

# **EVOLUTION ADDENDUM**

Chapters 11, 14, 15, 16

In the Textbook

# **BIOLOGY: The Dynamics of Life**

by

Biggs, Hagins, Kapicka, Lundgren, Rillero, Tallman, Zike

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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 as is evidenced by the textbook statement on page 10, *The gradual change in a species through adaptations over time is evolution. Clues to the way the present diversity of life came about may be understood through the study of evolution.* It should be remembered that biology is the study of living things. It is not necessary to know 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 Unit 5 defining evolution in this addendum (page 4) 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.

## 11.3 Genetic Changes Page 296 Mutations in Reproductive Cells Page 296

**Add this paragraph at the end of this heading.**

The statements in this section are misleading in that they imply the phenomena is deceptively simple. Since mutations are supposedly the source of information for evolution it is mandatory to clearly understand exactly what they are and what they are not. Recognize that the definition concerns changes in genetic information but that meaningful coherent information must be added to the DNA in order to build complexity in organisms. The question to keep in mind is, **Does the mutation actually increase the information contained in the DNA or decrease it.** An increase in information is necessary to claim that microorganisms eventually evolved into higher organisms like humans. It is essential that this need for information be understood. Did the transition from the conventional cars of today to the hybrid cars require additional coherent information or is the hybrid car simply a rearrangement of the information required to build a conventional car? Yes, information had to be added. The added information needed concerned electrical motors, drives and frame changes.

The rest of section 11.3 discusses different mutation mechanisms and forces that cause changes in genes and therefore changes in organisms at the species level. It must be recognized that just because mutational changes do occur at the species level this does not imply or prove that all organisms descended from a common ancestor. The textbook does not discuss some of the factors that give the reader an understanding of how difficult speciation is and the fact that it **cannot** explain the phenomena of molecules to man or even amoeba to man evolution (macro-evolution).

First of all it must be remembered that the DNA in a living organism contains the complete information necessary to form an identical organism including the instructions of how to make a reader for its own code system. The amount of information stored in the DNA is staggering. Second, the amount of information stored in the DNA of man is 4166 times more than that of the H-39 Mycoplasma - one of the smallest bacteria now called a mollicute.<sup>1</sup> To put this in perspective the mollicute (H-39 mycoplasma) DNA (768,000 base pairs<sup>2</sup>) has the amount of information contained in the first 170 pages (p. 145 plus the first 25 pages of introduction) of this text if every page were covered by nothing but print with **no** spaces, pictures, graphs or

headings similar to this typed page. The size of the pages would be the same as in the glossary. The information content in the DNA of man (3.2 billion base pairs<sup>3</sup>) is the same as 585 books like this text with **nothing but text** on the pages as just described. Some might argue that the above numbers are highly exaggerated because of what some call junk DNA but it is now known that the so called junk DNA is not junk. It is made up of introns, promoters, terminators and telomeres<sup>4</sup> which are functional parts of the DNA. A major question is where did all of this additional information come from by random chance happenings to fill the 584 6/7 additional books?

To understand the problem consider the following. There is no known mutational mechanism that will increase the information content of DNA in a **meaningful manner**. In other words, transposons, point and frameshift mutations, duplication errors, jumping genes, extra chromosomes do not add **meaningful** information to the DNA. Viral or bacterial invasion may add information but the chances of it being **meaningful is zero if it occurs in a random manner**. Think about this problem with respect to this textbook. Does mixing sentences, letters, paragraphs, errors in copying, mixing up chapters or adding two or more identical chapters add information? The textbook may contain more pages but does it contain more information? A chapter or sentences from another book may be added so that there is more information but is it meaningful information? Is it likely to contribute to the sense of the original book? It is inconceivable that meaningful information can be added to accomplish the bacteria to man requirement of macro-evolution by random chance happenings. It should be recognized that natural selection may decrease the information in DNA but it cannot increase it.

It is hypothesized that these changes in species ultimately lead to changes at the genus level, the family level and on up to the kingdom level (see Figure 17.5, page 449 of the text). The great complexity and preciseness found in the DNA and the tremendous increases in DNA information content necessary to evolve from amoeba to man make the hypothesis unlikely. When duplication errors, favorable mutations rates and the time necessary to establish a trait are considered this becomes apparent.

**Think Critically:** It has been discovered that the largest bacteria *Epulopiscium fishelsoni* has 85,000 copies of one of its genes and contains approximately 25 times as much DNA as a human cell.<sup>5</sup> Does this confirm the need for added DNA to be meaningful?

**The following is not considered lecture material and may be beyond the level of the text. It is included for the teacher.**

It is known that duplication (replication) errors are extremely rare as the authors state. The textbook *Biology: The Dynamics of Life* by Biggs, Kapicka and Lundgren (Glencoe, 1995) further complicates the problem when it makes the following statements, "*Sometimes, there is no effect on an organism, but often mistakes in DNA can cause serious consequences for individual organisms* (p.324). *This textbook's authors agree on page 414. "Sometimes, the errors caused by point mutations don't interfere with protein function, but often the effect is disastrous.* (p.325) *Proteins that are produced as a result of frameshift mutations seldom function properly.* (p.325) *Few chromosome mutations are passed on to the next generation because the zygote (several cells beyond conception) usually dies.* (p.326) *Mutations often result in sterility or the lack of normal development in an organism.* (p.328) Other authors comment that only about one in 1000 mutations "might" be beneficial.<sup>6</sup> Generally it takes about 5 mutations to make a significant physical change in an organism.<sup>6</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. Dodson proposes that it takes over 300,000 generations for a slightly beneficial recessive gene to increase in frequency from 1 in 1,000,000 to 2 in 1,000,000.<sup>7</sup> **It must also be remembered that a mutation in 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 macro evolution occur from processes that produce many more negative results than positive results?"

The previous paragraph reads so easily that most people do not realize that these apparently simple statements mean that amoeba to man evolution is extremely unlikely. To get an appreciation of this let us examine these probabilities in more detail.



actual impossibility for members of the ape family) and there are 150,000,000 mutations required to result in man (see section on Human Evolution on page 23 of this addendum) then 300 million years would be needed under very unusual and unique conditions for man to have come from the ape family. Not nearly enough time has elapsed to have established a small population of man under this condition since evolutionists claim that the supposed ancestor of modern man came on the scene about 4 million years before man. If the number of mutations, the small probability of a beneficial mutation and the difficulty of establishing a population are all considered, it is inconceivable that man could have evolved from an apelike ancestor.

Each one of the arguments discussed in the previous paragraphs indicates the amoeba to man evolution of man is not likely to have taken place. When all three are considered at the same time it should be apparent that molecules to man evolution (macro-evolution) is an impossible scenario.

Examples of mutational changes are particularly instructive when it comes to the evolutionary concept. 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>10</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>11</sup> that revealed mutations can cause only a limited variation in a species (micro-evolution). 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.*" This addendum'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. Smith and Wood, *Cell Biology*. Chapman and Hall, 1996, p. 121.
2. Smith, *Cell Biology*. Academic Press (1971), p. 86.
3. Starr and Taggart, *Biology, The Unity and Diversity of Life*. Wadsworth Group, 2004, p. 254.
4. Campbell, N. A. and Reece, J. B., *Biology*. Benjamin Cummings, 2002 (Sixth Edition), pp. 300-309.
5. Randerson, J., Record Breaker. *New Scientist*, Vol. 174, 8 June 2002, p. 14
6. Ambrose, E., *The Nature and Origin of the Biological World*, (1982), p. 120-121.
7. Dodson, E., *Evolution: Process and Product*, (1960), p. 225.
8. Johnson & Raven, *Biology, Principles & Explorations*. Holt, Rinehart and Winston, 2001, p. 197.
9. Smith, *Cell Biology*. Academic Press (1971), p. 86.
- 10,11. Rifkin, Jeremy, *Algeny*. (1983), p. 134.

## Unit 5 Change Through Time Page 366

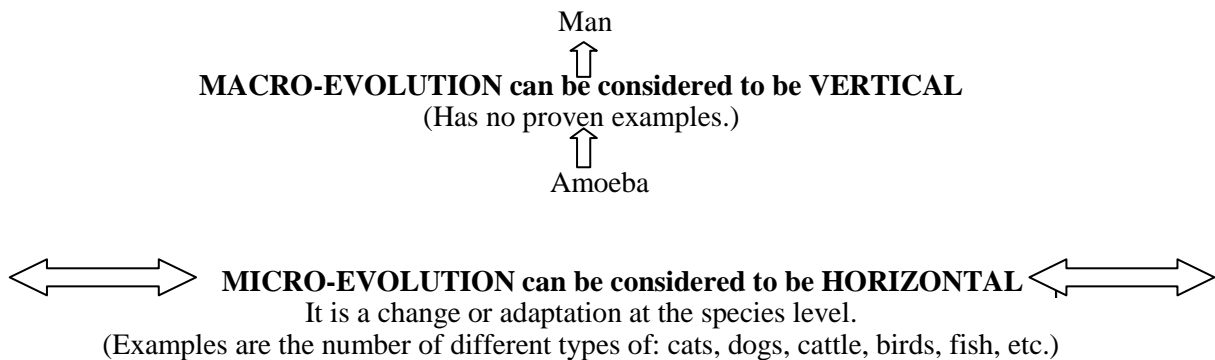
### Read to class.

As we start this unit it is important to recognize that the textbook presentation is very misleading at times, contains errors and misrepresentations. This unit is a good example of the ever changing face of science and how it works. The general theme of the unit is evolution. Twenty or thirty years ago many thought that evolution was a known fact. The truth of the matter is that when the term evolution is properly defined as the next paragraph does we will find that some aspects of the term evolution are true and some are not. In recent years some fraud, errors in reasoning and additional facts have been discovered so that more and more scientists have serious doubts about its validity. What we will do in this class is look at the reasons why these scientists have come to doubt evolution. What this textbook says should not be discarded

or discounted because it presents many valid facts and the modern thinking on the subject. Some believe that the errors should be left out and not discussed but this will be unfair to the student when they go to college or out into the working world.

## What Is Evolution

The authors state in the first line of this unit that, **Life on Earth has a history of change that is called evolution.** This definition is so broad that it will cause confusion between the various aspects of this unit unless it is discussed and more accurately defined. If this is the definition of evolution then certainly it has occurred since things have changed and are changing. However, in today's world this definition is very misleading. As you will learn in Chapter 15, 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 (see page 449) 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.



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 obviously misleading and unfortunate and has caused much misunderstanding among scientists and the public. The term macro or molecules to man evolution should be used in order to clarify the problem. It will be used from this point on in this addendum.

## Chapter 14

### Section 14.1    The Record of Life    Page 369

#### The Fossil Record

Many facts from the geological record tend to challenge macro-evolution. One is that many gaps exist in the fossil record (see discussion of punctuated equilibrium on page 411 and the writeup under Biochemistry in this addendum on page 16). 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].*" 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.

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, Vol.86, No.6, June-July 1977, p.24.

## Diversity During the Paleozoic Page 377

is paragraph should be added after the first paragraph under this heading.

The authors revealed in the previous paragraph that during the Paleozoic period (the Cambrian strata) - the first part of the .....*the fossil record shows an enormous increase in the diversity of life forms during this time.* This is called the Cambrian Explosion. They fail to comment that this is a most unusual happening and is one of the mysteries of geology in that most animal phyla appeared during about ten million years of this time period. 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 . *A Short Way to Big Ends*, Natural History, Vol. 95 #1 (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.

## Life in the Mesozoic Page 377

The authors state in the fourth paragraph that, *For example, in Figure 14.8A, you see the fossil of Archaeopteryx, a small bird discovered in Germany. ....Scientists suggest that such evidence supports the idea that modern birds evolved from dinosaurs.* This statement is very misleading because it does not even hint to the great amount of controversy and difference of opinion that exists about whether archaeopteryx is a transitional fossil. This textbook has much more to say on the subject on page 833. Dr. Alan Feduccia at the University of North Carolina at Chapel Hill, a world authority on birds, is convinced it is a bird. Dr. Larry Martin, a paleontologist at the University of Kansas agrees.

**Thinking Critically:** If archaeopteryx is a true bird and living birds such as the hoatzin, ostrich and touraco have similar features, why is it considered transitional?

The physiological differences between reptiles (dinosaurs) and birds is so large that the second statement quoted above does not follow from the first one. The fact that Archaeopteryx has some bird attributes which are not commonly found in reptiles and some reptile features that are not commonly found in birds does not necessitate that a relationship exists between reptile and bird. Without getting into the controversy there is an easier way to approach the problem. Consider the DNA changes necessary to account for the many differences between reptile and bird. Some of these differences are: (1) the weak and poorly developed upper torso and arms of an upright walking dinosaur are transformed into the highly developed upper torso of a bird, (2) the very sophisticated flight feather could develop from a scale, (3) the brains of reptiles and birds are vastly different, (4) the upper and lower jaw of birds both move where only the lower jaw of reptiles move, (5) the feet of birds are made for grasping whereas the feet of reptiles are adapted for walking (6) the bellows-ungs of reptiles operate on an entirely different principle in birds. To do all of this requires that a vast amount of additional information be added to the DNA. Since mutations

and natural selection do not provide additional coherent information but may destroy it there is no reasonable explanation of how a reptile could have turned into a bird.

## Section 14.2 The Origin of Life Page 380

In order to appreciate what is involved to accomplish macro-evolution and the origin of life it is important to review the information in section 6.3 on Life Substances (Page 161). On Page 158 the authors state, *In addition, compounds with the same chemical formula often differ in structure. Compounds that have the same chemical formula but different three-dimensional structures are called isomers.* Sugars and amino acids are a special kind of isomer called an optical isomer. This means that they have two structural forms which are mirror images of each other like our hands. They are referred to as dextro-rotary (D type or right handed) and laevo-rotary (L type or left handed) molecules. The astounding thing is that these molecules occur naturally in nature in equal numbers but living organisms **use only one or the other** of these molecules. Amino acids are always L type and sugars occur only as D type molecules and only these types are considered as biologic. In other words, D type amino acids and L sugars are non-biologic molecules and do not appear in living organisms even though they have exactly the same chemical equation. To further complicate the problem there is no known method of separating these molecules in nature and the L and D molecules show no preference in joining with each other. If a L and D type of amino acid join together the isomer is not functional from a biologic view point. When these facts are considered and the fact that there are thousands of different amino acids besides the 20 biologic ones it should be apparent that the origin of life from purely random chance happenings is impossible. A more detailed explanation is presented below.

It is recognized that the following presentation is beyond the level of this textbook but is included for the teacher should the need arise. It elaborates on the above paragraph.

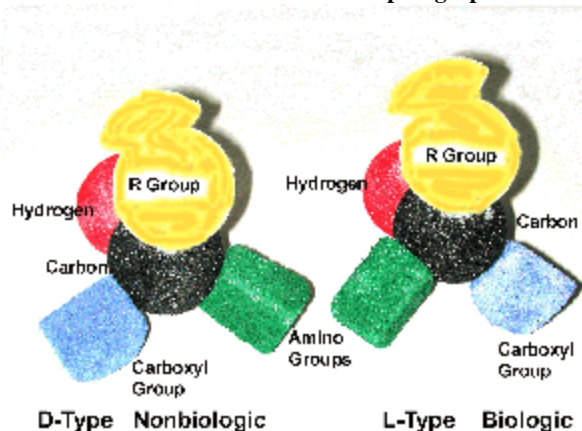


Figure 1. Amino Acid Types

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 and 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 the observer as shown in Figure

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 (page 161 of text). In forming an amino acid four different elements or compounds join to a central carbon atom as shown in Figure 1<sup>1</sup> - a Hydrogen atom, a Carboxyl Group (COOH), an Amino Group (NH<sub>2</sub>) and an R Group which is a carboxyl/hydrogen based unit. The composition of the R Group largely 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 shows this. The number of compounds that

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 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 connection of biologic versus 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 of the chain 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>

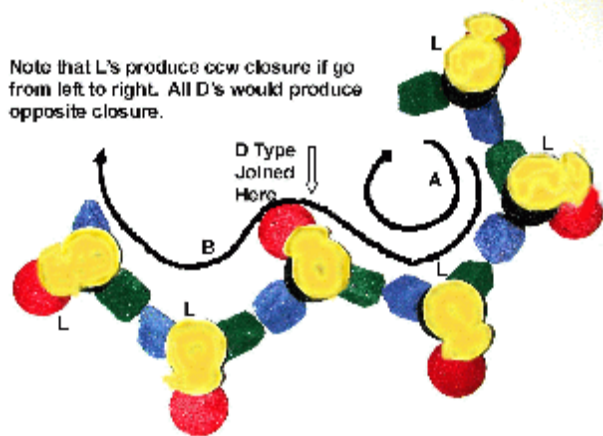


Figure 2. Effect of introducing a D molecule into an L molecule chain.

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 type sugars occur in equal numbers naturally and show no

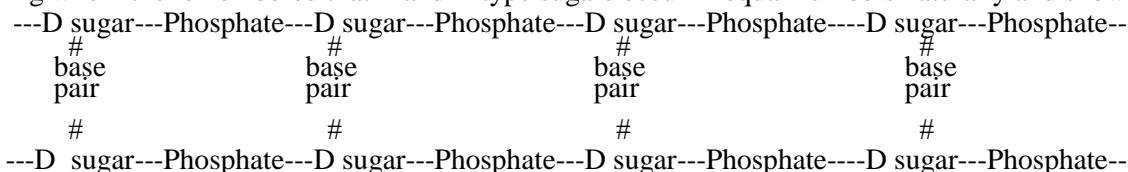


Figure 3. DNA Structure

preference in uniting with phosphates. The same holds true for amino acids. A human chromosome consists

of about 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 6,400,000,000 D type sugars.. Logically, half of these should be L type sugars but there are none. How could this have come about?

**Thinking Critically:** 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.

## Simple Organic Molecules Formed Page 382

**Insert this material between the first and second paragraphs under this heading.**

The previous paragraph refers to complex organic molecules. On the next page the term complex organic molecule is used to refer to ATP and nucleic acids. ATP contains only the base adenine plus a sugar and three phosphate groups.<sup>1</sup> This is very misleading because the smallest organic protein, insulin, is a chain of 51 amino acids in a particular order. ATP is only one tenth of the length of a chain of insulin. The chances of going from ATP to insulin are about the same as winning the Power Ball five times straight. The real problem is that getting an insulin molecule accomplishes nothing. One of the smallest bacteria, H39 mycoplasma, has 640 proteins whose average length is 400 amino acids.<sup>2</sup> This means that the total chain length is 256,000 amino acids long connected in a particular order. No non-organic amino acids or molecules are assumed to be present when the organism supposedly came into being. Is this reasonable? Natural selection cannot be considered because it does not have any effect on non-living organisms.

The next paragraph maintains that there was *little free oxygen* present in the early atmosphere. Having no oxygen in the early atmosphere is essential if amino acids are to be formed and exist since oxygen quickly unites with amino acids to make them non-biologic. The geologic evidence indicates that the necessary atmosphere **without any oxygen** was **not** present. Many primordial sediments contain red minerals which are metallic 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>3</sup> so that the formation of amino acids in any significant concentration in the atmosphere and therefore in the ocean was not possible.<sup>3</sup>

1. Johnson, G. B. & Raven, P.H., *Biology: Principles & Explorations*. Holt, Rinehart and Winston, 2001, p. 96.
2. Smith, Cell Biology. Academic Press, 1971, p. 86.
3. Clemmy & Badham, *Oxygen in the Precambrian Atmosphere: An Evaluation of the Geologic Evidence*, *Geology*, Vol.10 (1982), p.141

**The following is not considered lecture material but is given for the teacher should the need arise. It applies to the third paragraph and would be inserted between the third and fourth paragraphs.**

In the world as it presently exists, life could not have evolved. Why? 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>2</sup> Oparin attempted to solve this problem by proposing that if the atmosphere contained water vapor, hydrogen, methane and ammonia without any oxygen then energy from the sun and lightning would cause amino acids to be formed that would drop into the oceans and form a primordial soup from which life might have evolved. Remember the L and D problem. Oparin did not include oxygen as an atmospheric gas because amino acids react readily with oxygen to form non-biologic

compounds. His hypothesis led to the Miller-Urey experiments. There is, however, abundant evidence that oxygen was in the early atmosphere. Miller-Urey did prove by their experiment that the gases Oparin listed (methane, ammonia, hydrogen and water vapor) can be made to form amino acids (see section on Miller-Urey on p. 15 of addendum). Most of the amino acids formed were not biologic. This makes the formation of a biologic compound impossible for reasons given in #4 below. Some more 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 metallic 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>1</sup> so that the formation of amino acids in any significant concentration in the atmosphere and therefore in the ocean was not possible.<sup>3</sup>
2. Ultraviolet light breaks down the Oparin gases methane and ammonia, two of the three necessary building blocks of amino acids. 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 because the no oxygen hypothesis implies there was no ozone layer to reduce the ultraviolet intensity.
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 those 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 as discussed earlier--- 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>4</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 as pointed out earlier. The proteins of living organisms are made up of L type amino acids and the DNA strands from D type sugars. The duplication process of the cell assures use of only the right type of molecule. There is no other known process for separating and isolating L and D molecules. 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 poly-peptides (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 protein synthesis evaporate<sup>5</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 the origin of life could have taken place in this manner because many more proteins are needed to have even the simplest living organism.
6. Natural selection only takes place in 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>6</sup> How can the water be removed when everything is in water. Ferris states this scientifically as,<sup>7</sup> *"But it has not*

*proved possible to synthesize plausibly pre-biotic 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>8</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.

1. Clemmy & Badham, *Oxygen in the Precambrian Atmosphere: An Evaluation of the Geologic Evidence*, Geology, Vol.10 (1982), p.141
2. Fox, S., & Dose, K., *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.
3. Clemmy & Badham, *Oxygen in the Precambrian Atmosphere: An Evaluation of the Geologic Evidence*, Geology, Vol.10 (1982), p.141.
4. Cohen, J., Getting All Turned Around Over the Origin of Life on Earth. Science, Vol. 227 (1995). Pp. 1265-1266.
5. Horowitz & Hubbard, *The Origin of Life*, Annuals of Genetics, 8 (1974),p.393.
6. Thaxton, Bradley, & Olsen, *The Mystery of Life's Origin: Reassessing Current Theories*, New York: Philosophical Library,(1984), p.56.
7. Ferris, etal., *Synthesis of Long Prebiotic Oligomers on Mineral Surfaces*, Nature, Vol. 381, 2 May 1996, p. 59.
8. Abelson, *Chemical Events on the Primitive Earth*, Proc. National Academy of Sciences, Vol.55 (1966), pp. 1365, 1369.

**The following is not lecture material because of time constraints. It is provided only as supplemental information for the teacher if needed. The following material should be inserted after the last paragraph under this heading.**

The famous Miller-Urey experiment supposedly proved that life could have evolved. The apparatus is shown in Figure 14.12 on p. 382. One of the problems of this experiment was that the experiment produced both biologic amino acids plus other non-biologic amino acids and polymers which were capable of reacting with the desirable biologic amino acids to produce non-biologic compounds.<sup>1</sup> Miller had to use a trap to isolate the products of his experiment and keep them from getting back to the original gases since the biologic amino acids formed would react readily with the excess gases and form non-biologic compounds. As necessary as it is, there is no mechanism in nature that can perform this needed isolation.

Their experiment came up with a total of only 10 biologic amino acids and 25 non-biologic amino acids, sugars and other compounds all mixed together. As was pointed out earlier insulin consists of 51 amino acid bonds and requires 17 different biologic amino acids. This simplest of proteins could not have been formed had there been nothing but the Miller biologic amino acids present. Other scientists<sup>2</sup> have done similar experiments with other sources of energy and formed many other biologic and non-biologic compounds but with similar results. Still other scientists have devised experiments which have produced still other compounds found in living organisms. All of the cited experimenters results still involve biologic amino acids and sugars plus other non-biologic amino acids and sugars so that the peptides formed are **not** indicative of life.

1. Thaxton, Bradley, & Olsen, *The Mystery of Life's Origin: Reassessing Current Theories*, New York: Philosophical Library, (1984), pp. 52-54.
2. *ibid.* pp. 20-39.

## **The Formation of Protocells Page 383**

The validity of the first paragraph was discussed in the previous section.

The steps from protocell to actual cell is beyond comprehension. It should be recognized that the differences between the cell membrane and the protocell membrane is unbelievably large. The membrane enclosing a cell is much more complex than a shell like structure in that it has openings which allow certain chemicals to pass in and out and reject others. If a cell were placed inside a protocell instead of its own

membrane it would not live because there would not be any way to get nutrients into and waste out of the cell. Furthermore, Fox, et al. point out that protocells are readily dissolved with changes in PH, heat and dilution and are easily broken up by agitation.<sup>1</sup> What this means is that protocells occur under laboratory conditions and are rarely, if ever, found in nature. The other factor is that the contents within the cell membrane is much more complex than that of the protocell. It should be recognized that the protocell experiments are carried out in laboratories under carefully controlled circumstances rather than the random chance environment found in nature and so are not the ancestors of any kind of life forms. The authors acknowledge this in the first sentence of the next section.

**Thinking critically:** If a person puts together ten pieces of a 1,000 piece jig-saw puzzle is it reasonable to assume that the rest of the puzzle will eventually assemble itself if not touched? Is there a similarity between the jig-saw puzzle example and the first living cell from the protocell example cited in the textbook?

1. Fox, Harada, Krampitz, Mueller, *Chemical Engineering News*. June 22, 1970, p.80.

## **The Evolution of Cells Page 383**

In reading this entire section to the end of the chapter the reader should be aware that everything that is written is speculation. The authors make this plain by the numerous indefinite words used such as may, probably, might, proposed, would have, etc.

### **The Unbreakable Cycle.**

There is an unbreakable cycle in all cells and bacteria that makes any possibility of macro-evolution 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>1</sup> If this is true for living organisms it is also true for nonliving organisms where natural selection does not function. There is no known way for origin of life theories to account for the origin of the first functional genetic code in a living cell.<sup>2</sup>

**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. Darwin, Charles, *The Origin of Species*. Harvard University Press, 1964, p. 179.

2. Trevors, J.T. and Abel, D.L., Chance and Necessity Do Not Explain the Origin of Life. *Cell Biology International*, Vol. 28, pp. 729-739.

## Chapter 15 The Theory of Evolution Page 392

The authors open this section with the statement, *Evolution is a key concept for understanding 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 determine 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.

### 15.1 Natural Selection and the Evidence for Evolution

#### Charles Darwin and Natural Selection Page 393

At this point it is necessary to start using the terms micro-evolution and macro-evolution. The first sentence should read, *The modern theory of micro-evolution is a fundamental concept in biology.* As noted in the previous section this is not necessarily true. If it is so fundamental why is the term evolution so rarely used in textbooks except for the unit on evolution?

#### Darwin Explains Natural Selection Page 395

**Add this at the end of the material under this heading.**

As the textbook explains Darwin observed what he called natural selection. It has taken place over the centuries and is an observable fact. Living organisms do adapt to their environment. This is what is called natural selection and operates only at the species level or in some cases the genus level due to classification difficulties (see pages 447-449). It must be recognized that natural selection has no direct effect upon the DNA. The authors Campbell, Mitchell and Reece point this out on page 9 of *Biology: Concepts and Connections* (Addison Wesley, 2000) with the statement, *Here we see that natural selection is not a creative process, but an editing mechanism.* It simply selects from the existing gene pool. It definitely cannot directly add DNA to that that already exists, a very necessary happening if macro-evolution is to take place. **It only affects micro-evolution.** Actually, natural selection restricts or may remove information from the gene pool. It acts to stabilize a species and provide for its survival. The blind mole rats shown in Figure 15.3 page 396 are correctly given as an example of natural selection. Note that natural selection has actually reduced the gene pool for these rats and therefore the information in the DNA, not increased it. This is an example of micro-de-evolution. The blind cave fish and minnows also fall into this same category.

#### Structural Adaptations Arise Over Time Page 397

**Add this material after the last sentence under this heading.**

The authors rightfully discuss the peppered moth in terms of adaptation in Problem-Solving Lab 15.1. This is a clear illustration of how natural selection can operate to change the characteristics of an organism. It is important to recognize that the moths are still recognizable as peppered moths. All that has happened is that the moths have adapted to their environment. This example of micro-evolution provides no proof or data regarding macro-evolution.

Since Kettlewell performed his experiment several facts have come to light that cast a shadow on his results. First, the moths are nocturnal so that release of the moths in the daylight possibly distorted the data. Second, it is now known that peppered moths do not normally rest upon tree trunks.<sup>1</sup> The normal resting place is beneath small reasonably horizontal branches probably high up in the tree canopy.<sup>2</sup> What this means is that the picture (Problem Solving Lab 15.1) showing the moths resting on tree trunks have been staged by gluing the moths to the tree.

1. Wells, Jonathan, *Icons of Evolution*. 2000, pp. 146,149.

2. Mikkola, Kauri, *Biological Journal of the Linnean Society*. Vol.21 (1984), pp. 409-421.

## Physiological Adaptations Can Develop Rapidly Page 399

**Thinking Critically:** In Figure 15.5 has the name of the resistant bacteria changed? Why not? What type of evolution is represented by this example?

## Other Evidence for Evolution 399

**Thinking Critically:** In the first sentence the authors state, *The development of physiological resistance in species of bacteria, insects, and plants is direct evidence of evolution.* What kind of evolution is the sentence talking about? Has any evidence been presented to indicate a new species or higher organism has appeared?

## Fossils Page 399

**Thinking Critically:**

1. Table 15.1 shows the supposed evolution of the camel. What kind of evolution is indicated by this figure?

## Anatomy Page 400

Place between the second and third paragraphs under this heading.

The textbook makes the statement in the first paragraph, *"Evolutionary biologists view such structural similarities as evidence that organisms evolved from a common ancestor.* This statement falsely leads one to the conclusion that homology is one of the proofs for macro-evolution. The real question is whether things that look similar **necessarily** have the same origin. The authors point out that *structural or functional similarity of a body feature doesn't always mean that two species are closely related.* The question is when do similarities indicate common ancestry and when not. Would you consider the bones of the same color shown in Figure 15.6 (p. 401) as being similar if you were given all of them in a bag with no labeling? Upon close examination of the differences in the animal structures presented in the figure it should be noted that the bones are located in the same relative location on the limbs but this does not mean that they have the same length, 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** as the authors point

out. What is it about a structure which determines common ancestry? 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?

The examples given for vestigial structures do not prove macro-evolution. Originally there were about 180 supposed examples of vestigial structures. Now it is a problem to find any because uses have now been determined for most of these supposed useless organs. A good example is the baleen whale shown in Figure 15.8 on page 402. It is now known that the supposed vestigial legs are not legs but anchor points for specific organs and therefore not vestigial. In the male whale they are an anchorage for the male reproductive organs and in the female an anchorage for the vaginal expulsion muscles. They also serve as guides for mating.

It should be noted that examples of the blind mole rats and cave fish and ostrich may be vestigial but they are not evidence for macro-evolution. Natural selection has actually reduced the gene pool for these organisms and therefore the information in the DNA, not increased it. This is an example of micro-evolution.

### Thinking Critically:

1. The labeling for Figure 15.7 says that, "The bones of each were modified for their function." Is there evidence that this can be achieved via chance based evolutionary processes? Why isn't the supposed common ancestor named? Does it exist?
2. The examples in the last paragraph under this heading list blind mole rats and cave fish and ostriches as features that are vestigial. Did the mutations that caused these supposed vestigial structures increase or decrease the total information in the organism's DNA?
3. When you look into the works of a computer, TV, washing machine, etc. do you know exactly what each component does? Does this mean that they are vestigial? Is it reasonable to assume that because the function of a particular part of an organism is not presently known that it has no function?

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

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

3. Ibid. # 2, p. 146

4. Kawanishi, H., *Immunology*. 1982, Vol. 60, pp. 19-28.

## Embryology Page 402

**This material is to be inserted at the end of the material under this heading.**

The textbook authors are very misleading in their treatment. Advances in embryology have shown that the slits (more properly creases or skin folds) seen under the head of the various embryos do not have anything to do with gills at any stage of their development but rather develop into organs that do not even remotely resemble gills. As the authors point out, all of the so called gill slits on the fish do not develop into gills. If this is so then how can gill slits be compared on different organisms. The idea that the human embryo is similar to that of a fish has been rejected by many scientists.<sup>1</sup> It is now known that the bulge just below the head on a human embryo 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>2</sup>

The whole idea of gill slits was established in 1891 by Ernst Haeckel when he produced a series of drawings of vertebrate embryos proposing that they represent a kind of tree of life.<sup>3</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>4</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>4</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>5</sup> as reported by Pitman. 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.

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

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

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

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

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

## Biochemistry Page 402

**Insert this material between the first and second paragraphs under this heading.**

The statement that, "Biochemistry also provides strong evidence for evolution" is very misleading. It is true that some scientists try to use biochemical relationships to demonstrate that macro-evolutionary relationships do exist and that common ancestry is true.. Scientists who study the classification of organisms to determine their evolutionary relationships work in the field of systematics. Systematists encounter many difficulties when trying to prove common ancestry because the result obtained by examining biochemical relationships does not agree with those obtained by examining the form and structure of organisms (called morphology). Trisha Gura comments, "Evolutionary trees constructed by studying biological molecules often don't resemble those drawn up from morphology."<sup>1</sup> (Morphology is the form and structure of an organism.) She continues by referring to the phrase 'evolution wars' about which she says, "...the phrase could also be applied to a debate that is raging within systematics." (Systematics is the study of the classification of organisms to determine their evolutionary relationships.) Rokas and Carroll concur when they state, "However, recent analyses of some key clades (a group of organisms arriving from a common ancestor) in life's history have produced bushes and not resolved trees. The patterns observed in these clades are both important signals of biological history and symptoms of fundamental challenges that must be confronted."<sup>2</sup> Further on they state, "How can it be that despite the availability of large amounts of data and powerful

statistical techniques, evolutionary trees upon which experts agree have not been reached?”

Molecular biology yields some very unexpected and contradictory results when used in trying to prove macro-evolutionary concepts. For instance, Rokas and Carroll report, “Whereas genomic analyses have shown that at the species level, chimpanzees are humans’ closest relatives, many of the genes and genome segments examined have followed different evolutionary paths. Specifically, analyses of almost 100 genes under two different optimality criteria) show that approximately 55% of genes support a human-chimpanzee clad,...”<sup>3</sup> Obviously this does not agree with the popularly held statements about human and chimpanzee having a DNA difference of about 1.4%. (For further information see the write-up on Human Ancestry later in this addendum.)

1. Trisha Gura, *Bones, molecules...or both*. Nature, Vol. 406, 20 July 2000, p.230

2. Rokas, Antonis and Carroll, Sean, *Bushes in the Tree of Life*. Biology, Vol. 4, Issue 11, Nov. 2006, p.1899.

3. *ibid.* #2, p. 1900

## **15.2 Mechanisms of Evolution    Page 404**

### **Changes in Genetic Equilibrium    Page 405**

**Add this paragraph after the second paragraph of the material under this heading.**

The second paragraph discusses mutational effects. The reader should go back and review the material on mutations in this addendum (pages 2-5). The textbook authors suggest that beneficial mutations occur. The reader is urged to try to find and name some beneficial mutations. Is sickle cell anemia a beneficial mutation? Is an anti-biotic resistant bacteria a beneficial mutation? Has the bacteria gained or lost information in its DNA? These are the only examples ever cited as possibly beneficial mutations. The sickle cell anemia person has a shortened life and the bacteria have not gained any additional meaningful information in their DNA although they have existed longer. These examples are not evidence for macro-evolution.

**Thinking Critically:** Are either of these mutational changes indicative of anything more than micro-evolution?

### **Natural Selection Acts on Variations    Page 407**

**Place at the end of the material under this heading.**

**Thinking Critically:** What kind of evolution is represented by the butterflies in Figure 15.13?

Does natural selection increase or decrease the total information contained in the DNA?

### **Speciation Rates    Page 411**

**Place between the third and fourth paragraphs under this heading.**

The need for the punctuated equilibrium hypothesis has been brought about by the recognized gaps in the fossil record. The Harvard paleontologist Stephen J. Gould, who along with Niles Eldridge and Steven Stanley 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. Note that this hypothesis has no factual evidence supporting it. The fact that there is no supporting evidence (the gaps exist) is the supposed proof of the hypothesis. Contrary to the punctuated equilibrium authors’ wishes, some have extended the hypothesis to include the gaps at higher than the species level.

Two of the major objections to the hypothesis are:

1. The lack of evidence as established by the gaps. The feeling is that it is dangerous to let the idea of lack of evidence as proof get started in science.
2. There is no plausible mechanism or explanation for the genetic changes that occur.

**Thinking Critically:** What kind of evolution does the punctuated equilibrium hypothesis explain?  
What kind of evolution do Figures 15.17 and 15.18 demonstrate?

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

## **Patterns of Evolution Page 412**

The last sentence under this section says, *These patterns support the idea that natural selection is an important agent for evolution.* What kind of evolution is demonstrated by this statement?

## **Diversity in New Environments Page 412**

- Thinking Critically:**
1. Do the birds pictured in Figure 15.18 demonstrate micro or macro-evolution?
  2. Justify your answer. Based upon your answer to this question what type of evolution is represented by the divergent evolution concept?
  3. Answer the same question for the Finches shown on the bottom of page 469.

## **Chapter 16 Primate Evolution Page 420**

### **16.1 Primate Adaptation and Evolution Page 421**

This section defines and describes primates and where various fossils have been found. It brings out the uncertainty in exactly what the fossil record means. Note the great number of words that are used that indicate uncertainty.

### **16.2 Human Ancestry Page 428**

#### **Hominids Page 428**

Place this material after the second paragraph under this heading.

A word by word analysis of the textbook presentation on this subject does not seem profitable when the facts presented below are considered. As the textbook is read note the large amount of uncertainty indicated with respect to what goes where and how the fossils fit together.

The MiniLab 16.2 on page 429 presents amino acid sequences that are not accurate and lead the student to believe that the human, gorilla and chimp all have identical DNA. Consider the following facts in deciding whether or not man and chimpanzee evolved from the same apelike ancestor. A 2002 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. 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 246,400,000 base pairs different. This is the amount of information contained in a book whose thickness is equivalent to about 43 books such as this textbook if it contained nothing but full pages of print from cover to cover. This is a lot of informational difference in the DNA and does not include the 10% additional DNA and two chromosomes

the chimp has more than the human. 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 supposed ancestor and man must be much larger. Where and how did this vast amount of additional information come about when, as stated earlier, it is recognized by the SETI project that additional coherent information does not come about by accident? It is completely inconceivable that this much coherent information could have been accidentally 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 (page 430) 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, 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.

## 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 at this time:

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 the origin of life by random chance happenings.

4. Other explanations for what is observed on earth should be examined..