Can mutations create new information?

Robert W. Carter

In the same way that species are not static, neither are genomes. They change over time; sometimes randomly, sometimes in preplanned pathways, and sometimes according to instruction from pre-existing algorithms. Irrespective of the source, we tend to call these changes 'mutations'. Many evolutionists use the existence of mutation as evidence for long-term evolution, but the examples they cite fall far short of the requirements of their theory. Many creationists claim that mutations are not able to produce new information. Confusion about definitions abounds, including arguments about what constitutes a mutation and the definition of 'biological information'. Evolution requires the existence of a process for the invention of new information from scratch. Yet, in a genome operating in at least four dimensions and packed with meta-information, potential changes are strongly proscribed. Can mutations produce new information? Yes, depending on what you mean by 'new' and 'information'. Can they account for the evolution of all life on Earth? No!

The phrase, "Mutations cannot create new information" is almost a mantra among some creationists, yet I do not agree. Evolutionists have a number of responses to the idea, although most of them display faulty reasoning. Most evolutionary responses display a lack of understanding of the complexity of the genome. I will explain below why I believe the genome was designed to operate in at least four dimensions and why this causes difficulty for the evolutionary belief in the rise of new information.

Another issue, especially displayed among evolutionists (but creationists, including myself, are not immune), is a lack of understanding of the location of biological information. Most people tend to think DNA (the 'genome') is the storage place of information. While it is certainly the location of a tremendous amount of it, this gene-centered view ignores the information originally engineered into the first created organisms. The architecture of the cell, including the cell wall, nucleus, sub-cellular compartments and a myriad of molecular machines, did not originate *from* DNA, but was created separately and alongside DNA. Neither can exist without the other. Thus, a large, yet immeasurable, part of biological information resides in living organisms outside DNA. Taking an organism-centric view changes the debate dramatically.[1] Yet, because the organism-centric view ultimately involves the creative genius of God, which we cannot begin to fathom, we immediately run into a 'wall of incalculability'. For this reason, I will focus on one subset of biological information, genetic information, for the remainder of this article.

A third issue involves the fact that Darwin actually wrote about two different ideas, what I call his *special* and *general* theories of evolution (described below). Creationist reactions against evolution in general have led to some misunderstanding of the amounts of change we might expect in living organisms over time. There are three basic ideas I would like to introduce in this discussion: 1) In the same way that God was not limited to creating static species, God was not limited to creating static genomes; 2) God may have placed intelligently designed genetic algorithms into the genomes of His created kinds that cause changes in genetic information or even create information *de novo*; and 3) God could have engineered information in compressed form into the genome that would be later decompressed and seen as 'new' information.

What is a mutation?

A 'mutation' is a change in the sequence of DNA. Mutations can be bad or (theoretically) good, but they all involve some change in the sequence of letters (base pairs) in the genome. A single mutation can be as simple as a single letter swap (e.g. C changed to T) or the insertion or deletion of a few letters. These simple mutations are in the majority. Mutations can also be complex, like the deletion or duplication of an entire gene, or even a massive inversion of a millions-of-base-pairs section of a chromosome arm.

I do not believe all current human genetic differences are due to mutation. We have to make a distinction between mutation and 'designed variation'. There are a huge number of single letter differences between people, and these are mostly shared among all people groups.[2] This indicates that much of the diversity found among people was designed: Adam and Eve carried a significant amount of diversity; this diversity was well-represented on the Ark and in the Babel population immediately after the Flood, and the post-Babel people groups were large enough to carry away most of the variation present at Babel. Most deletions (~90%), however, are not shared among the various human subpopulations.[3] This indicates that a significant number of deletions have occurred in the human genome, but *after* Babel. Deletions are apparently not designed variation and are an example of rapid genomic decay. The same can be said of DNA insertions, but they are about 1/3 as common as the same-size deletion. The ubiquity of large, unique deletions in the various human subpopulations worldwide is evidence for rapid erosion or corruption of genetic information, through mutation.

What is a gene?

Technically, a 'gene' is a piece of DNA that codes for a protein, but modern genetics has revealed that different parts of different genes are used in different combinations to

produce proteins,[4,5] so the definition is a bit up in the air at the moment.[6] Most people, including scientists, use 'gene' to mean two different things: either 1) a piece of DNA that codes for a protein, or 2) a trait. This is an important distinction to keep in mind.

What is information?

This question, 'What is information', is the real crux of the argument, yet the term 'information' is difficult to define. When dealing with this subject, in most cases evolutionists use a statistical measure called Shannon Information. This was a concept invented by the brilliant electronic engineer C.E. Shannon in the middle of the 20th century, who was trying to answer questions about how much data one could stuff into a radio wave or push through a wire. Despite common usage, Shannon's ideas of information have little to do with biological information.

Syntax *Code, Grammar*	*Genetic code* The DNA contains words that are 3 letters long.
Semantics *Meaning*	– Description of the amino acid sequences for all the proteins: Process of Transcription. – Commands for construction of the organs.
Pragmatics *Action*	– Protein synthesis in living cells: Process of Translation. – Construction of the entire organism. – Realisation of all biological functions.
Apobetics *Purpose, Result*	Existence of life

Figure 1. A biological system is defined as containing information when all the following five hierarchical levels of information are observed: statistics (here left off for simplicity), syntax, semantics, pragmatics and apobetics (from Gitt, ref. 9).

Case in point: A beautiful cut-glass vase can be described quite easily. All one needs is a description of the material and the location of each edge and/or vertex in 3-D space. Yet, a million-dollar vase can be smashed into a worthless pile of sand quite easily. If one wanted to recreate that pile of sand exactly, a tremendous amount of *Shannon* information would be required to describe the shape of each grain as well as the orientation and placement of grains within the pile. Which has more 'information', the pile of sand or the original vase into which a tremendous amount of purposeful design was placed? It depends on which definition of information one uses!

In other definitions of 'information', the pile of sand could be described quite easily with just a few statistical measures (e.g. average grain size + mass of sand + angle of repose). In this sense, any number of independent piles of sand can be, for all practical purposes, identical. This is the essence of *Zemansky's* use of information,[7] yet this also has little to do with biological information, for biology is not easy to summarize, and any such attempts would produce meaningless results (e.g. a statistical measure of the average rate of a chemical reaction mediated by a certain enzyme says nothing about the origin of the information required to produce that enzyme).

A definition of 'biological information' is not easy to come by, and this complicates the discussion of the power of mutation to create information. However, pioneers in this field, including Gitt[8] and others, have discussed this issue at great length so it is not necessary to reproduce all the arguments here. I will follow Gitt and define information as, "… an encoded, symbolically represented message conveying expected action and intended purpose", and state that, "Information is always present when all the following five hierarchical levels are observed in a system: statistics, syntax, semantics, pragmatics and apobetics" (figure 1).[9] While perhaps not appropriate for all types of biological information, I believe Gitt's definition can be used in a discussion of the main focus of this article: potential changes in *genetic* information.

Can mutations create information?

Now we can address the main question, "Can mutations create new genetic information?"

1) God was not limited to creating static genomes, in the same way that He was not limited to creating fixed species.[10] In the 1800s, Darwin pushed back against the popular idea that God created all species in their present form. The Bible does not teach 'fixity of species', of course; this idea came from the teachings of older scientists and philosophers, primarily rooted in the writings of Aristotle.[11] Today, most creationists do not have trouble with *non*-fixity of species. Evolutionists constantly attempt to bring up the straw man argument that we believe in species stasis, even comparing us to people who believed in a flat earth, but both of these are historical myths.[12] Most people throughout history believed the earth was round, and there were creationists, like Linnaeus[13] and Blyth,[14] prior to Darwin who believed species could change (though not beyond a certain limit). CMI, in particular, have published articles and one DVD[15] on the subject of how species change over time and have an entire section on the topic on our Q&A page.[16] Here is an important question: if species can change, what about their genomes?

Not only are species not fixed, but more than several articles have been published in this journal alone on the topic of non-static genomes, including recent articles by Alex Williams,[17] Peer Terborg,[18] Jean Lightner,[19] Evan Loo Shan,[20] and others. It looks like God engineered into life the ability to change DNA. This occurs through homologous crossover, jumping genes (retrotransposons,[21] ALUs, etc.), and other means (including the random DNA spelling errors generally called 'mutations'). Terborg has coined a

phrase, 'variation inducing genetic elements' (VIGEs)[22] to describe the intelligently-designed genetic modules God may have put into the genomes of living things to induce DNA sequence changes (figure 2).

2) Creationists are making a strong case that genomes are not static and that the DNA sequence can change over time, but they are also stating that some of these changes are controlled by genetic algorithms built into the genomes themselves. In other words, not all changes are accidental, and a large proportion of genetic 'information' is algorithmal. If a change occurs in DNA through an intelligently-designed algorithm, even an algorithm *designed* to make random, but limited, changes, what do we call it? Mutation originally simply meant 'change' but today it carries a lot of extra semantic baggage. Can we say that a mechanism designed by God to create diversity over time within a species can be a cause of 'mutation', with its connotation of unthinking randomness? In fact, there is considerable evidence that some mutations are repeatable[23,24] (that is, not wholly random) (figure 3). This suggests the presence of some genomic factor designed to control mutation placement in at least some cases. If that something causes an intentional change in the DNA, do we call that a 'mutation' or an 'intelligently engineered change in the DNA sequence'? Of course, random mutations still occur, and these are mostly due to the error rate of the DNA replication and repair machinery.

3) There could be a considerable amount of information stored in the genome in compressed, hidden form. When this information is decompressed, deciphered, revealed, or unscrambled (call it what you will), this cannot be used as evidence for evolution, since the information was already stored in the genome.

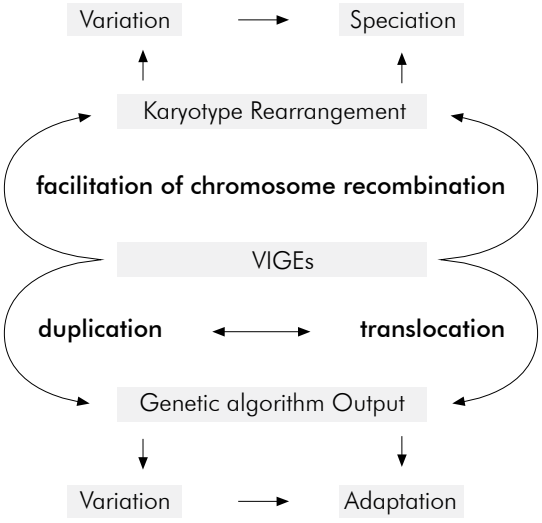

Figure 2. Schematic view of the central role that 'intelligently-designed' VIGEs may play in generating variation, adaptations and speciation events in the genomes of living things to induce DNA changes. Lower part: VIGEs may directly modulate the output of (morpho)genetic algorithms due to position effects. Upper part: VIGEs that are located on different chromosomes may be the result of speciation events, because their homologous sequences facilitate chromosomal translocations and other major karyotype rearrangements. (From Terborg, ref 22.)

Take the information God put into Adam and Eve. An evolutionist looks at any DNA difference as a result of mutation, but God could have put a significant amount of designed variation directly into Adam and Eve. There are millions of places in the human genome that vary from person to person, the majority of this variation is shared among all populations,[25] and most of these variable positions have two common versions (A *or* G, T *or* C, etc.).[26] The bulk of these should be places where God used perfectly acceptable alternate readings during the creation of man. These are not mutations!

The in-built alternatives God put into Adam and Eve are scrambled over time, and new traits (even many good ones not previously in existence) might arise during this process. How? One way is through a process called 'homologous recombination'. People have two sets of chromosomes. Let's say a certain portion of one of Adam's chromosome #1 reads 'GGGGGGGGGG' and codes for a green-colored something-or-other. The other copy of chromosome 1 reads 'bbbbbbbbbb' and codes for a blue something-or-other, but blue is recessive. Someone with one or two copies of the all-G chromosome will have a green something-or-other. Someone with two copies of the all-b chromosome will have a blue something-or-other. In the early population, about three quarters of the people will have the green version and about one quarter will have the blue version.

How, then, does this process produce new traits? Homologous chromosomes are recombined from one generation to the next through a process called 'crossing over'. If a crossing over event occurred in the middle of this sequence, we might get one that reads 'GGGGGbbbbb' that causes the production of a purple something-or-other. This is a brand new thing, a new trait never seen before. This is the result of a change in the DNA sequence and we will not be able to tell the difference between this crossing over event and a 'mutation' until we can sequence the piece of DNA in question. Thus, new traits (sometimes incorrectly or colloquially referred to as 'genes') can arise through homologous recombination.[27] But this is not mutation. Recombination is part of the intelligently-designed genome and usually only reveals information that was previously packed into the genome by the Master Designer (it can also reveal new combinations of mutations and designed diversity). Also, recombination is not random,[28,29] so there is a limit to the amount of new traits that can come about in this way.

Bad examples used by evolutionists

Adaptive immunity

I have a hard time calling something like adaptive immunity, which involves changes in the order of a certain set of genes to create novel antibodies, 'mutation'. Adaptive immunity is often brought up by the evolutionist as an

	72	73	75	76	79	81	83	85	91	92	94	95	96	97	98	99	100	101	103	109	111	112	114	115	118	121	127	128	130	131	133	134	135
Orang	A	C	C	G	G	G	G	G	C	A	C	C	A	*	G	A	G	G	T	C	T	A	T	G	C	C	C	C	G	C	G	G	A
Man	A	C	T	G	G	G	G	A	C	A	C	T	G	*	G	A	G	G	T	C	T	A	T	G	C	C	C	C	G	T	G	G	A
Chimp	A	C	T	G	G	G	C	A	C	A	C	T	G	*	G	A	G	G	T	C	T	A	T	G	C	C	C	C	G	C	G	G	A
Macaque	A	A	C	G	G	G	G	G	C	A	C	C	A	*	A	G	G	G	T	C	T	A	T	G	C	C	C	C	G	C	G	G	A
Guinea Pig	A	C	C	T	G	G	G	G	C	A	C	C	G	**G**	G	G	G	G	C	C	T	G	T	G	C	C	C	C	G	A	G	G	A
Mouse	A	C	C	C	G	A	G	G	C	A	C	C	G	**A**	G	G	T	G	T	C	T	G	T	G	C	G	C	C	G	A	G	G	A
Cow	A	C	C	C	G	A	G	A	C	A	T	C	G	**C**	G	G	G	G	C	C	T	G	T	G	C	C	C	C	G	A	C	G	A
Chicken	A	C	C	T	G	A	G	G	T	G	T	C	G	**A**	G	C	G	G	T	C	G	G	T	G	C	C	C	C	G	C	G	G	A
Pig	A	C	C	C	G	A	G	G	C	A	T	C	G	**G**	G	C	G	G	C	C	T	G	T	G	C	C	C	C	G	A	G	G	A
Dog	T	C	C	T	G	A	G	C	C	A	C	C	G	**C**	G	G	G	G	T	C	T	G	T	G	C	C	C	C	G	A	G	G	A
Rat	A	C	C	C	A	A	G	G	C	A	C	C	G	**A**	G	G	C	G	T	T	T	G	T	G	C	C	C	C	G	A	G	G	A

Figure 3. There is considerable evidence that some mutations are not random. E.g. mutations in nucleotide sequences of exon X (ten) from GULO genes and pseudogenes from a number of species. In this illustration, positions with identical nucleotides in all organisms are not shown. The deletion mutation in position 97 (indicated by *) in this pseudogene is usually hailed as the ultimate evidence for the common descent shared between humans and the great apes. At first glance, this may appear to be a very strong case for common descent. However, after examining a large number of organisms, enabling the excluding non-random mutations, it becomes obvious that position 97 is in fact a hot spot for non-random mutations. (From Terborg, ref. 24.)

example of 'new' genes (traits) being produced by mutation. Here we have an example of a mechanism that takes DNA modules and scrambles those modules in complex ways in order to generate antibodies for antigens to which the organism has never been exposed. This is a quintessential example of intelligent design. The DNA changes in adaptive immunity occur only in a controlled manner among only a limited number of genes in a limited subset of cells that are only part of the immune system, and these changes are not heritable. Thus, the argument for evolution falls flat on its face.[30]

Gene duplication

Gene duplication is often cited as a mechanism for evolutionary progress and as a means of generating 'new' information. Here, a gene is duplicated (through several possible means), turned off via mutation, mutated over time, turned on again through a different mutation, and, *voilà!*, a new function has arisen.

Invariably, the people who use this as an argument never tell us the rate of duplication necessary, nor how many duplicated but silenced genes we would expect to see in a given genome, nor the needed rate of turning on and off, nor the likelihood of a new function arising in the silenced gene, nor how this new function will be integrated into the already complex genome of the organism, nor the rate at which the silenced 'junk' DNA would be expected to be lost at random (genetic drift) or through natural selection. These numbers are not friendly to evolutionary theory, and mathematical studies that have attempted to study the issue have run into a wall of improbability, even when attempting to model simple changes.[31–33] This is akin to the mathematical difficulties Michael Behe discusses in his book, *The Edge of Evolution*.[34] In fact, gene deletions[35] and loss-of-function mutations for *useful* genes are surprisingly common.[36] Why would anyone expect a deactivated gene to stick around for a million years or more while an unlikely new function develops?

But the situation with gene duplication is even more complicated than this. The effect of a gene often depends on gene copy number. If an organism appears with extra copies of a certain gene, it may not be able to control the expression of that gene and an imbalance will occur in its physiology, decreasing its fitness (e.g. trisomy causes abnormalities such as Down syndrome because of such gene dosage effects). Since copy number is a type of information, and since copy number variations are known to occur (even among people[37]), this is an example of a mutation that changes information. Notice I did not say 'adds' information, but 'changes'. Word duplication is usually frowned upon as being unnecessary (ask any English teacher). Likewise, gene duplication is usually, though not always, bad. In the cases where it can occur without damaging the organism, one needs to ask if this is really an addition of information. Even better than that, is this the type of addition required by evolution? No, it is not.

Several creationists have written on this subject, including Lightner,[38] Liu and Moran.[39] Even if an example of a new function arising through gene duplication is discovered, the function of the new must necessarily be related to the function of the old, such as a new but similar catalysis end product of an enzyme. There is no reason to expect otherwise. New functions arising through duplication are not *impossible*, but they *are* vanishingly unlikely, and they become more unlikely with each degree of change required for the development of each new function.

Degraded information

There are abundant examples in the evolutionary literature where genetic degradation has been used in an attempt to show an increase in information over time. Examples include sickle cell anemia (which confers a

resistance to the malaria parasite by producing deformed hemoglobin molecules),[40] aerobic citrate digestion by bacteria (which involves the loss of control of the normal anaerobic citrate digestion),[41] and nylon digestion by bacteria (which involves a loss of substrate specificity in one enzyme contained on an extra-chromosomal plasmid).[42] Since they all involve decay of prior information, none of these examples are satisfactory evidence for an increase in biological complexity over time.

Antibiotic resistance in bacteria

This has been dealt with so many times that I hesitate to even mention it. However, for some reason evolutionists keep bringing it up, almost *ad nauseam*. The interested reader can easily find many articles on the subject, with detailed creationist rebuttals.[43]

General gain-of-function mutations

Evolution requires gain-of-function (GOF) mutations, but evolutionists have had a difficult time coming up with good examples.[44] Adaptive immunity, homologous recombination, antibiotic resistance in bacteria, and sickle-cell anemia in humans have all been used as examples, but, as detailed above, each of these examples fails to meet the requirements of a true GOF. The general lack of examples, even theoretical examples, of something absolutely required by evolution is strong testimony against the validity of evolutionary theory.

The real issue

The development of new functions is the only thing important for evolution. We are not talking about small functional changes, but radical ones. Some organism had to learn how to convert sugars to energy. Another had to learn how to take sunlight and turn it into sugars. Another had to learn how to take light and turn it into an interpretable image in the brain. These are not simple things, but amazing processes that involve multiple steps, and functions that involve circular and/or ultra-complex pathways will be selected away before they have a chance to develop into a working system. For example, DNA with no function is ripe for deletion, and making proteins/enzymes that have no use until a complete pathway or nano-machine is available is a waste of precious cellular resources. Chicken-and-egg problems abound. What came first, the molecular machine called ATP synthase or the protein and RNA manufacturing machines that rely on ATP to produce the ATP synthase machine? The most basic processes upon which all life depends cannot be co-opted from pre-existing systems. For evolution to work, they have to come up from scratch, they have to be carefully balanced and regulated with respect to other processes, and they have to work before they will be kept.

Saying a gene can be copied and then used to prototype a new function is not what evolution requires, for this cannot account for radically new functionality. Thus, gene duplication cannot answer the most fundamental questions about evolutionary history. Likewise, none of the common modes of mutation (random letter changes, inversions, deletions, etc.) have the ability to do what evolution requires.

Darwin pulled a bait and switch in his *On the Origin of Species*. He actually produced two separate theories: what I call his *special* and *general* theories of evolution. He went on at length to show how species change. This was the Special Theory of Evolution and he was preceded by numerous others, including several creationists, with the same idea.

It took him a long time to get to the point, but he finally said,

> "… I can see no limit to the amount of change … which may be effected in the long course of time by nature's power of selection."[45]

This was his General Theory of Evolution, and this is where he failed, for he provided no real mechanism for the changes and was ignorant of the underlying mechanisms that would later be revealed. To use a modern analogy, this would be akin to saying that small, random changes in a complex computer program can create radical new software modules, without crashing the system.[46] Thus, the 'can mutations create new information' argument is really about the bridge between the special and general modes of evolution. Yes, mutations can occur within living species (kinds), but, no, those mutations cannot be used to explain how those species (kinds) came into existence in the first place. We are talking about two completely separate processes.

The meta-information challenge

We need to get past the naïve idea that we understand the genome because we know the sequence of a linear string of DNA. In fact, all we know is the first dimension out of at least four in which the genome operates (1: the one-dimensional, linear string of letters; 2: the two-dimensional interactions of one part of the string with another, directly or through RNA and protein proxies; 3: the three-dimensional spatial structure of the DNA within the nucleus; and 4: changes to the 1st, 2nd and 3rd dimensions over time). There is a tremendous amount of information packed into that genome that we have not figured out, including multiple simultaneously-overlapping codes.[47] When discussing whether or not mutations can create new information, evolutionists routinely bring up an overly-simplistic view of mutation and then claim to have solved the problem while waving their hand over the real issue: the antagonism between ultra-complexity and random mutation.

If a four-dimensional genome is hard enough to grasp, there is also a huge amount of 'meta-information' in the genome. This is information about the information! This is the information that tells the cell how to maintain the

information, how to fix it if it breaks, how to copy it, how to interpret what is there, how to use it, when to use it, and how to pass it on to the next generation. This is all coded in that linear string of letters and life could not exist without it. In fact, life was designed from a top-down perspective, apparently with the meta-information coming first. According to a brilliant paper by Alex Williams,[48] for life to exist, organisms require a hierarchy of

1) Perfectly pure, single-molecule-specific biochemistry,
2) specially structured molecules,
3) functionally integrated molecular machines,
4) comprehensively regulated, information-driven metabolic functions, and
5) inversely-causal meta-information.

None of these levels can be obtained through natural processes, none can be predicted from the level below, and each is dependent on the level above. Meta-information is the top level of biological complexity and cannot be explained by naturalistic mechanisms, yet life cannot exist without it.[49] Putting all other arguments for and against the rise of biological information aside, where did the meta-information, upon which all life depends, come from?

Conclusions

Can mutation create new information? Yes, depending on what you mean by 'information'. Also, 'new' does not necessarily imply 'better' or even 'good'. When evolutionists cite examples of 'new' information, they are almost invariably citing evidence of new *traits*, but these traits are caused by the corruption of *existing* information. Mutations can create new varieties of old genes, as can be seen in white-coated lab mice, tailless cats, and blue-eyed people. But damaging mutations cannot be used to vindicate molecules-to-people evolution. Breaking things does not lead to higher function (and presupposes a pre-existing function that can be broken). Also, not all new traits are caused by mutation! Some come about by unscrambling pre-existing information, some from decompressing packed information, some from turning on and off certain genes.

In all the examples I have seen used to argue against creation, evolution is not helped. There are no known examples of the *types* of information-gaining mutations necessary for large-scale evolutionary processes. In fact, it looks like all examples of gain-of-function mutations, put in light of the long-term needs of upward evolutionary progress, are exceptions to what is needed, because every example I have seen involves something breaking.

We as creationists have the upper hand here. If we treat this properly, we can score a great victory in our long war for truth. The genome is not what evolution expected. The examples of mutations we have are not of the types required for evolution to advance. Evolution has to explain how the four-dimensional genome, with multiple overlapping codes and chock full of meta-information, came about. Can a mutation create new information? Perhaps, but only in the most limited sense. Can it create the kind of information needed to produce a genome? Absolutely not!

Acknowledgments

I must thank Don Batten, Jonathan Sarfati, and three anonymous reviewers for critical comments on this manuscript. This was very much a team effort as the ideas were distilled through years of interaction among my creationist colleagues, many of whose contributions were not mentioned due to lack of space, not due to lack of merit. I am afraid I did not do justice to those who have gone before me.

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Robert Carter received his Bachelor of Science in Applied Biology from the Georgia Institute of Technology in 1992 and his Ph.D. in Coral Reef Ecology from the University of Miami in 2003. He has studied the genetics of fluorescent proteins in corals and sea anemones and holds one patent on a particular fluorescent protein gene. His current research involves looking for genetic patterns in the human genome and the development of a biblical model of human genetic history. He works as a speaker and scientist at CMI-US.