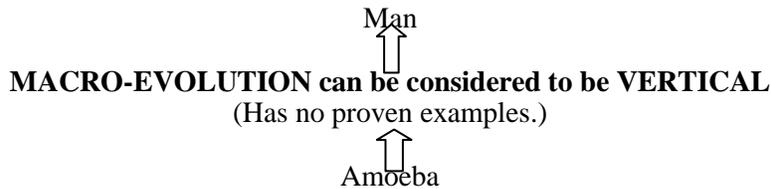
The authors specify that there are two different "parts" to evolution. Unfortunately, it is not until the next chapter that the textbook author labels the two "parts" with the terms micro and macro evolution. Charles Darwin observed that species change and adapt to their surroundings. He observed that natural selection was a very strong driving force that can and does cause these kinds of changes. He then assumed that these small changes meant that all living organisms could be accounted for through this adaptive process. Wherein this assumption is held by many scientists there is a large number that do not agree with Darwin's assumption. Because of this the term evolution has been broken down into the terms micro-evolution (meaning adaptation) and macro-evolution. Darwin observed the ability of organisms to adapt (micro-evolution) and assumed that on this basis macro-evolution was true. Macro-evolution could be said to occur if a dog became a cat or a dinosaur became a bird. It occurs at the genus or higher level and implies that all life on Earth descended from a few types of cells that somehow came into being in the past. Many scientists do not agree with this hypothesis. The diagram below should help you to understand the differences.

↔ **MICRO-EVOLUTION can be considered to be HORIZONTAL** ↔

It is a change or adaptation at the species level.

(Examples are the number of different types of: cats, dogs, cattle, birds, fish, etc.)

On the basis that micro evolution was true Darwin hypothesized that "macro evolution" or "molecules to man evolution" was also true as stated in the text.



Based upon these definitions it is easy to see that micro-evolution is true but the truth of macro-evolution has not been established. Using the term "evolution" without specifying which type is being discussed is unfortunate and has caused much misunderstanding among scientists and the public. The term macro evolution should be used in order to clarify the problem.

An illustration occurs in the third paragraph of page 321 where the textbook authors discuss changes in the beaks of finches due to environmental factors. They state that "**the finches have evolved.**" The finches have adapted to changes in their environment and may be said to have gone through a micro evolutionary change but they are still finches and therefore have not gone through a macro evolutionary change.

## The Fossil Record Tells a Story of Evolution Page 327, column 2

The Geologic Time Scale was essentially in its present form by 1840 as the text says. This was long before much was known about world geology. If macro evolution is accurate then the order presented by Figure 15-6 is what would be expected in the fossil record. However, there are facts that tend to nullify this assumption. One of them is that many gaps exist in the fossil record. Are these gaps real? Darwin was aware of this problem when he wrote, "*Why then is not every geologic formation and stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic change, and this is perhaps the most obvious and serious objection which can be urged against the theory [of macro-evolution].*"<sup>1</sup>

Professor Stephen J. Gould of Harvard University confirmed Darwin's doubts are still valid when he stated, "*All paleontologists know that the fossil record contains little in the way of intermediate forms; transitions between major groups are characteristically abrupt*"<sup>2</sup> The fact that the gaps are still there prompted Professor Gould and Niles Eldredge of the American Museum of Natural History to develop the punctuated equilibrium theory. It should also be noted that the gaps are also present in comparative molecular biology as brought out in this topic on p. 7 of this paper.

1. Darwin, Charles R, *The Origin of Species*. Harvard university Press, 1964, p.280.

2. Gould, Stephen J., *The Return of the Hopeful Monsters*, Natural History, Vo1. 86, No. 6, June-July 1977, p. 24.

## Extinct Living Fossils Page 328, column 1, line 2

The text says, "**Extinct species do not suddenly reappear millions of years later as a new creation.**" The table below shows a small portion of organisms that have gone through so little change over millions of years that they are still recognizable as the same as the fossils. Paleontologist Dr. Joachim Scheven has a museum in Hagen, Germany where he has accumulated almost five hundred examples of fossils that were thought to be extinct but have been found alive. He has a video out on the subject. Some of the more commonly referred to fossils are shown in this table.

ALIVE ORGANISM	YEARS PRESENT IN THE FOSSIL RECORD
Coelacanth	350 to 70 million years <sup>1</sup>
Horseshoe Crab	424 to 50 million years <sup>2</sup>
Lingula	510 to 430 million years <sup>3</sup>

Neoplina	600 to 385 million years <sup>4</sup>
Graptolites	570 to 360 million years <sup>5</sup>

How can these fossils be alive and recognizable today and yet not show up in the fossil record for periods greater than 50 million years or more? Does this kind of data increase or decrease your confidence in the fossil record?

1. Hickman, et al., *Integrated Principles of Zoology*. C. V. Mosby, London, 1979, 6th. Edition, p. 508.
2. *ibid.* p. 333.
3. *ibid.* p. 437.
4. *ibid.* p. 270
5. Rigby, Sue, *Nature*. Vol. 363,3/18/93, p.209.

## The Cambrian Explosion Page 330, column 2

The Cambrian Explosion is one of the mysteries of geology in that so many of the modern day phyla appeared as the author states. The real problem is that these organisms seem to appear suddenly without any ancestors. Richard Dawkins, author of *The Blind Watchmaker*, puts it this way, "...the Cambrian strata of rocks, vintage about 600 million years, are the oldest in which we find most of the major invertebrate groups. And we find many of them already in an advanced state of evolution, the very first time they appear. It is as though they were just planted there, without any evolutionary history." <sup>1</sup> For instance, the trilobite is an extremely complex organism with a segmented body and legs including a complex nervous system and one of the most complex eyes known. Science News puts it this way regarding trilobite eyes, "...the most sophisticated eye lenses ever produced by nature." <sup>2</sup> There are trilobites in the pre-Cambrian strata but they show no signs of being related to the Cambrian trilobites. Even Charles Darwin recognized the Cambrian Explosion problem and had this to say on the subject, "*The case at present must remain inexplicable; and may be truly urged as a valid argument against the views here entertained.*" <sup>3</sup>

1. Dawkins, Richard, *The Blind Watchmaker*. New York: W. W. Norton, 1987, p. 229.
- Stephen J. Gould of Harvard concurs. *A Short Way to Big Ends*, Natural History, Vol. 95 (January 1986), p. 18-28.
2. Shawver, Lisa J., *Trilobite Eyes: An Impressive Feat of Early Evolution*. Science News, Vol. 105, (2 February, 1974), p. 72.
3. Darwin, Charles, *On the Origin of Species*. Harvard University Press, 1964, p. 308.

## Comparative Anatomy or Homologous Structures Page 333, column 2, line 13

The textbook makes the statement, "**Similar structures, despite differences in function, imply common ancestry and, therefore, evolution.**" Note that the correct term here is macro evolution. The real question is whether things that look similar *necessarily* have the same origin. Would you consider the bones color-coded in Figure 15-9 (p. 333) as being similar if you were given all of them in a bag with no labeling? Upon close examination of the animal structures presented in the figure it should be noted that there are bones located in the same relative location on the limbs but this does not mean that they have the same bony heads and size. Examination reveals they are not similar after all. The bone lengths, diameters and knobby protrusion locations, shape and size are all different. The information in the DNA must be very different to direct the formation of each of these different bone structures.

To further confuse the picture, Sir Gavin deBeer, Director of the British Museum of Natural History, said back in 1971 that, "*Has Dobzhansky explained it when he stresses that there is no one to one relation between a gene and a trait, that evolution does not consist of independent changes of organs or traits; but what changes is the genetic system. Is this also why organs can be homologous in spite of the*

*genes controlling them being different.*”<sup>1</sup> The genes reveal that just because a structure is serving a similar purpose in different animals **it may not have come from an identical gene** and therefore have the same ancestor. Even if the genes were similar it is inconceivable that the many mutations required to produce these differences could have occurred by random chance happenings. For instance, the divisions of the fertilized egg (zygote) up to the stage where a complete sphere is formed (blastula) in reptiles and mammals are so different that it is impossible to conceive of the idea that they descended from the same ancestor even though the forelimbs look similar (homologous).<sup>2</sup> Also, the fore limbs of the newt, lizard and man develop from different parts of the embryo.<sup>3</sup> There are so many instances where similar structures obviously do not mean descent from a common ancestor that biologists call these **analogous structures**. What is it about a structure which determines common ancestry? What is this common ancestor? It has not been named. There is no clearly defined set of guidelines so that, basically, the decision depends upon what the observer is attempting to prove.

Another consideration regarding similarity of structures is whether there is an alternative way to perform a needed function. How many different ways can an appendage like a leg that serves to support an organism be attached to an organism? The requirement that the appendage must have stiffness can only be done in a living organism by bone or cartilage located either in the appendage or on the outside such as insects have. Can you think of another way? Except for the way they are connected together, shouldn't the bones used for support look approximately the same?

1. Sir Gavin deBeer, *Homology: An Unsolved Problem*, 1971, p. 16 (from *Readings in Genetics and Evolution*, No. 8)

2. Michael Denton, *Evolution: A Theory in Crisis*, 1986, p.145 and Figure 5.4.

3. *Ibid.* number 2, p. 146.

## **The Horse Fossils Page 333, column 2, last paragraph and Figure 15-12, page 335**

The text and figure propose that the supposed changes in the horse is an example of evolution. The use of the word evolution in this context is very misleading in that all of the animals except for the Hyracotherium are still horses (see #1 below) so that if they are thought to have evolved they are an example of micro evolution and do not imply macro evolution. Consider the following facts:

1. Hyracotherium has little or no resemblance to horses but is similar to the Hyrax which is alive today.<sup>1</sup>

2. In northeastern Oregon, the three-toed (Neohipparion) and the one-toed horse (Pliohippus) are found in the same strata which means that they lived at the same time in the same place. No transitional forms have been found. One does not seem to be the ancestor of the other as Figure 15-12 proposes.

3. In South America the one and the recessed three-toed horses (Equus and Merychippus) were found together in the Miocene strata (13-25 million years) and the full three-toed horse (Meshippus) above the other two in the Pliocene strata (2-13 million years).<sup>2</sup> This completely contradicts Figure 18.4.

4. Size cannot be used as an indicator of evolution because today's horses range in size from 16 to 80 inches tall.

5. As late as 1892 three toed horses were reported to be living with the one toed horse in the U.S.<sup>3</sup>

6. A volcanic eruption in Nebraska buried a one-toed and a three-toed horse together proving that they lived together at the same time.<sup>4</sup>

7. David Raup, Curator of the Museum of Natural History, where approximately 20% of the world's fossils are housed, comments,<sup>5</sup> “.....*some of the classic cases of Darwinian change in the fossil record, such as the horse in North America, have had to be discarded or modified as a result of more*

detailed information.” Note that this comment was made back in 1979.

1. Kerkut, G.A., *Implication of Evolution*. Pergamon Press, London, New York, 1960, p.149.
2. Roemer, A S., *Vertebrate Paleontology*. Third edition, Univ. of Chicago Press, Chicago, 1966, pp. 259-261.
3. Marsh, O.C., *Recent Polydactyle Horses*. American Journal of Science, Vol. 43, 1892, p. 339-354.
4. National Geographic. January, 1981, p.74.
5. Raup, David, *Conflicts Between Darwin and Paleontology*, Field Museum of Natural History Bulletin, Vol. 50, No.1 (1979), p. 25.

## **Vestigial Structures Page 334, column 1, line 10**

Originally, there were thought to be approximately 180 vestigial organs in man. Slowly over the years this has been reduced to a handful so that present thinking is that a use will be found for these few remaining organs as science progresses. The text says, "**Our own tail-bone, invisible without an x-ray image, is a vestige of another way of life.**" This is no longer a true statement in that it is now known that the human tail-bone serves as an attachment point for muscles that allows humans to walk more upright than the primates.<sup>1</sup> The medical profession now knows that the appendix plays a functional role in the immune system.<sup>2</sup>

The hypothesis that pseudogenes or junk DNA are vestigial is not supported by the evidence. It is now known that there is a biological mechanism present in organisms for the removal of DNA that has no function. This means that the pseudogenes would have been removed if they were truly vestigial.<sup>3</sup>

Figure 15-13 reports that the blue whale has vestigial pelvic bones. It is now known that the supposed vestigial legs are not legs but anchor points for specific organs. In the male whale they serve as an anchorage for the male reproductive organs and in the female an anchorage for the vaginal expulsion muscles.

1. C. M. Goss, editor, *Gray's Anatomy*, 25 th edition, Lea and Febiger, 1948, pp. 408-409.
2. H. Kawanishi, *Immunology*, 1987, Vol. 60, p. 19-28.
3. Farlow, B., *Stuff or nonsense?* New scientist, Vol. 166, No. 2232, 2000, pp. 38-41.

## **Comparative Embryology Page 334, column 2, Figures 15-14 and 15**

In 1891, Ernst Haeckel produced a series of drawings of vertebrate embryos proposing that they represent a kind of tree of life.<sup>1</sup> The drawings supposedly showed that all vertebrates pass through all of their evolutionary history in arriving at its final state. He used the drawings to prove what he called the Biogenetic Law. Haeckel was such an enthusiastic evolutionist that he altered his drawings in order to prove his point. These errors were discovered before he died and he was tried in a court of his fellow professors at the University of Jena in Germany and found guilty of fraud.<sup>2</sup>

Even though it has been known for almost one hundred years that the drawings of Haeckel and the Biogenetic Law are not true very little effort was made to find out exactly what the truth is. Michael Pitman in 1984 reported<sup>3</sup>, "*Had he (Haeckel) started at the logical place, the zygote, he would have realized that different classes of egg differ greatly in yolk content, size and shape, cleavage patterns, blastula, and in the organization which prepares them for gastrulation. Haeckel's series begins at the point when these diverse early stages converge, just before organ formation. This seems, for reasons unknown, to be the only tolerable intermediate stage. Thereafter, divergence again occurs into the diverse adult types.*" In the middle 1990's Dr. Michael Richardson of St. George's Medical School conducted a large scale investigation to determine the truth. He found that Pitman was right and that

there was little resemblance between Haeckel's drawings and the truth. What he did find was that **some** embryos "*pass through an intermediate stage in which some of them superficially resemble each other* (Haeckel's first stage)" <sup>4</sup> as reported by Pitman and shown in Figure 15.14. It is important to recognize that this one appearance of similarity is true for this case only and therefore indicates nothing since the embryos are very different for earlier and later development stages. Based upon this fact the similarity between the mouse and human embryos shown in the figure is a gross misrepresentation of the facts.

The textbook author is very misleading in his figures and statement, "*For example, all vertebrates embryos, including mans, have tails and gill-like branchial arches.*" Advances in embryology have shown that the slits (more properly creases or skin folds) seen under the head of the human embryo are not gill slits as they are in fish. The idea that the human embryo is similar to that of a fish has been rejected by many scientists.<sup>4</sup> The idea that the slit or opening in the child's neck is related to a fish gill is not true. This is a birth defect just like any other birth defect. This is classified as a birth defect because none of the supporting evidence for a gill is present in these children - no increased blood supply or lung tissue. It is now known that the bulge just below the head develops into the thymus gland, the second bulge becomes the parathyroid gland, the next one becomes the middle ear and the fourth becomes the tonsils. Keith Thomson, Chairman of the Yale University Biology Department, said, "*Surely the biogenetic law is as dead as a doornail. It was finally exorcized from biology textbooks in the fifties. As a topic of serious theoretical inquiry it was extinct in the twenties.*" <sup>5</sup>

1 Wells, Jonathan, *Haeckel's Embryos & Evolution: Setting the Record Straight*. The American Biology Teacher, Vol. 61, (May 1999), Num. 5, p. 345.

2. Pitman, Michael, *Adam and Evolution*. London, Rider, 1984, p. 120.

3. Ibid. for reference 1, p. 345.

4. E Beck, DB. Moffat and D.P. Davies, *Human Embryology*, 1985, p.172.

5. K. S. Thomson, *Ontogeny and Phylogeny recapitulated*. American Scientist, May/June 1988, pp. 273-275

## **Comparative Molecular Biology Page338, Column 2, page 336**

The authors end the 2nd paragraph with the statement that, "*The universal homology of this system suggests that it is a common heritage passed down from some ancient common ancestor.*" This statement does not follow from the fact that all organisms use DNA, RNA, ribosomes, the same genetic code, the same 20 amino acids, ATP, the same essential life cycles and similar proteins. They have these things in comon because they must operate in the same environment.

At the bottom of the next page the authors say, "*Not surprisingly, similar species have similar cytochrome c's while very different species have more changes. For example, humans and chimpanzees have exactly the same sequence of amino acids in cytochrome c while humans and tuna differ by more than a hundred. Evolutionary biologists now routinely use data from such comparisons to construct phylogenetic trees.*" These statements are interesting in light of the tree presented in Figure 15 -16. First of all note the two errors in these statements according to the tree example - human and chimpanzee differ by one amino acid, not zero, and humans and tuna vary by 29.1, not 100, amino acids. It is also worth noting that there are a number of ways to plot these trees and still be consistent with the data. This particular tree is interesting in that it shows the turtle is more closely related to the birds (8.7) than to a snake, a fellow reptile (28) (the smaller the number the more closely related are the organisms); humans are more closely related to the kangaroo (9) than the rabbit (11.2); rabbits are more closely related to the kangaroo (6.7) than the dog (7.1) or pig; and the pig is more closely related to the donkey (4.3) than the dog (6).

Are these what you would expect?

The general order of macro evolution is: bacteria, algae, yeast, plant, insect, lamprey, fish, amphibian, reptile, bird, mammal. Cytochrome c differences strongly disagree with this order. The percent differences in the order of the amino acids is as follows as compared to the bacteria *Rhodospirillum rubrum* C<sub>2</sub> where the numbers indicate the number of amino acids that are not in the same place in the cytochrome C:

(yeast) bakers yeast-69, (plant) wheat-66, (insect) silkworm moth-65, lamprey-66, (fish) carp-64, (amphibian) bullfrog-65, (reptile) turtle-64, (bird) pigeon-64, (mammal) horse-64, (Mammal) human-65.

Isn't it logical that these numbers should get progressively larger as one progresses up the macro evolutionary ladder? This result is even more startling when it is recognized that in each case there is a different arrangement of the amino acids. The conclusion is that bacteria are a separate entity with no intermediate forms between them and man. If the silkworm moth is compared to its descendants the results are:

lamprey-30, carp-25, turtle-26, pigeon-25, horse-27.

If the carp is compared to its evolutionary descendants the results are:

lamprey-12, bullfrog-13, turtle-13, pigeon-14, horse-13.

Note once again that the silkworm moth and the carp are almost equally separated from all of their supposed evolutionary descendants so that the similar numbers in the bacterial comparison do not represent identical amino acid differences. It does not appear that any of these vertebrates descended from its supposed ancestor. Based upon this data cytochrome c does not agree with the concept of macro evolution.

The other thing that studies of cytochrome c produces is that there are gaps at the molecular level just like there are in the fossil record. The gaps between fish, amphibian, reptile, bird and mammal exist at the molecular level and the fossil record.<sup>1</sup>

1. A table that more clearly shows these relationships can be seen in Michael Denton's book *Evolution: A Theory in Crisis*. Adler & Adler, Bethesda, Maryland, 1986, p. 277-293.

## Chapter 16

### Micro and Macro Evolution Page 349, Column 2, line 47

As was stated earlier, the authors define micro and macro evolution at this point in the text. The key to the interpretation of this chapter is contained in the definition of macro evolution and the title of Chapter 17, page 368. The text states, "**Micro evolution is distinct from macro evolution – the process by which species and higher groupings (taxa) of organisms change and go extinct, a topic we will discuss in the next chapter.**" This very clearly reveals that this chapter will discuss micro evolution and Chapter 17 will discuss macro evolution.

The chapter does a commendable job of describing various theories about how adaptation occurs. There are, however, some instances where the facts are over simplified so that additional information will provide the necessary background for accurately understanding the process.

### What Is Genetic Variation? Page 350, column 2

The authors state, "**Most chromosomal mutations are lethal or extremely damaging in animals, though less so in plants. But chromosomal rearrangements can, on occasion, benefit the organism. For example, the duplication of a chromosome segment, if harmless, can be passed on.**"

**In time, mutations in the new copy of the gene can allow it to take on new functions. As a result, the species has more genes than it did formerly.”**

To the casual reader the above statement seems very plausible. When the details of execution are examined the picture changes considerably.

DNA contains the complete instructions (information) for assembling another organism like the parent organism including how to make the tools (enzymes) necessary for reading this information and the necessary enzymes to assemble the various parts. If the simplest living organism is to take a macro evolutionary step there must be an increase in the information content of the DNA. In preparation for the next chapter the authors are trying to explain how this might occur by the above statements. This is not as simple a process as is inferred.

To put this in perspective consider that the letters in this textbook are the DNA of an organism. The text therefore gives detail instructions on how to make another similar organism. A chromosomal mutation is similar to making a copy of any chapter in this book and randomly adding the copy into the text by shutting your eyes, randomly opening the book and inserting the material. Do you think that this will enhance this textbook? Try it with a single page or two to get a feeling for what needs to be done. Has any new information been added? The answer is obvious - NO. The above quote proposes that this copied chapter or page will be randomly modified one letter at a time until the added material is new information. This new information must not conflict with the existing information but actually add to it in a coherent manner so that a more complex organism is described. A chapter of this book contains approximately 40,000 letters. They would have to be changed by completely random mutations to accomplish this. When this is considered in light of the facts in the next section chromosomal mutations are not a source of additional coherent information.

We know that the addition of another chromosome or extra DNA to the existing DNA (Trisomy) does occur. This does not increase the information in the DNA and is not desirable in the animal kingdom since the results are usually fatal or produce deformed off-spring such as Down's syndrome, Klinefelter's syndrome or Turner's syndrome do in humans. Even though some of these individuals can become contributing members of society, the additional chromosome does not make them more survivable. Trisomy is not known to be beneficial to the overall characteristics of an organism. The chances of a random section of DNA from any source joining with the DNA of a reproductive cell (gamete) in an overall constructive manner is impossibly small.

## **Mutations Page 352, column 2**

The textbook states, **“Mutations cause random changes in protein structure and, thus, most mutations damage the organism. Occasionally, however, random changes may cause no harm or may even give an advantage to the organism that bears them. Such rare advantageous mutations are the fuel of evolution.”** A thorough understanding of what is being said here is essential to the understanding of not only this chapter but also the next one.

Some authors have commented that only about one in 1000 mutations "might" be beneficial.<sup>1</sup> This value appears to be extremely optimistic but can be used to get a better understanding of what the textbooks are saying in the first statement in the above quote. Fruit fly experiments reveal that generally it takes about five mutations to make a significant physical change in an organism<sup>1</sup>. Note that this does not mean a new species has been formed. Many more than five mutations at a time have been caused on fruit flies [*Drosophila melanogaster*] with only a deformed fruit fly as a result. **It must also be remembered that a mutation in the DNA of any cell other than the reproducing cell does not have any influence on succeeding generations.** When all of these probabilities are combined, the question must be asked, "How can evolution occur from processes that produce many more negative results than positive results?"



million years ago and the coelacanth from 350 to 70 million years ago. The ginkgo tree does not appear in the top 100 million years of the geologic record.

## CHAPTER 17

The title of this chapter is “Macroevolution: How Do Species Evolve? The authors define macroevolution on page 369, column 2 as “**the origin and multiplication of species.**” They do not propose at this point that, because species evolve, “molecules to man” evolution is true which is the more commonly held definition of macro evolution. They lightly hint about the subject of “molecules to man” evolution in the next chapter when discussing the origin of life.

### **How Do Species Form? Page 373, column 1**

The authors have just presented a detailed discussion of the difficulties of determining and defining species in both the fossil record and living organisms.

This section opens with a very important statement that is the key to the rest of the chapter. It is, “**We have seen that for two populations to become separate species, they must become *reproducibly isolated, unable to interbreed.***” Wherein these authors classify this type of speciation as macro evolution this is adaptation to the natural environmental pressures and therefore micro evolution. The fact that the organisms are no longer able to interbreed as a result of their isolation does not infer that new genetic information exists. Actually genetic information has been lost compared to the original parents.

### **The Cambrian Explosion Page 380, column 2**

The Cambrian Explosion was also discussed in some detail in Chapter 15 and page 4 of this addenda. It has been known about since Darwin’s time and remains one of the major biological mysteries. As the textbook reports that “**all of the modern animal phyla that have fossilizable skeletons appeared.**” Darwin was very concerned over it in his time and it still remains a problem today.

### **Gaps in the Fossil Record Page 384, column 1, line 8**

As the textbook noted in chapter 15, page 327 and page 2 of this addenda the gaps in the fossil record do pose a problem. It should also be remembered that the gaps also exist in molecular biology as discussed on page 7 of this addenda. It is these gaps that prompted the “hopeful monster” hypothesis discussed on page 386 of the text and the “punctuated equilibrium” hypothesis discussed on page 387. The Harvard paleontologist Stephen J. Gould, who along with Niles Eldridge originated the punctuated equilibrium hypothesis, said,

*“The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolution trees that adorn our textbooks have data only at the tips and nodes of their branches, the rest is inference, however reasonable, not the evidence of fossils.”<sup>1</sup>*

The authors of the punctuated equilibrium hypothesis proposed it to explain the gaps in the fossil record at the species level. Contrary to the wishes of Gould and Eldridge, some have tried to extend the hypothesis to include the gaps at higher levels. The authors of this text keep it as it was intended.

Two of the major objections to the hypothesis are:

1. There is no evidence except the gaps. In other words, the lack of evidence is considered as proof of the hypothesis. The feeling is that it would be dangerous to let this idea get started in science.
2. There is no plausible mechanism or explanation for the genetic changes that occur.

Examples of mutational changes are particularly instructive when it comes to the macro evolutionary concept as defined by the authors. Mice living at the Chernobyl reactor show mutational changes but they and their offspring are still mice. With all the thousands of mutational experiments carried out on the fruit

fly (*Drosophila melanogaster*) where the mutational rate was increased by 15,000 percent <sup>2</sup>, none have produced a better fruit fly nor anything other than a fruit fly that survived and reproduced. In fact, an interesting experiment was carried out in 1948 by Ernst Mayr and reported by J. Rifkin <sup>3</sup> that revealed mutations can cause only a limited variation in a species. Starting with a parent stock that had 36 bristles, the fruit fly was selectively bred (not a random event) in an attempt to have a fruit fly with no bristles. After 30 generations the number of bristles was lowered to 25 but then the line became sterile and died out. A second experiment was carried out to increase the number of bristles. Once again sterility set in when the number of bristles reached 56. Mayr concludes "*The most frequent correlated response of one-sided selection is a drop in general fitness. This plagues virtually every breeding experiment.*" As mentioned earlier this paper's author can confirm this from his experience in raising peaches commercially. The peach trees that produce the prettiest and largest peaches will quickly die if not cared for. This is in direct contrast to wild trees that are seen flourishing around an old abandoned house for years without care. The selective crossbreeding of trees for large fruit with good flavor weakens the ability of the tree to survive. What does all of this mean? It means that when man deliberately introduces mutational changes into the DNA, the probable result is an organism that is not as environmentally adept at coping with the environment as it could originally. Why should an organism be stronger when undergoing random mutations if "controlled" mutations do not do the job?.

1. Gould, S. J., *Evolution's Erratic Pace*. Natural History, vol. 86 (May 1977), p. 14.

2,3. Rifkin, *Algeny*. (1983), p.134.

## **The Chimpanzee and Human Similarity Page 390, column 1**

The author states "...that humans share a common ancestry with other apes." As backup of this hypothesis the text says beginning on line 22 that, "Our own DNA differs from that of chimpanzees and their cousins the bonobos ("pigmy chimps") for example, by less than 1 percent." A recent article in the Proceedings of the National Academy of Sciences suggests that there is approximately a 5% difference between the DNA of chimpanzees and humans.<sup>1</sup> This information was obtained by comparing approximately 1% of the genome and considered substitutions, insertions and deletions. As more of the genome is considered the difference has risen to 7.7% <sup>2</sup> and even 13.3%. It has even been estimated to be as high as 20%.<sup>3</sup> The much publicized number of 1.4% was obtained by considering only substitutions.

Any of these numbers amounts to a staggering amount of information in the DNA. The 5% difference amounts to a staggering amount of information in the DNA. If the human and chimpanzee genomes are both considered to have 3,200,000,000 base pairs (in spite of the chimp having 2 more chromosomes than the human and 10% more DNA)<sup>4</sup> the 7.7% amounts to 246,000,000 base pairs different. This is the amount of information contained in a book whose thickness is equivalent to about 46 books such as this textbook if it contained nothing but full pages of print from cover to cover similar to this type written page. Remember that all of these mutations had to occur in the zygote (one cell) that actually takes place in reproduction.

**Critical Thinking:** If the chimp has 10% more DNA than a human how can it be said that there is only a 7.7% difference? Which of the differences given above is the most reasonable?

If this much information difference exists in the DNA between the chimpanzee and the human the difference between man's ancestor and man **must be much larger**. It is completely inconceivable that this much coherent information could have been accidently changed in the DNA of a member of the ape family to get man when the mutational problems discussed earlier are considered. If the transition from ape to man is to be accomplished by mutations, it is apparent that there should be plenty of fossil evidence. Where is the fossil evidence?

There is much disagreement over whether or not "Lucy" is in the ancestral lineage of man. Many reputable paleontologists maintain that she is only a pygmy chimpanzee similar to ones alive today.

Paleontologist Adrienne Zihlman, University of California at Santa Cruz says, "Lucy's fossil remains match remarkably well with the bones of a pygmy chimp."<sup>5</sup> Evolutionists such as Charles Oxnard, Sir Solly Zuckerman, William L. Jungers, Jack T. Stern, Jr and Randall L. Susman all concur.<sup>6-9</sup>

1. Britten, R.J., *Divergence Between Samples of Chimpanzee and Human DNA Sequences Is 5% Counting Indels*. Proceedings of the National Academy of Sciences, USA, Vol. 99 #21, 2002, pp. 13633-13635.
2. Watanabe, H. et al, *DNA Sequence and Comparative Analysis of Chimpanzee Chromosome 22*. Nature, Vol. 429, 27 May 2004, pp. 382-388.
3. Weissenbach, Jane, *Differences With Relatives*. Nature, Vol, 429, 27 May 2004, pp. 353-354.
4. Hacia, J. G., *Genome of the Apes*. Trends in Genetics, Vol.17 #11, 2001, pp. 637-645.
5. Zihlman, A.L., "Pygmy Chimps, People, and the Pundits," New Scientist, Vol.104, No.1430, Nov.1984, pp. 39.
6. Oxnard, Charles E., *University of Chicago Magazine*, Winter 1974, p. 11.
7. Zuckerman, Solly, "Beyond the Ivory Tower," London: Taplinger Press, 1970, p. 78.
8. Jungers, "Lucy's Limbs: Skeletal Allometry and Locomotion in *Australopithecus Afarensis*," Nature, Vol. 297, 24 June 1982, pp. 676-678..
9. Stern and Susman, "The Locomotor Anatomy of *Australopithecus Afarensis*," American Journal of Physical Anthropology, Vol. 60, March 1983, pp. 279-317.

## CHAPTER 18

### Prebiotic Evolution: How Could Complex Molecules Evolve? Page 404

In order to bring this discussion of the origin of life into correct perspective several facts must be recognized and kept in mind:

(1) A carbon atom, an essential part of an amino acid, has four bonding sites. In forming an amino acid four different elements or compounds join to a central carbon atom as shown in Figure 1<sup>1</sup> below - a Hydrogen atom, a Carboxyl Group (COOH), an Amino Group (NH<sub>2</sub>) and an R Group which is

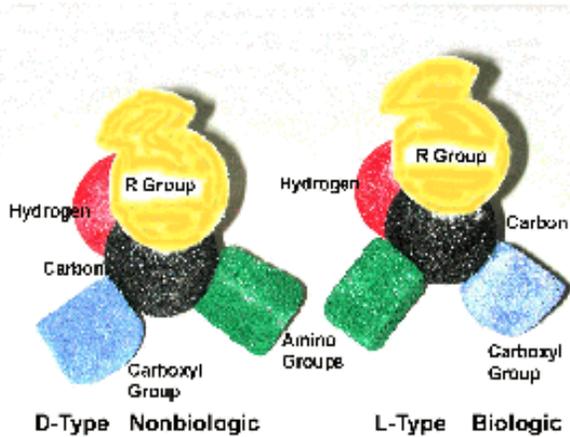


Figure 1. Amino Acid Types

a carboxyl/hydrogen based unit. The composition of the "R Group" determines the particular characteristics of the amino acid and therefore its name. Note that the R Groups are very rarely symmetrical about an axis. The mock up shown in Figure 1 on the next page shows this. The number of compounds that can join to the carbon atom at this spot is very large. Estimates are as high as several thousand. In each case the result is called an amino acid. Of all the possible amino acids occurring naturally only 20 are found in living organisms and are called biologic amino acids. This means that the vast majority of amino acids are classified as non-biologic. If one of the non-biologic amino acids joins with one of the 20 biologic amino acids, the result is a compound that

is not useful for biologic purposes.

(2) To further complicate the situation, the exact order in which the Hydrogen atom, the Amino Group, the Carboxyl Group and the R Group join to the central carbon atom determines whether the amino acid formed can

be used in forming a biologic protein. Amino acids are optical isomers which fall into two structural types -- dextro-rotary (D type) and laevo-rotary (L type). The L and D type molecules are identical chemically but are mirror images of each other just as our hands are. Notice that if the R Group and the H atom are taken as a reference by putting the H atom farthest from to the observer as shown in Figure 1 there are only two different ways the Amino and Carboxyl Groups can join the carbon atom - the Amino Group is either on the left or right of the reference. Only the order shown on the right of Figure 1 above (Amino Group to the left of the line proposed above) is used in forming a biologic protein. Very rarely are D amino acids found in

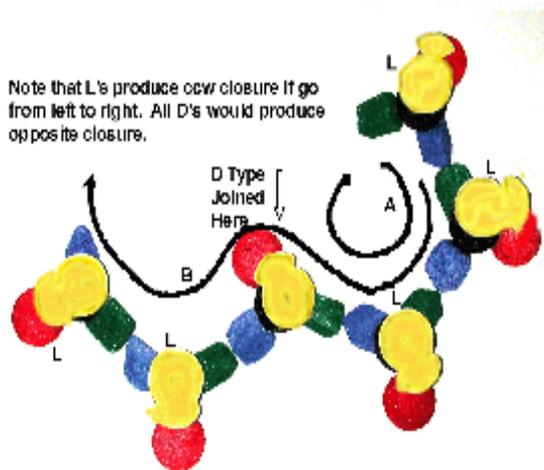


Figure 2. Effect of Introducing a D molecule into an L molecule chain..

living organisms.<sup>2</sup>

(3) It is important to recognize that the L and D amino acids like that shown in Figure 1 above occur in equal numbers in nature but no known life forms use both types of amino acids.<sup>3</sup> In forming a polypeptide the amino acids join to each other by the Amino Group joining the Carboxyl Group. Since these are common to all amino acids this means that there is no preferential connections of biologic verses non-biologic amino acids in forming poly-peptides. As shown above the difference between the L and D molecules is that the Carboxyl Group and the Amino Group swap places on the central carbon atom. In each resultant molecule the chemical equation is the same even though the shapes of the molecule are different. This is most easily understood by looking at Figure 1 and connecting the Carboxyl and Amino Groups together. This makes the R

Groups point in the opposite directions with respect to the polypeptide chain so that the shapes are different.

(4) If only L amino acids are connected in a chain they form a helix as shown by line "A" in Figure 2. If a single D amino acid is connected into a chain of L amino acids the resultant protein becomes non biologic. Note that not only is the R Group (yellow color) in the opposite direction from that of the L molecules but the shape of the polypeptide has also changed from the closed circular pattern of an all L chain to the shape shown by line "B". If a single D type molecule gets into the chain of "L"s the shape of the molecule has changed even though the chemical equation is the same. It is very important to recognize that the shape of a molecule determines how it will interact with other molecules. Dr. Mader points this out in her Biology textbook when she says, "*Shape is very important in determining how molecules interact with one another*" and "*Once a protein loses its normal shape it is no longer able to perform its usual function.*"<sup>4</sup>

If a L type sugar were introduced into a chain of D sugars in the DNA strand it would not be able to coil without causing a tangle as illustrated by line "B".. This would be a fatal mistake.

(5) It is also known that nucleotides (DNA) are formed from a deoxyribose sugar molecule bonded to a phosphate molecule and a nitrogen base. RNA has ribose sugars in the place of deoxyribose sugars. The sugars in these nucleotides also occur in L and D type molecules. The arrangement of the sugars in the DNA ladder is shown below in Figure 3. (More details are given in the Chapter on DNA.) Two different bases join to form a base pair and make a ladder rung.

How proteins formed originally with only L type amino acids and how sugars in the nucleotides (DNA and RNA) formed originally with only D type sugars is an unanswered question. This is particularly puzzling when it is remembered that L and D sugars occur in equal numbers naturally and show no preference in uniting with phosphates. The same holds true for amino acids. A human chromosome consists of about

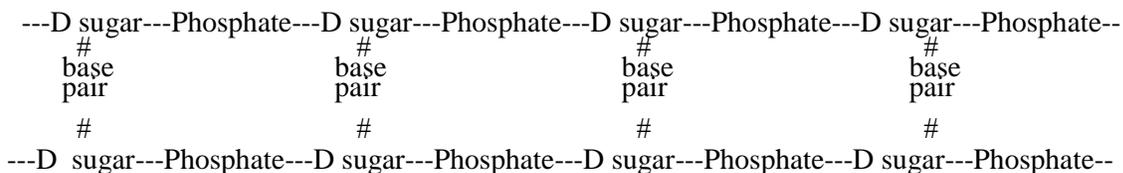


Figure 3. DNA Structure

65 million base pairs on average which means that there are 130 million D type sugars in the DNA of one chromosome. The human genome contains 6,000,000,000 D type sugars.. Logically, half of these should be L type sugars but there are none.

**Question:** What do the L and D type molecules and the great number of possible amino acids do to the

origin of life concept? Support your answer.

1. Idea suggested by Figure 2-16 (p.44) of G.J. Tortora, B.R. Funke, C.L. Case, *Microbiology: An Introduction*. Benjamin Cummings, 1989, Third Edition.
2. Tortora, G.J., Funke, B.R., Case, C.L., *Microbiology: An Introduction*. Benjamin/Cummings, 1989, Third edition, p.44.
3. Cohen, J. "Getting All Turned Around Over the Origins of Life on Earth." *Science*, Vol. 267 (1995), pp. 1265-1266.
- Bonner, W., "Origins of Life." 1991,21, pp.59-111.
4. Mader, S.S., *Biology*. McGraw Hill, Seventh Edition, 2001, p. 37 and 47.

## The Early Atmosphere

### Page 404, column 1, line 18 and Page 405, column 2

In the world as it presently exists, life could not have evolved. Why? Oxygen is present in the atmosphere. On line 18 of this section the author makes this point by saying, "**Had oxygen been present in any quantity, it would certainly have oxidized the starting materials for life.**" The presence of oxygen in the atmosphere precludes the formation of amino acids and the formation of polypeptides, proteins, ATP, nucleic acids in DNA and lipids.<sup>1</sup> Oparin recognized the problem and hypothesized that if the atmosphere contained water vapor, hydrogen, methane and ammonia without any oxygen then energy from the sun and lightning would form amino acids that would drop into the oceans and form a primordial soup from which life might have evolved. There is, however, abundant evidence to the contrary. The only part of Oparin's hypothesis that has been proven by experiment is that the gases he listed (methane, ammonia, hydrogen and water vapor) can be made to form amino acids. Most of the amino acids formed are not biogenic. Some of the problems regarding the origin of life under this hypothesis are:

1. The geologic evidence indicates that the necessary atmosphere **without any oxygen** was not present. Many primordial sediments contain red minerals which are metal compounds of oxygen indicating oxygen was present at the time of their formation. There is geologic evidence that the earliest rocks (dated at 3.7 b.y.) existed in an oxygenic atmosphere<sup>2</sup> so that the formation of amino acids in any significant concentration in the atmosphere and therefore in the ocean was not possible.<sup>1</sup>
2. Ultraviolet light breaks down the Oparin gases methane and ammonia, two of the three necessary building blocks of amino acids. If there was no oxygen in the atmosphere then there should have been no ozone layer. This means that ultra violet radiation would have been much more intense than what we have today. The concentrations of these building blocks would have been reduced quickly to such a low level that they could not have played an important part in amino acid formation.
3. Ultraviolet light breaks down water, the third building block of amino acids, into oxygen and hydrogen. The presence of oxygen minimized the formation of any amino acids in the atmosphere.

These first three problems point out that any significant amino acid concentration in water could not come from the reaction of gases in the atmosphere. Even if amino acids could somehow be formed in a pool, lake or sea there are factors such as listed below that make the formation of life unlikely. Consider the following problem areas:

4. There are two structural types of amino acids and sugars --- dextro- rotary (D type) and laevo-rotary (L type). Whenever amino acids and sugars are being formed these two types are formed in equal numbers. No known life forms use both types of amino acids<sup>7</sup> and sugars. Both types of molecules will easily combine chemically with each other but only one of the wrong type of amino acid in a protein or sugar in the DNA will make it biologically useless from a functional viewpoint. There is no natural process for separating and isolating L and D molecules outside of the cell. The proteins of living organisms are made up of L type amino acids and the DNA and RNA strands from D type sugars. The duplication process of the cell assures use of only the right type of molecule. DNA produces tRNA which promotes the synthesis of L type proteins. There is no evidence that such a separating mechanism was present until the first replicating life form came into existence.

5. Water is a diluting and reacting agent so the question must be answered as to how the amino acids can be concentrated to form polypeptides (chains of amino acids), proteins and, ultimately, organisms. The evaporating pool hypothesis that evaporation will concentrate the amino acids has the problem that some of the compounds necessary for "molecules to man" evolution to take place evaporate<sup>3</sup> along with the water. Insulin, the smallest protein, requires fifty-one L type amino acids (17 different types). It is inconceivable that this many amino acids could be assembled on a molecular basis without the detrimental effects of water, D type or other type of amino acids or other non-biologic compounds interacting.. Even if insulin is obtained this does not verify that "molecules to man" evolution could take place because many more proteins are needed to have even the simplest living organism.
6. Natural selection only has an effect on living organisms.
7. Amino acids are quick to combine with other compounds, including those from which they were formed, to form non-biologic compounds.
8. When two or more amino acids unite by the addition of energy to form a polypeptide, a water molecule is produced. This water molecule must be removed immediately because it will unite with the polypeptide. This means that the polypeptide is not stable unless the water is removed.<sup>5</sup> How can the water be removed when everything is in water. Ferris states this scientifically as,<sup>4</sup> *"But it has not proved possible to synthesize plausibly prebiotic polymers this long (30 to 60 monomers) by condensation in aqueous solution, because hydrolysis competes with polymerization."*
9. Biochemical compounds tend to break down (decay) when not combined within a living organism. When living organisms die they decompose back into their simplest molecular components. The chemical tendency is away from life.<sup>6</sup> Thus even if a protein were formed it would not have been stable and would not have waited around for a spontaneous combination at some later time with other proteins.

The famous Miller-Urey experiments supposedly proved Oparin was right and suggests that life could have evolved. The apparatus is shown in Figure 18.8 on p.406. One of the problems of this experiment was that the experiment produced both D and L type amino acids, other non-proteinous amino acids and polymers which were capable of reacting with the desirable amino acids to produce non-biologic compounds.<sup>8</sup> Miller had to use a trap to isolate the products of his experiment from getting back to the original gases since the biologic amino acids formed would react with the excess Oparin gases and form non-biologic compounds. What mechanism in nature would be available to perform this same separation task? Their experiments came up with a total of only 10 biologic amino acids, sugars, other compounds and 30 non-biologic amino acids all mixed together. Insulin, one of the smallest of proteins, consists of 51 amino acid bonds and requires 17 different biologic amino acids. This protein could not have been formed had there been nothing but the Miller biologic amino acids present. Other scientists<sup>9</sup> have done similar experiments with other sources of energy and formed many other biologic and non-biologic compounds but with similar results. If all of the cited experimenters results are combined the necessary 17 different amino acids required for insulin are not produced.

It is further noted in the textbook that even though science has demonstrated other ways in which vital organic compounds might have been formed there is a vast gap between the forming of individual compounds and their assembly into the precise order necessary to obtain a living organism. The complexity of even the simplest life form is far from simple or primitive. One of the smallest prokaryotes (H-39 strain of mycoplasma, a bacterium) consists of 640 proteins whose average length is 400 amino acid bondings<sup>10</sup>. This means that it has 256,000 amino acids arranged in a very specific order. These amino acid bonds are coded in the DNA by means of 768,000 base pair bondings in a specific order and 1,536,000 sugar-phosphate pairs. If we add all of this together, we find that there are 4,864,000 individual chemical entities that must come together to form this "simple" bacterium (2x768,000 bases+1,536,000 sugars+1,536,000 phosphates+256,000 amino acids). Under ideal conditions, the odds of this many amino acids coming together in the right order are approximately the same as winning the Power Ball Lottery every week for the next 640 years. This assumes that to begin with no wrong L or D amino acids or sugars, no non-proteinous amino acids and

other compounds such as were formed in the Miller-Urey type experiments were present. This is a very unrealistic assumption. The addition of these unusable compounds greatly increases the already astronomical odds that organic compounds did not form spontaneously so that the experiment added additional problems for the “molecules to man” evolutionist. How could this have happened accidentally? The step from inanimate organic compounds to a living organism is beyond man’s ability to create. How can it be expected to come together by random chance happenings?

Experiments concerning the formation of polypeptides do not enhance the chances of “molecules to man” evolution taking place unless the polypeptide is one that can be used in the particular organism. If it cannot be used then it is only making “molecules to man” evolution less likely since it introduces an additional non-usable compound. If it is usable then it must be included in exactly the right place in the protein being formed - a very unlikely scenario.

## The Unbreakable Cycle

There is an unbreakable cycle in all cells and bacteria that makes any possibility of macro evolution coming about impossible. Part of the problem is that DNA by itself is useless unless the information can be read and acted upon. Another problem is that a cell without any DNA cannot duplicate itself and so does not lead anywhere. The fact that the mechanisms (enzymes) for duplication of cells and reading DNA is contained in the organism but the instructions on how they are to operate and how to form these mechanisms is in the DNA poses another difficulty. In other words, if the reading enzymes somehow came into existence without something to read (the DNA) plus instructions on what to do with the information obtained, they would be useless. They should have been eliminated according to standard evolutionary theory. In a similar manner, what good are the replication enzymes if operating instructions are not present. All of this information is in the DNA but serves no purpose by itself without some means to read it. The net result is that the DNA and the rest of the organism had to form at the same time. Any one by itself is a dead end. This means that the formation of the first living organism could not have occurred in steps. There is no theory of evolution which can account for the origin of biological structures which have multiple interdependent parts. Darwin recognized this for living organisms when he said, “*If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down.*”<sup>11</sup> If this is true for living organisms it is also true for nonliving organisms where natural selection does not function.

**Thinking Critically:** If all of modern science and technology have been unable to create life, are we to believe it happened by purely natural processes? Support your answer.

1. S. Fox & K. Dose, *Molecular Evolution and the Origin of Life*, Freeman and Co., 1972, p. 44.
- Miller, *Production of Some Organic Compounds under Possible Primitive Earth Conditions*, Journal of Am. Chemical Society, Vol. 77, (1955), pp. 2351, 1361.
2. Clemmy & Badham, *Oxygen in the Precambrian Atmosphere: An Evaluation of the Geologic Evidence*, Geology, Vol. 10 (1982), p. 141.
3. Horowitz & Hubbard, *The Origin of Life*, Annuals of Genetics, 8 (1974), p. 393.
4. Ferris, et al., *Synthesis of Long Prebiotic Oligomers on Mineral Surfaces*, Nature, Vol. 381, 2 May 1996, pp. 59.
5. Thaxton, Bradley, & Olsen, *The Mystery of Life's Origin: Reassessing Current Theories*, New York: Philosophical Library, (1984), p.56
6. Abelson, *Chemical Events on the Primitive Earth*, Proc. National Academy of Sciences, Vol. 55 (1966), pp. 1365, 1369.
7. Cohen, J.. “Getting All Turned Around Over the Origins of Life on Earth.” Science, Vol. 267 (1995), pp. 1265-1266.
8. Thaxton, Bradley, & Olsen, *The Mystery of Life's Origin: Reassessing Current Theories*, New York: Philosophical Library, (1984), pp. 52-54.
9. Ibid # 8, pp. 20-39.
10. Smith, *Cell Biology*, Academic Press (1971), p. 86
11. Darwin, Charles, *The Origin of Species*. Harvard University Press, 1964, p. 179.

## Chapter Summary

A good summary of the rest of this chapter is given by the authors on the bottom of page 414. They state, **“In this chapter, we have explored scientists’ hypotheses about how life might have evolved on Earth billions of years ago. Our discussion of such long ago events has been, necessarily, speculative.”**

The authors must be complimented in the way they handled this material. It is presented as hypotheses and ideas about how things could have happened and not as fact. They use many hedge words such as - may have, possibly, remains a mystery, we may guess, probably, suggests and so on. If the textbook reader looks for the hedge words it will quickly become apparent that the textbook is only suggesting possible scenarios in the latter part of the chapter. All of the section headings from page 407 to 414 fit into this category.

## Conclusions

What has been covered in this addendum should be kept in mind as one reads through the rest of the textbook. As stated at the beginning of this addendum the authors assume that macro-evolution is true and use this assumption occasionally to make unsubstantiated statements addressing the origin of different organisms. The reader should always keep in mind the problem of increasing the information content of the DNA when thinking about whether or not these changes are reasonable and/or possible.

Several conclusions should be obvious such as:

1. It is very misleading to use the term evolution without specifying whether it is micro or macro evolution being discussed.
2. Adaptation or micro evolution occurs at the species level and is provable using conventional scientific tests and principles. It is a fact.
3. The fact that adaptation of species (micro evolution) is true does not imply or prove that molecules to man evolution (macro evolution) occurs any more than the first cool days of October imply or prove that an ice age is beginning or because a person learns something from watching PBS for an hour imply or prove that watching PBS continuously will produce a genius. The major problems that Darwin recognized with his hypothesis are still true plus new ones as science has advanced. Some of these are:
  - Gaps in the fossil record.
  - Cambrian explosion
  - The fossilization process demands catastrophic happenings more violent than what we see today.
  - Similar genes do not necessarily produce similar structures.
  - How new meaningful information can be added to the DNA by random chance happenings.
  - Optical isomers preclude life evolving.
4. Other explanations for what is observed on earth should be examined.