Inheritance of biological information—part II: redefining the 'information challenge'

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The 'information challenge' (Where did the new information for 'goo to you' evolution come from?) raises lots of questions for creationists when viewed in the light of Gitt's multidimensional theory of information. It highlights God's purpose in creation but also our ignorance of biology. Creationists need to develop a new attitude towards biological information, and develop new tools for discovering its multiple levels of meaning. Despite this challenge, however, the Gitt theory provides a stunning confirmation of a creationist position because the true nature of biological information rules out a chance origin and requires intelligent design.

In Part I of this article I pointed out that information is conventionally treated as a one-dimensional *statistical* entity, but creationist Werner Gitt has shown that information is a five-dimensional *nominal* entity. By nominal we mean that information can be named (i.e. identified) but it cannot be explained in terms of matter or energy so it is a third fundamental component of the universe after matter and energy. Despite this revolutionary new understanding of information, creationists appear not have made any progress in applying it to biological problems. In this article, I use the Gitt theory to redefine the 'information challenge' that creationists have been bringing against evolutionists. And in a third article in this series, I will look at control of information transfer during inheritance in the context of the Gitt theory.

Darwinian treatment of biological information

Creationists commonly challenge evolutionists to explain how vast amounts of new information could be produced that would be required to turn a microbe into a microbiologist (or 'goo to you' and other catchy alliterations). We shall look at this challenge in detail shortly, but before we proceed, it is instructive to look at how leading Darwinists have handled the problem of information in their own worldview. They seem not to have dealt with it at all, and perhaps have deliberately ignored it.

No Darwinist appears to have developed a full theory of information—it took a creationist to do so. Indeed, a prominent cause of Darwinism's survival is that the *true* nature of information has *not* been properly understood (and perhaps even suppressed). One reason for this is that Darwinian evolution is a mechanical theory that was born in a mechanical age (the Industrial Revolution) and information theory only began in the mid-twentieth century. Darwin's theory is based on four main propositions:

1. organisms produce offspring that differ slightly from themselves;
2. they produce more offspring than survive to reproductive age;
3. there is a struggle for survival; and
4. those individuals most suited to their environment are naturally selected and they pass on their genes to future generations.

Although information is passed on in this process, no information is needed to drive it, just the 'blind forces' of nature. This has allowed Darwinists to occupy themselves with the 'blind forces' and to ignore the true nature of information.

Lets look at some examples. In a review of evidence presented for evolution in ten biology textbooks,[1] the best example that addressed the 'information challenge' is the case of four-winged fruit flies being produced by mutation from two-winged fruit flies. But the extra wings arose from three mutations that *switched off* existing developmental processes. No new information was added. Nor was any new capability/functionality achieved—the extra wings were non-functional and the fly was a cripple.

One of the most authoritative works in print at present on evolutionary theory is the late Stephen Jay Gould's 1,433-page *The Structure of Evolutionary Theory.* After a lifetime of challenging Darwinian gradualism and its adaptationist story-telling, Gould's *opus magnum* reveals that the foundation of all evolutionary theory is still natural selection.[2] Everything that has happened since Darwin, has served to change the downstream details that flow from natural selection, but nothing has displaced natural selection from the foundation. While he does use genetic arguments when they suit his purpose, not one of the 348 headings in his table of contents deals directly with subjects like information, genetic code or DNA, nor do these words appear amongst the 2,600 items in the Index. At no point does he formulate evolution as an information-creating process.

Darwinian philosopher of science Michael Ruse also recently addressed the issue of design in biology.[3] He, like Gould, covered the history of biological thinking in great detail, but failed to even mention the subject of biological information.

When asked by creationists if he knew of any biological

Figure 1. *The late Stephen Jay Gould used Scilla's coral as an icon to illustrate the structure of Darwinian theory. The trunk represents natural selection.*

process that could increase the information content of a genome, Oxford Professor Richard Dawkins could not answer the question.[4] He later wrote an essay on the subject titled *The Information Challenge*[5] but even in the essay he could not give a single example of a mutation that could increase the information content of a genome. This is not surprising, for both Gitt[6] and Dembski[7] have independently shown that no naturalistic process can produce new information. Gitt has also pointed out that information is a non-material entity, which further elucidates why naturalistic material processes cannot create it. This theorem has the status of a natural law that Dembski calls the 'Law of Conservation of Information'. It states that naturalistic processes can use, transfer or degrade information, but they cannot create it. Information only comes from information, and ultimately from an intelligent source.

Dawkins' failure to have any answer at all when first questioned on the subject illustrates that his information analysis, as published in his essay, is completely uninformative. He based his analysis on the Shannon theory, which deals only with the statistics of information systems. This theory defines information as a numerical property calculated from the number of ways in which the system can be configured. In this concept, a random string of letters can have more 'information' than a meaningful sentence.

Evolutionary physicist Hubert Yockey has been investigating the role of information in biology for many years. He has not been able to progress beyond the Shannon theory, but he does appear to recognize the impossible barriers that information poses to the naturalistic origin of life. He has come up with a quasi-solution that it is undoubtedly a matter of chemistry, but the actual mechanism may be beyond the scope of human reason to grasp. He writes,

> 'There is nothing in the physico-chemical world that remotely resembles [the genetic code]. The existence of a genome and the genetic code divides living organisms from non-living matter. … [Neils] Bohr argued that life is *consistent* with but *undecidable* by human reasoning from physics and chemistry.'[8]

Which, interpreted, means they have no idea how the genetic code could arise spontaneously from non-living chemicals.

Evolutionary quantum chemist John Avery has recently published a book on 'Information theory and evolution' which summarises quite well how evolutionists misinterpret and misrepresent the evidence on information.[9] Avery defines information in terms of Shannon's theory, and points out that 'thermodynamic information' is coming to us continually in photons from the Sun, and he attributes the origin of life to this source (p. ix). He then 'explains' that it is only 'Gibbs free energy' (a favourable energy balance between reaction terms in chemistry) that can drive a chemical reaction, and 'life maintains itself and evolves by feeding on Gibbs free energy' (p. 174). The implication (for the unwary reader) is that 'information' in sunlight can explain the information in living organisms and the information needed for evolution from microbe to man.

However, in chapter 5 he admits that there is a difference between thermodynamic and cybernetic information (although he does not say what the difference is). Cybernetics is the field of communication and control in machines and living organisms. So Avery's admission means that the information in sunlight *cannot* explain the information in intelligently designed machines and living organisms. Indeed, the full sentence quoted above is:

> 'Life maintains itself and evolves by feeding on Gibbs free energy, that is to say, by feeding on the enormous improbability of the initial conditions of the universe.'

In admitting that the 'initial conditions of the universe' were 'enormously improbable' he is inadvertently admitting that it was intricately designed, because 'enormously improbable' events don't happen by chance. The evidence for special creation is right there in front of him but he cannot (or will not) see it.

The information challenge

When viewed in the light of the multidimensional nature of information, the 'information challenge' that creationists commonly throw up to evolutionists, is not at

all straightforward for *anyone* to answer. At its simplest level, the information challenge can be stated in two parts as follows:

1. The human genome is much larger and contains more genes than that of a microbe.
2. What naturalistic mechanism does an evolutionist have to explain the increase in information content from microbe to man?

This seems to be a reasonable well-formulated question, but is it really? Consider the following facts. The genome of the Anthrax bacterium *Bacillus anthracis* contains about 5 million base pairs while the human genome contains about 3 billion base pairs. Thus, at a statistical level, it seems to take almost a thousand times more information to make the human. This kind of analysis seems to be confirmed when we look at an intermediate-scale organism such as rice (*Oryza sativa*) the genome of which contains an intermediate value of 466 million base pairs.

However, the reasoning starts to fall apart when we look at genes rather than base pairs. The bacterium contains about 5,500 genes, but humans have only 20 to 25 thousand genes.[10] Surely humans are more than four times more complex than bacteria! Furthermore, the rice plant has an estimated 46,022 to 55,615 genes,[11] so it appears to take *more* genetic information to make grass (rice belongs to the grass family) than it does to make a human! Suggested solutions to this paradox lie in two main areas. On the one hand, perhaps the rice genome is heavily redundant and contains a lot of repeated information. On the other hand, human genes (and probably rice genes as well) can be read in different ways (a process called 'alternative splicing') and edited in different ways to produce numerous different products from the same gene.[12] Also, humans, and others of the more complex eukaryotes, have a huge amount of DNA that does not code for proteins. What this does is only slowly starting to be discovered. A recent paper implicated quite a bit of it in regulating embryo development in mice.[13] Whatever the final resolution to this apparent contradiction, however, it illustrates that our ignorance still far outweighs our knowledge in these areas and we need to be careful.

Human gender provides us with another challenging example. The X and Y chromosomes determine gender. XX yields a female, and XY yields a male. Now the Y chromosome (with about 50 million base pairs) is only one-third the size of the X chromosome (with about 150 million base pairs), but it contains a mosaic of 'maleness' genes that are not present in the X chromosome.[14] So, does it take more, or less, information to make a male than a female?

From the point of view of statistics (total amount of DNA code), it takes about 100 million base pairs *less* to make a male than it does to make a female. However, if we go the extra step up the information ladder and look at genes, we come to the *opposite* conclusion, that it takes *more* genes to make a male than it does to make a female.

Let us now see what happens when we take semantics, syntax, pragmatics and apobetics into account (Gitt information theory—see part I, p. 29).

Since the X chromosome is always present (in healthy individuals), the default configuration is XX. Both male and female components occur in every embryo, but the XX chromosome combination will cause them to develop into a female. Only when the Y chromosome is present do the embryonic structures develop into a male. The XX pair of chromosomes are duplicates (one from the father, one from the mother) that may contain different copies of comparable genes (alleles). but they will carry essentially the same amount of total (statistical) information. From a *semantic* point of view, X means female and Y means male (with the implied condition that a complementary X is always present).

In regard to *syntax*, the X chromosome has regions associated with more than 100 genetic disorders, while the Y chromosome is involved in only two disorders. Therefore, correct syntax in the X chromosome appears to be far more important than in the Y chromosome. Alternatively, the Y chromosome may be much less prone to mutations, due to the palindromic error-correction system that seems to operate in much of the sequence.[14] Lack of variation in the Y-chromosome sequences has surprised researchers.[15]

In regard to *pragmatics*, the previously mentioned statistics illustrate that the X chromosome has enormous practical importance in constructing a healthy child of either sex. Male diseases such as prostate cancer and male breast cancer result from defects on the X chromosome, while it is clear that the *SRY* gene complex on the Y chromosome is crucial in developing male gonads, hormones and other sexual characteristics.

And what about *apobetics*? What was the Creator's purpose in gender differences and sexual reproduction? This is a great enigma in evolutionary biology, because the enormous investment in sex that organisms have to make (the peacock tail is an extreme example), coupled with the dilution of an individual's genes by 50% in the mating process, would surely cause natural selection to weed out such inefficiencies—or at least natural selection would not permit mutations to invent it (if it were possible) in an asexual organism. While some advantage comes from added variation in cross-fertilization and getting rid of some deleterious mutations, the advantage is not likely to exceed the 50% loss incurred in meiosis and the halving of the number of reproducers. In a number of cases, asexual species appear to be just as successful as congeneric sexual species.

Given that there *is* a purpose in sex, however, that purpose finds its expression in the embryological implementation of the genetic blueprint. Since the purpose is to produce humans of two kinds, then from an apobetic point of view the two kinds are entirely equivalent. So the apobetic answer is 'No, there is no more information required to make a male than a female.' The information is simply packaged and dispensed in such a way that one combination

(XX) produces a female and the other combination (XY) produces a male. This is remarkably consonant with the description we find in Genesis 1:26–27

> 'Then God said, "Let us make man in our image, in our likeness, and let them rule over the fish of the sea and the birds of the air, over the livestock, over all the earth, and over all the creatures that move along the ground." So God created man in his own image, in the image of God he created him; male and female he created them.'

God's single intention (to make man) resulted in two sexes.

God's purpose in creation

The crucial role of apobetics in information structures has some profound and wide-ranging implications, especially when we look at God's overall purpose in creation.

We have so far assumed that God had numerous different purposes in mind when He created the many different kinds of creatures, but this is not so. The Bible tells us that God has an overall unified purpose in creation. We could express this in various ways, but perhaps one way is to look at Jesus' claim, 'I am the Alpha and the Omega, the First and the Last, the Beginning and the End' (Revelation 22:13). In Christ, the Creator has expressed his eternal power and divine nature in what has been made (Romans 1:20). Furthermore, all things are held together by His word of power (Hebrews 1:3) and all things are being brought together under one head, even Christ (Ephesians 1:10). One intention therefore points to a single informational structure, of which the myriad creatures are but parts.

Could it be, then, that God's intention to make man is one with His intention to make microbes? If it is, then perhaps just as human males and females result from a single information structure, so do the microbes. We can perhaps see this in the ecology of the Earth. Man could not live alone on planet Earth. The microbes carry out essential tasks such as breaking down waste products and recycling nutrients. Without them we would drown in refuse and leaf litter while starving from malnutrition. And other organisms carry out equally important tasks that all contribute to the whole—a unique world where man can live. Nowhere else in the universe (that we know of) is like planet Earth.

Since (at this stage in human history) only God can make microbes and only God can make humans, perhaps it actually takes the *same* amount of information to make a bacterium as it does to make a human. That 'same amount of information' is the Creator Himself!

Going one step further along this line of argument, God's purpose that organisms reproduce 'after their kind' has not changed. Should we therefore say that *no biological change whatever* involves a change of information content? This apparently absurd conclusion is not meant to be a *reductio ad absurdum* argument. It merely highlights the multidimensional nature of information.

The information content of the biosphere (i.e. biologically unique baramin-level information) was fixed at the beginning by the Creator at the apobetic level. No new baramins have since been created, but many have become extinct, so the overall amount of biologically unique information in the biosphere has decreased, not increased. The 'information challenge' then reduces to the question 'Can new biological information arise at other levels?' To answer this question, we need to go beyond the Mendelian paradigm and discover a more comprehensive understanding of how information is stored, used and inherited in cells.

Semiotics—the new science of signs

As pointed out in Part I, the enormous gap between the true nature of information and that which is passed off as 'information' in our colleges and universities has not gone unnoticed. Workers on this problem in many different fields have recently discovered one another and have come together under the heading of 'semiotics'.[16] Semiotics is the study of signs, meaning and communication. The basic concept is the 'semiotic triad'—a *sign* represents an *object* that has some significance to an *interpreter*. In genetics, the codon is the sign, the amino acid that it represents is the object, and the interpreter is the cell mechanism that implements the genetic instructions.

This very simple recognition of what actually goes on in cells (as opposed to the Darwinian phylogenetic treatment of genomes merely as strings of symbols that are compared statistically) has created a minefield of controversy. One reason for the controversy is that the relation between the sign and object is arbitrary and cannot be explained in terms of the laws of physics. Thus, information is revealed to be a fundamental entity in its own right, not reducible to matter, energy or the forces that govern them. This principle is the first of Werner Gitt's thirty theorems on information,[17] and has been recognized by pioneer in biosemiotics Marcello Barbieri,[18] who therefore classed information as *nominable* (that is, it can be named) alongside the more familiar *quantitative* and *qualitative* entities of physics.

Another reason for controversy is that the relation between the sign and the object is entirely dependent upon the context, and is independent of the nature of the sign or the object. A sign in one context might signify something entirely different in another context. This leads to the conclusion that the cell is the unique and crucial context for the meaning of genes, which appears to contradict Dawkins' notion of the 'selfish gene'. It also contradicts the notion that cellular life could arise from something other than cellular life (e.g. chemical evolution). Yet another reason for controversy is that the need for an 'interpreter' highlights the concept of 'mind' as something distinct from matter. Materialists vigorously dispute such conclusions, but they have offered no viable alternative explanations.

A pioneering book (published on-line) in this field is *The Organic Codes: the birth of semantic biology*, by Marcello

Barbieri, founder and president of the Italian Association for Theoretical Biology.[19] Barbieri cites Karl Popper and René Thom among his mentors, and he quotes the former as saying his semantic theory is 'revolutionary'. While Barbieri is a committed evolutionist, his theory appears to be wide open to creationist interpretations.

For example, his theory of semantic evolution says:

> 'The origin and the evolution of life took place by natural selection and by natural conventions. The great events of macroevolution have always been associated with the appearance of new organic codes' (p. 227).

By 'organic codes' he means the protocols or conventions that exist within cells for reconstructing organisms from their originating cells, and these include things like the genetic code, the translation code, the splicing code, the patterning codes and (in humans) the linguistic code. His definition of the origin of an organic code is a gift to creationists:

> 'The origin of an organic code is the appearance of a complete set of rules, because when that happens it also appears something totally new in nature, something that did not exist before' (p. 225).

Creationists merely have to point out the irreducible complexity of the semiotic triad and the best explanation of 'evolution' (the origin of biological complexity) becomes special creation.

In explaining why others have not uncovered what he calls the 'organic codes' he says that

> 'They can be discovered only if we are looking for them, and we can look for them only if we believe that they can exist. In order to build a semantic biology, therefore, the first step is a new mental attitude towards nature, even if this will probably be possible only with a new generation of molecular biologists' (p. 233).

One of the great challenges of 'semantic biology' is to find a way of treating 'meaning' in a quantitative way. Barbieri points out that the study of linguistics is producing a theory of *group* properties that may be relevant to biosemiotics (pp. 230–232). This again has creationist implications because the 'universal grammar' of human language is built-in at birth, and becomes particularised only when the child learns an actual language (p. 217). Research into artificial intelligence faces the same challenge of quantifying meaning. Recent use of the Internet is relevant here. The meaning of a word can be thought of as a point in the multidimensional space of all word meanings, and the relationship between any word and any other word can be gauged by putting each pair of words into a *Google* search on the internet. Word pairs for which *Google* returns a large number of hits are clearly more closely related than word pairs for which it only returns a small number of hits. Thus a quantitative measure of meaning emerges as a statistical association between words of related meaning.[20]

As outlined in Part I, the centrepiece of Barbieri's theory is a model of development as a process of *reconstructing* the adult organism from an *incomplete set of information* (i.e. that in the zygote). He believes this is achieved by the zygote using one or more *memories* ancillary to the chromosomes (genes are just one kind of memory) that

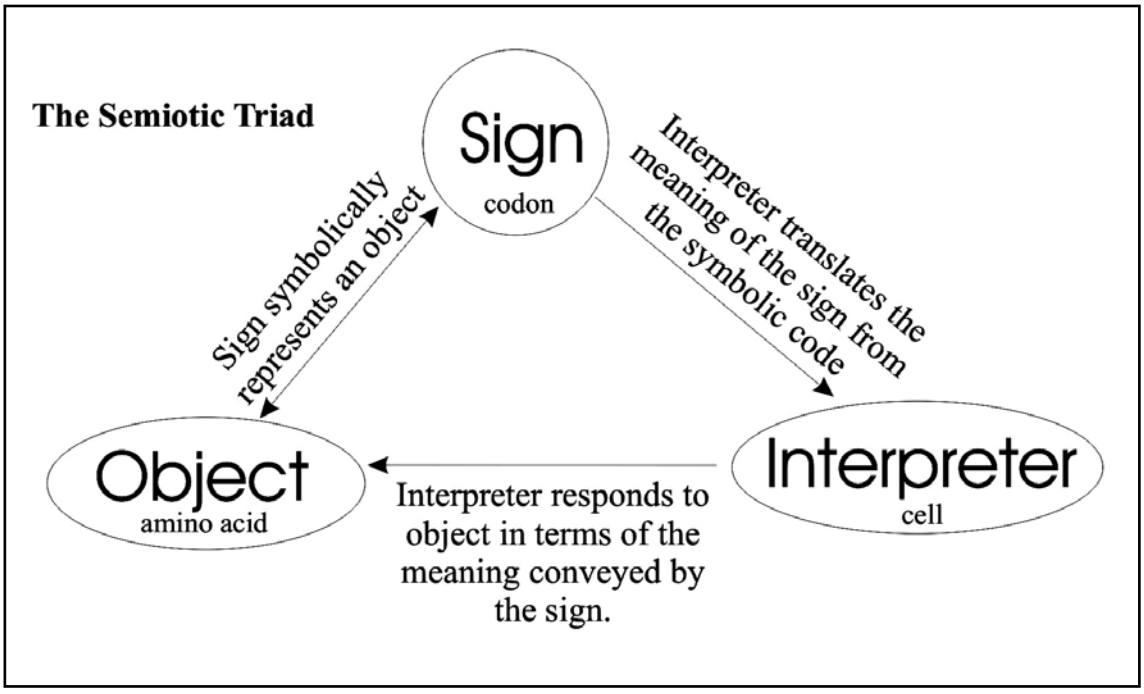

Figure 2. *The semiotic triad. In genetics, the amino acid is the object that is symbolically represented by the codon, which the cell interprets via the translation mechanism (the ribosome).*

are each linked to development by an associated *code* (the genetic code is just one kind of code). Differentiation is one of several examples that he gives. When a cell differentiates in the embryo it retains its identity throughout the life of the organism, so there must be a memory of this lodged somewhere, together with a code that ensures the cellular repair mechanisms always maintain this identity. While the model still requires extensive investigation and validation, it provides creationists with a much more information-rich template to build upon than the naïve Mendelian model. It also makes testable predictions that we can possibly join with biblical starting assumptions.

Conclusion

The expectation of those that have used the 'information challenge' seems to have been that evolutionists cannot answer it, but creationists can. There is certainly a huge information problem for evolutionists, but when it comes to a rigorous definition of biological information, creationists have a lot of work to do. In particular, when we try to formulate the question in terms of Gitt's 5-dimensional theory of information, we encounter vast gaps in our knowledge of the way that cells store, use and pass on biological information. Clearly, a lot more theoretical and experimental work is required. However, defining information in terms of apobetics (purpose), which even the new secular field of semiotics does, seems to provide a stunning confirmation of creationist thinking—because the true nature of biological information rules out a chance origin and requires intelligent design. In Part III of this article (to appear in a future issue of *TJ*), I will use the Gitt theory as a framework for understanding the experimental evidences for the control of information transfer and change in biology.

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