APPENDIX A: COMMON BIOLOGICAL MISCONCEPTIONS

The following topics are often presented to students in support of evolution. They have nothing to do with it.

I. THE MECHANISM OF EVOLUTION.

An obvious explanation for the presence of physical and genetic features of living things is Initial Complexity – that they began in a complex condition due to the actions of an intelligent designer.

Those who believe in Initial Disorganization (evolution) must look for biological processes that might cause relatively simple living things to acquire more information in their DNA and thus become more complex.

A. LAMARCKIANISM - Use and Disuse of Body Parts.

Darwin's *The Origin of Species* is mistitled. He did not answer the question of why new species should develop, merely how they might have diversified after they first appeared. Others built on his work and developed a model of evolution called "Darwinism" which attempted to explain the appearance of new features and the loss of old ones. Darwinism depended upon *Lamarckianism*, named after its inventor, French biologist Jean Baptiste de Lamarck.

As individual organisms use certain parts of their anatomy those parts become more developed. Likewise, as they stop using body parts those parts atrophy. Lamarck believed that their offspring would inherit the changes. The most famous example of this belief is his 1809 story about how giraffes developed long necks. He said that they must have lived in an area subject to periodic drought. When the weather dried up, so did the trees. The shorter giraffes starved after the lower leaves were gone. Only those who stretched their necks enough to reach the higher ones survived. They passed on their longer necks to their offspring, who repeated the process for many generations. Finally, the familiar long-necked giraffe had evolved.

Visual # A-1

Lamarckianism has been thoroughly discredited. The effects of use and disuse are *not* passed on to offspring. Repeated experiments such as cutting the tails off 100 successive generations of mice have shown that the basic structures of each organism (the *phenotype*) are determined by the DNA inherited from its parents (the *genotype*). Use and disuse has no effect on DNA. Even if people lift weights until they become champion body-builders, their children will not be any stronger than if they had never exercised. The only way to affect future offspring is by damaging DNA with drugs, radiation, and the like.

B. NEO-DARWINISM - Natural Selection Operating on Mutations.

With Lamarckianism conclusively disproved, opponents of initial complexity tried to come up with another explanation for the giraffe's long neck. The new scenario said that since some giraffes would naturally be taller than others, only those fortunate enough to have longer necks would survive. As the droughts continued for many generations all the giraffes with genes for short necks died out. Eventually, only giraffes with genes for long necks remained.

While this may sound to those not familiar with genetics, the length of the modern giraffe's neck is not the only factor that needs to be considered.

1. SURVIVAL OF OTHER LEAF-EATERS.

Visual # A-2

The giraffe is not the only leaf-eating animal. How did its leaf-eating neighbors survive in the same environment without developing long necks?

2. ***ABILITY TO EAT GRASS.***
   If other animals survived by simply bending down and eating grass, so could the shorter-necked giraffes. They should still be with us today.
3. ***FOSSIL GIRAFFES.***
   No one has ever found any short-necked fossil giraffes.
   - Though an animal called an okapi is similar in some ways to a giraffe, it is not considered ancestral. Like the giraffe, it appears in the fossil record suddenly and fully formed.
   - Likewise, an extinct animal called *Samotherium* is considered a member of the giraffe family, but it is not considered an ancestor to the giraffe (Danowitz et al., 2015).
4. ***SEXUAL DIMORPHISM.***
   Giraffes exhibit *sexual dimorphism:* the males are one to two feet taller than the females. In an environment in which a few inches more height meant the difference between life and death, the females would have starved. The species would have become extinct in one generation.
5. ***HEIGHT AT WEANING.***
   An adult male giraffe grows as tall as nineteen feet. The young are only about twelve feet tall when their mothers refuse to nurse them any more. If adults had trouble reaching the leaves, the young would have been far too short to feed themselves. Giraffes would have become extinct in one generation.
6. ***INTERNAL NECK STRUCTURES.*** (Davis & Kenyon, 1989; Mitchell et al., 2009)
   Length is not the only unique feature of the giraffe's neck. Since the head is so high above the ground, the heart has to pump harder than any other animal's to get blood to the brain. But when the giraffe lowers its head to get a drink of water, it not only has to contend with the full force of its heart's pumping action, but also has to deal with gravity trying to force the blood the wrong way through its neck. Were it not for the control structures in the neck, the pressure could produce brain aneurysms that would rupture and kill the animal.

   Such a misfortune does not happen because the giraffe's neck has built-in pressure sensors which detect increases in blood pressure as it bends down. The brain then sends signals to the heavily muscled arteries. Some constrict to reduce the blood flow, while others reroute a portion of it through a network of blood vessels known as the *rete mirabile* ("marvelous net"). Meanwhile, a series of one-way valves prevent blood from flowing the wrong way back up the neck. When it straightens up again, everything goes back to normal.

   No other animal known has such a system.
   - The giraffe's supposed relative, the okapi, lacks these structures (Augliere, 2016; Coppedge, 2016).
   - We cannot be sure about soft tissue in *Samotherium* because it is known only from fossils.

   This elaborate system exists because of information contained in the giraffe's DNA. Though some of its evolutionary ancestors might be a bit taller or shorter because of genetic variation, no one has come up with any possible scenario to explain how the DNA might have mutated to produce the intricate blood control system at the same time as a gradually lengthening neck. The most reasonable conclusion is that giraffes were designed that way from the beginning.

Visual
A-3

a. Use and disuse of body parts is not a valid mechanism for evolution.

b. Normal variation is not sufficient to introduce radically new structures.

Those who reject the possibility of design must admit that the only mechanism available to cause one species to evolve into another is random mutation. However, there is not a single known case where mutations add to the genetic content of a species; instead, they change segments of DNA from meaningful to meaningless. In those few cases where an individual benefits from a mutation, the species suffers because its gene pool is damaged. There is no way mutations could produce a giraffe. They destroy genetic information rather than creating it.

II. EMBRYONIC RECAPITULATION.

Recommended visual materials: "The First Days of Creation," *Life Magazine* , August 1990, pp. 26-46

The "Embryonic Recapitulation" fraud has persisted in textbooks for well over a hundred years. Beginning in 1866 Ernst Haeckel, a professor of zoology at Jena University in Germany, published drawings and reports claiming that the human embryo exhibits all the stages of evolutionary development as it matures. He said that it develops gill slits, a yolk sac, a tail, etc. He called this the "Fundamental Biogenetic Law," often expressed in the slogan "ontogeny recapitulates phylogeny."

Visual # A-4

Haeckel's deception was immediately obvious to embryologists such as Wilhelm His, who first pointed it out in 1874, just a few years after Haeckel published it (I. Taylor, 1987, 275-277). This did not deter Haeckel. For over 40 years he taught this "Law" at lectures and seminars all over Europe. So blatant was his deception that in the early 1900's a Jena University Court of his peers finally found him guilty of fraud for falsifying his drawings (Wysong, 1976, 401; Hitching, 1982, 202-203; Fix, 1984, 285; Pitman, 120; Singer, 1931, 487; Morris & Parker, 1982, 92, 98-99). Incredibly, embryonic recapitulation is still taught in many schools over a century after Haeckel's disgrace.

Visual # A-5

The "gill slits" on the human embryo are neither gills nor slits. They never have anything to do with breathing but are pharyngeal pouches housing the thymus and parathyroid glands and the middle ear canals. The "yolk sac" contains blood cells, not yolk. The "tail" is essential as an anchoring point for the pelvic muscles. [12] In addition, many events during embryonic development take place out of evolutionary sequence. The tongue develops before the teeth, the heart forms before the rest of the circulatory system, the respiratory surface of the lung forms after the rest of it is complete, and so on.

The modern technique of intrauterine photography shows how a baby actually develops in the womb. For a beautiful view refer to the 1990 *Life Magazine* article mentioned above. Some might say that a developing baby at four and a half weeks (p. 40) looks somewhat like a reptile. Does this mean it is going through a reptile stage? Not at all.

Someone can look at a cloud and say it looks like an elephant, but that does not mean it *is* an elephant. It just means that person has a good imagination. However, if the person thinks that because it looks to them like an elephant it must be an elephant, it means only that the person is an idiot. Likewise, if one thinks a 4-1/2 week baby looks like a reptile it does not mean it is a reptile. It just means the person has a good imagination. If the person says it *is* a reptile, he/she is an idiot.

A baby receives its full complement of DNA - 23 chromosomes from the mother and 23 from the father - at the instant of conception. As soon as the sperm and egg unite into a single cell the new baby has all the genetic information it needs to develop a fully formed human body.

The development it goes through for the next nine months is merely the visible expression of the information contained in its DNA. Despite what courts and abortion clinics say, an embryo is not a blob of protoplasm, but a developing person.

What about reports of babies born with tails? In no case has a "tail" ever contained bone. They are nothing more than fatty tumors. If these are really tails, what about babies born with fatty tumors on their necks or stomachs? Does this mean that our ancestors used to have tails on their necks or stomachs? Of course not. Tumors can grow anywhere.

III. VESTIGIAL AND NASCENT ORGANS.

A. INITIAL DISORGANIZATION (evolution): As animals and plants evolve into new kinds, they develop new structures while losing old ones – legs taking the place of fins, wings taking the place of legs, and so on. Thus, evolving species should have partially formed *nascent* organs that are not yet fully functional. Likewise, they should have *vestigial* structures that no longer have a function and are merely evolutionary leftovers. In the 1800's the German biologist Wedersheim compiled a list of over 180 structures in the human body which he said had served some purpose in man's evolution but were now useless evolutionary vestiges (Key, 1939, 15).

Visual # A-6

B. INITIAL COMPLEXITY: There should be a complete absence of nascent structures. Any vestigial structures reflect deterioration of the gene pool rather than evolution, that is, genetic information has been lost because of the accumulation of harmful mutations through the centuries. The number should be quite small.

C. ACTUAL OBSERVATION :

1. Nascent structures: There is not a single nascent structure known in any type of creature. We do not see anything with half an eye, half a wing, or half of anything else.

2. Vestigial structures: Many textbooks and biology classes still erroneously refer to some of the structures identified by Wedersheim as vestigial such as the coccyx (tailbone), appendix, tonsils, etc. However, there are now at most six organs in the human body for which a function is not known (Kofahl & Segraves, 1975, 171).

Visual # A-7

- If you look at a bare skeleton, the coccyx does indeed look like a tail. However, if you look at the whole body including muscles, the function of the coccyx is obvious: it is the anchoring point for the pelvic muscles. (Anyone who has ever had a broken tailbone knows that it is not.) Besides, the apes supposed to be our closest relatives, chimps and gorillas, do not have tails. Why should we?
- The tonsils and appendix are part of the body's reticuloendotheliel system and contain lymphoid tissue used in fighting infection, especially during infancy. If a structure has a function at any time, it is not a useless evolutionary leftover.

  Our hypothetical lower mammal ancestors DO have an appendix; monkeys DO NOT; apes and humans DO. This organ would have had to be lost through random mutations, then regained through other random mutations.
- Though some types of bacteria are harmful, most are not. In fact, many are necessary for proper functioning of the digestive system. The appendix contains a store of the good bacteria necessary in case the system needs to be "rebooted." (Smith *et al.,* 2009).
- We now know of a function for almost all the rest of these "vestigial" structures.

Many recent high school biology textbooks still list the appendix, tailbone, and so on as evolutionary vestiges. This is not because of the evidence, but in spite of it.

IV. EVOLUTION VS. DESCENT WITH MODIFICATION.

The concept of Initial Disorganization (evolution) in living things is based on the observation that animals and plants produce offspring that vary somewhat from their parents. However, this phenomenon fits equally well with Initial Complexity. Both expect offspring to differ from their parents to some degree.

A. INITIAL DISORGANIZATION: Many mutations beneficial.

Visual # A-8

Evolution (initial disorganization) says that some of the changes that occur in successive generations ultimately produce new body structures. The gradual accumulation of these structures must lead to the appearance of new and more complex types of creatures. Such changes must be ascribed to mutations, accidental errors in the process of copying each generation's DNA.

There is no question that most mutations are harmful. However, since so many new structures have developed, there must have been a great many beneficial mutations through the eons. We should observe at least a few modern day mutations that have a beneficial effect on the affected species.

B. INITIAL COMPLEXITY: Almost All Mutations Harmful.

Initial Complexity says that except for mutations, changes occur only within the limits set by the genetic information placed in each kind's DNA at the beginning. In case of mutation, we expect the change to be harmful or at best neutral. Since mutations work by changing what is already present rather than adding new information, no mutation should improve the overall condition of the kind.

Visual # A-9

When most people say evolution,. they mean ***macroevolution***. This would require the addition of new genetic information to produce totally new structures such as wings, bones, eyes, etc. It has never been observed. ***Microevolution***, on the other hand, is nothing more than minor variation within a kind. It happens all the time, as already existing genes are expressed (e.g. selective breeding). It would be more accurate to call it "microexpression" instead.

Visual # A-10

Evolution requires not just change, but change in the direction of increased complexity, or from simple to complex. This is macroevolution, not microevolution.

Since evolution postulates that everything began at its least organized, it predicts that many changes must have added genetic information. It is an uphill process, tending from simple to complex. Creation postulates that everything began at its most complex. It is a downhill process, tending from complex to simple. Changes would not add new information but rather tend toward deterioration.

V. EVOLUTION VS. ADAPTATION TO THE ENVIRONMENT.

It is obvious that many species are able to adapt to changing conditions in their environment, and that some individuals adapt better than others. This leads many to think that the species and individuals must have evolved.

Visual # A-11

This is not true. According to Initial Disorganization (evolution), the first living cell would have been extremely simple. In order for brains, bones, eyes, hearts, lungs and so forth to evolve, many brand new genes would have had to come into existence. This would require the addition of a great deal of genetic information. By contrast, Initial Complexity leads us to expect that a skillful designer would have built in enough variability to allow each kind to adapt to changing circumstances.

Consider how cells use the information stored in their DNA to produce their physical structures. DNA is subdivided into dozens of units called chromosomes, which in turn are subdivided into thousands of small segments called genes. These combine in countless ways to produce the physical structures of every living thing.

Visual # A-12

- Some genes known as *homeotic* genes are the same in all healthy specimens of a kind. If a homeotic gene is missing or damaged, the individual will probably have a great deal of difficulty even surviving.
- Other genes can exist in several forms called *alleles*. In just about every case where two or more alleles exist, one is dominant, that is, it is the only one that produces visible results. (It is *expressed*.) However, the recessive alleles may still be present and be passed on to future generations. If a descendant receives only recessive alleles and no dominant ones, this may result in a "throwback" to an earlier generation or even to the appearance of a feature that was previously masked by dominant genes.

Though individuals might adapt by changing their behavior, the species would adapt through the expression of already existing combinations of genes. Suppose, for instance, that a dominant gene resulted in yellow skin for a particular type of lizard, while the recessive allele led to purple skin. As long as the environment was primarily yellow, the lizards with the dominant gene would thrive. However, if something happened to kill off all the vegetation except the purple vines and flowers, the yellow lizards would stand out and would become easy prey. The yellow gene might eventually be eliminated. Even if it was still expressed occasionally, the purple lizards would take over. Though we might say that the species adapted to its new environment, all that really happened was that previously dominant genes were eliminated and allowed previously recessive ones to be expressed. This is a *loss* of information. It is not evolution at all.

VI. NATURAL SELECTION VS. SELECTIVE BREEDING.

One of the principal arguments used in support of for evolution is the fact that humans have been able to develop new strains of animals and plants by selectively breeding for desired features. For example, selective breeding has produced cows that give more milk and chickens that lay more eggs.

Visual # A-13

Selective breeding works by deliberately breeding individuals that have desired genes and eliminating the ones without those genes by isolating or killing them. In an extremely simplified example, suppose a certain variety of rose had only two alleles for color, yellow (recessive) and red (dominant). If each plant had only two gene sites for color with an equal probability of each being occupied by the dominant or recessive allele, an average of one out of four offspring should be yellow. However, we could selectively breed the offspring to produce either all red or all yellow flowers within just two generations. Nothing would have evolved; we would merely have eliminated previously existing genes from the selectively bred strain.

Those who believe in Initial Disorganization must believe that since man can bring about limited changes such as these, natural selection (random chance operating on the raw material furnished by mutations) must have been able to produce unlimited changes. This belief goes against thousands of years of observation.

A. REDUCED VIABILITY.

Visual # A-14

The individuals produced by selective breeding are less *viable* (able to survive on their own) than those in the wild state. They require much more care in order to stay alive (Falconer, 1960, p. 186). For example, chickens have been bred to reach frying size only seven weeks after hatching, but they require a great deal of care simply to be kept alive for those seven weeks. The selective breeding helps us, not the chickens. It makes them weak and unable to survive without constant care from the breeders.

B. INSTABILITY.

When the selective breeding is discontinued, the group reverts to its wild state within a few generations (Wysong, 1976, 317-318).

C. LIMITS TO VARIATION.

Selective breeding enables us to emphasize preexisting features, but in every case we reach a limit beyond which no further change is possible (Fix, 1984, 184-185). Two examples are the sugar beet and the fruit fly *Drosophila*. In 1800, experimenters in France began attempting to increase the percentage of sugar in table beets from the natural amount of six percent. By 1878, after many generations of selective breeding, they were able to raise the percentage to seventeen. In more than a century since then, attempts to go beyond this limit have failed. Likewise, attempts to reduce the number of bristles on the thorax of fruit flies succeeded for twenty generations until a limit was reached. In hundreds of generations since then no further change has been possible (Tinkle, 1967, 55).

These are not isolated cases. In every instance, breeders have found that they soon reach a limit beyond which no further changes are possible (Lester & Bohlin, 1984, 95-96). In order to stay alive, the affected individuals require greater care than those not produced by artificial selection. When allowed to resume natural breeding the group reverts to its wild state within a few generations.

The best efforts of careful breeders throughout history have never been able to make any species of animal or plant vary beyond definite limits. Nevertheless, some believe that a series of accidents accomplished what thousands of years of careful planning could not. They must discard thousands of years of observation simply because they are not willing to accept the evidence. The observations of science show that even under carefully controlled conditions there are clearly defined limits to change within kinds.

VII. ANTIBIOTIC RESISTANCE IN BACTERIA AND INSECTS.

There is a common misconception that some bacteria are becoming "superbugs" by evolving a resistance to antibiotics, and that some insects are evolving an immunity to pesticides. This is not evolution at all.

Visual # A-15

Suppose you have a barnyard with machinery set up to automatically care for 1,000 chickens. You have 950 white chickens and 50 brown ones. Now suppose that someone tampers with the feeding apparatus by putting in a special poison that happens to kill only white chickens. Soon only 50 chickens are left, all of them brown. Since the farm is equipped to feed a thousand, they quickly multiply. Before long the barnyard is populated by 1,000 brown chickens. (The occasional white descendants continue to die and be swept away until all the white genes are gone.)

The brown chickens did not evolve. They survived because they were resistant to the poison all along. Nothing has been added to the chickens' gene pool; instead, the ability to produce white chickens has been lost.

This illustrates what sometimes happens when doctors prescribe antibiotics. Suppose your doctor gives you a dose of an antibiotic that kills 99% of the bacteria that are causing your condition. If there were a billion to begin with – not an unreasonable number – ten million are still alive. (This is why you are supposed to keep taking your prescription even after you feel better.) The survivors are still in the environment that allowed them to live in the first place, but they no longer have competition, so they rapidly reproduce to fill up the space.

The bacteria that survived did not become immune to the antibiotics, but already were from the beginning. (This is similar to the way some people are immune to a disease that sickens many around them.) Those that had a greater immunity survive and multiply until only the resistant strain is left. If they had acquired this resistance by random mutations there would be many different strains in different geographic areas, each resistant to a different kind of poison. However, some bacteria thawed out after being frozen for over a hundred years have the same

resistance as the supposedly new "superbugs" (Struzik, 1990). They have been here all along. Likewise, "mutated" insects or bacteria show immunity to the same poisons in widely different areas. This shows that their immunity is not the result of mutation but was present in some of them all along. It has nothing to do with evolution.

This is similar to what happens with bacteria and insects. It is an example of natural selection, but no new genetic information is added.

VIII. INDUSTRIAL MELANISM - THE PEPPERED MOTH.

Visual # A-16

In the area around Liverpool, England lives a species of moth known as Kettlewell's moth, the peppered moth, or *Biston betularia*. It comes in light and dark varieties. Before the industrial revolution, the trees in the area were light in color. As the story goes, the light moths were hard for birds to see as they rested on the trees, while the dark ones were easy to spot. Most of the dark moths were quickly eaten, victims of natural selection. The light moths which escaped comprised the vast majority of the moth population. However, when the industrial revolution got under way and factories began to belch out great quantities of smoke, the light-colored lichens on the trees died and the soot-coated trees became darker and darker. Now it was easier for the dark moths to blend in and survive. Soon the percentage of dark moths was far greater than that of the light ones.

This is not a case of increasing complexity at all. The moth population began with light and dark moths of species *Biston betularia* and it ended with light and dark moths of species *Biston betularia*. In addition, a pollution cleanup campaign in the area made the trees lighten again. As they moved back toward their original color, the percentage of light moths also shifted back towards its original amount. The peppered moth is an excellent example of natural selection, but it has nothing to do with the evolution of a new kind of creature (Matthews, 1991). Nothing new was added.

A postscript to the story: the famous photos of the light and dark moths found in many biology books were faked by photographers who pinned dead moths to the tree trunks. In real life, the moths do not rest on the trunks but stay mostly in the upper branches. Even if the story were accurate, it still would not show any increase of genetic information as required by evolution.

> Suggestion for teachers: you can illustrate industrial melanism, natural selection, and the peppered moth by making two large cutouts in the shape of moths, one of them out of black construction paper and the other out of white. Hold the two against a white background and ask the students which would be easier for birds to see and eat. Repeat the demonstration against a black background. The students will be able to see for themselves how natural selection operates. It works on previously existing features without creating anything new.

IX. "PSEUDOGENES"

Visual # A-17

Many different species contain segments of DNA that are similar to each other and to other genes that have a known function, yet the suspect segments themselves have no known function. Many call these "pseudogenes" or "junk DNA" and claim that they are evolutionary leftovers from a common ancestor. (Side note: some pseudogenes found in humans and gorillas are notably missing from our supposed closest relative, the chimpanzee (Woodmorappe, 2000). Why would transmission of the pseudogene have skipped over such a crucial step?)

The very name of pseudogenes, meaning "false genes," is reminiscent of the concept of vestigial organs. Because many in the late 1800's did not know the function of about 180 organs in the human body, they decided those organs had no function. Medical science has exposed their ignorance by discovering what almost all these "vestigial" organs do.

Now the argument has shifted from visible organs to microscopic segments of DNA. Some say that since they don't know the function of pseudogenes, there is no function. This is a very arrogant attitude. We learn more and more of the mysteries of DNA all the time. For instance, we used to have no idea what the nucleotide sequence TTAGGG on a DNA strand meant. Now we recognize that it is a "stop" code indicating the end of a chromosome (Moyzis, 1991, 48-55). Many believers in Initial Complexity believe that a function will also be discovered some day for many of the supposed pseudogenes. Several factors already known may have something to do with the answer.

A. CELL DIFFERENTIATION.

The DNA of every cell in an organism contains the same information, yet some of them become heart cells while others develop into skin cells, brain cells, or a myriad of others. Despite a great deal of speculation, no one is sure why a cell develops into one type and not the other. Perhaps pseudogenes have something to do with it.

B. REGULATORY FUNCTIONS.

Researchers have discovered the function of a number of genes previously thought to be useless. For example, a gene known as p53 has no obvious function in normal human cells. However, biologists have recently discovered that it inhibits the runaway reproduction of defective cells. If p53 is missing or damaged, the defective cells can quickly develop into cancer tumors. Some pseudogenes may also have an as-yet-undiscovered regulatory function.

C. THREE DIMENSIONAL STRUCTURE OF DNA.

We usually consider DNA as if its full information content could be discovered by starting at one end and reading down its entire length - TTAGGGCATTGCA, etc. However, scientists are learning that DNA's 3-dimensional structure may have an important part to play in its replication (Wilder-Smith, 1993). During reproduction, it forms loops and makes contact with itself in many different places. While "pseudogenes" do not contain any known *transcriptional* information (one triplet specifying one amino acid), perhaps they furnish *structural* information. They may be the contact points for the loops, or may be involved in specifying where the contact points are.

D. HIDDEN INFORMATION ENCODED IN DNA.

Visual # A-18

At least a few segments of DNA contain far more information than is immediately obvious. For instance, the genes that code for human antibodies function something like a dictionary from which the words can be combined to form any sentence imaginable. Using fewer than 300 gene segments, the DNA can code for up to 10 billion antibodies. This occurs because the cell is able to combine short pieces of them, not necessarily in sequence, in at least 10 billion ways (Behe, 1996, 127-134). There is far more here than meets the eye. Perhaps "pseudogenes" are similar. The cell may use them in pieces rather than all at once.

Even if none of these is the correct explanation, our ignorance of the function of "pseudogenes" doesn't mean they have none. There is no positive evidence that they have anything to do with evolution. We might wonder, too: If "pseudogenes" don't do anything, then *why bother trying to sequence them?*

X. GEOGRAPHIC DISTRIBUTION - one of the Pillars of Evolution.

Visual # A-19

Biogeography, or the geographic distribution of species, is considered to be one of the "pillars of evolution." The same species or genera of animals and plants may be found in different places throughout the world, but with variations. In nature this usually happens for one of two reasons. (1) *Distance*. Roaches, for example, live almost everywhere. However, those in the western

United States are somewhat different from those in the east. Distance has kept the two groups from interbreeding, allowing them to develop visible differences.

(2) *Natural barriers*. The squirrels on the north and south rims of the Grand Canyon belong to the same species, yet have a few visible differences. These have arisen because the two populations of squirrels cannot get across the canyon to breed with each other.

Many other species show similar types of variation. In extreme cases, group may specialize so much that they are no longer able to interbreed and are therefore classified as separate species. This process is known as *allopatric speciation.* Despite what evolutionists say, it has nothing to do with evolution.

A. GEOGRAPHIC DISTRIBUTION AND NATURAL SELECTION.

A "species" is defined as a reproductively isolated biological unit, that is, its members can only breed with each other. Selective breeding experiments on the fruit fly *Drosophila* illustrate the concept well. The flies have been separated into groups according to desired characteristics such as eye color, number of hairs on the thorax, etc. As each new generation matures, only those individuals with the desired features are allowed to breed. The process is repeated for many generations until each group consists almost entirely of individuals that have the selected characteristics. If two groups that have been kept separated for a great many generations are finally allowed to mix together, they are sometimes unable to interbreed. In this case each of the groups is reproductively isolated from the other. Because of their inability to interbreed they are defined as separate species.

Such diversification has nothing to do with evolution. The breeders selected features that were already present. Not only have the groups failed to develop any new features, they do not even have all of the characteristics of the original parent flies. They have *lost* some of the original genetic information. (Their inability to interbreed may be related to the loss of other genes with no obvious relation to reproduction. Many genes affect more than one body function.)

B. HOW SPECIALIZATION CAN HAPPEN IN NATURE.

We can use a greatly simplified example to show how this phenomenon could happen in nature. Imagine a species of birds with two varieties, one with straight beaks and the other with curved beaks. Let's assume that there are just two alleles that control the beak shape, the "B" gene (straight beaks) and the "b" gene (curved beaks). Let's also assume that the B gene is dominant. If we start with two birds which each have both the dominant and recessive genes, they can pass on one of four combinations to their offspring, as follows:

Visual # A-20

Gene from Father	Gene from Mother	Visible Result
B	B	BB - Straight beak
B	b	Bb - Straight beak
b	B	bB - Straight beak
b	b	bb - Curved beak

On average, only one out of four babies will have a curved beak.

Visual # A-21

Suppose these birds live on an island fifty miles long and one mile wide with a dormant volcano in the center. On the island are two kinds of trees, one with seeds that require a straight beak to eat, the other with seeds requiring a curved beak. As long as things go along normally, the population contains a mixture of the two beak types.

Visual # A-22

One day the volcano erupts. Its poisonous gases kill all the animals on the eastern half, as well as all the trees whose seeds require straight beaks. (In nature, some individuals

have a greater tolerance for harmful substances than others.)

Visual # A-23

Months later the volcano becomes dormant again. The surviving birds from the west begin to fly to the eastern half again. Those with straight beaks find nothing to eat and either fly back or starve. Those with curved beaks (bb genes only) stay and begin to reproduce. Soon there are only curved-beak birds on the eastern half of the island. Since they have no B genes, they will never again produce straight-beak offspring.

Visual # A-24

Another disaster strikes. A great windstorm blows many of the birds from both halves of the island to an island beyond their normal flying range. (They are too far away to fly back.) All the trees on the new island have seeds that require straight beaks. The curved-beak birds starve, leaving a smaller and smaller percentage of b genes in the population. After many generations, almost all the b genes are eliminated. The few curved-beak birds that hatch on the island quickly die, leaving only straight-beak adults.

Visual # A-25

Visual # A-26

Is this evolution? Not at all. We started with a *founder population* which originally had two variants. After natural selection, there are still only two variants. However, some individuals have become specialized ("adapted") to fit into their environment. The curved-beaks have lost the ability to produce straight-beak offspring and the straight-beaks have just about lost the ability to produce curved-beaks. The only thing that changed was the geographic distribution of the two varieties. Nothing new was added. Nothing evolved.

Visual # A-27

In the real world, there are seldom just two alleles controlling any given characteristic. However, the principle is the same. If a founder population starts to radiate outward from a starting point -- say, from the Atlantic Ocean toward the Pacific -- its members encounter varying food sources and environmental circumstances as they travel. The individuals whose characteristics are best suited for each area will tend to thrive and leave more offspring there. Those less suited will likely go back or continue to migrate. As they continue to spread out the process will repeat. Because of the gradual loss of genetic information in those that keep migrating, there will be a gradual shift in characteristics of the species from the starting to the ending points. The population will tend to become more and more specialized as it moves farther away from where it began. Some groups may even become reproductively isolated from the others. In this case, they are defined as new species even though they do not have any new features.

Visual # A-28

Such geographical variation does not explain where the genetic information came from in the first place. The specialized groups each have *less* genetic information than their generalized ancestors in the founder population. They are degenerate, not more advanced. Evolution can't explain how the ancestors got all their genetic information in the first place. Geographic distribution has to do with the diversification of species, but it cannot explain their origin.