"A LAW OF BIOLOGICAL CONSERVATION"

IAN MCDOWELL*

A "Law of Biological Conservation" is developed in the context of the well-known Laws of Thermodynamics. It is asserted in this Law that the total information implicit in all living creatures at a given instant cannot exceed the total information coded upon all the genes of all their cells. As a corollary of such a law, it becomes obvious that creation requires a Creator because the information implicit in these living beings today cannot exceed the total amount of information of all kinds which was required to specify the whole of the original creation. Evolutionists should face this issue and consider its implications.

Introduction

One form of the First Law of Thermodynamics is the Law of Conservation of Energy, which states that the total energy within a closed system remains constant. In other words, energy cannot be created or destroyed, though it may be changed from one form into another.

Energy is the quantitative measure of the capacity to do work. A closed system is one into which no energy enters from or escapes to the outside.

Energy takes many forms, e.g. mechanical (a battering-ram in action), chemical (petrol), heat (the heat of the sun).

Energy still exists undiminished after doing work, but is less available to do further work. Heat energy within a closed system at a uniform temperature is not available within that system at all. The system has suffered a "heat death."

This gives rise to the Second Law of Thermodynamics, which states that all changes in the form of the energy within a closed system must increase the entropy of that system. Entropy measures quantitatively the non-availability of energy to do further work. It measures the disorder of the system in the sense that when energy levels vary greatly, energy is more available to do work than when such levels draw together as work is done.

This paper extends thermodynamic concepts via the information theory of the communications engineer to the realm of biology, leading to a "Law of Biological Conservation" and some corollaries.

Order and Disorder

Thermodynamic entropy has to do with the availability of energy in a closed system for doing work, but we may apply the concept in other ways.

Consider a pack of playing cards. Begin by arranging the 52 cards in order of suits and values. Define this arrangement arbitrarily as the most orderly one. Shuffle the pack—this destroys the order, though plenty of traces of it remain. As shuffling continues the order of cards in the pack becomes more "random" in relation to the original order, i.e. the "entropy" of this system increases.

To find that the initial order suddenly recurred would surprise us, and we would prefer to believe that somebody who knew of our most orderly arrangement had intervened to rearrange the pack. This being so, we would expect some relationship to exist between the knowledge (or information) he possessed, and the order, or non-randomness, or decrease in entropy in this different sense, which he introduced.

The Measurement of Information Content

The concept of order in a transmitted message, such as a telephone conversation or a television transmission, becomes important to the communications engineer. He has the task to compress the maximum amount of information upon the frequency band width of the available communications channel by eliminating as much redundant (repeated in some way) material as possible.

Spoken or written English is highly redundant in this sense, i.e. any given sentence contains many more characters or sounds than it needs to convey its essential message. So the communications engineer prefers to "code" the message in such a way as to eliminate redundant material. He may reduce sounds or shorten words, but today various sophisticated electronic coding techniques are available to him as well.

The point of special interest is that the formula for the amount of information actually contained in a given message using symbols x where the probability of any symbol occurring in normal usage is P(x), is:

$$H(x) = -\sum_{x} P(x).\log_2 P(x)$$

which resembles closely the usual entropy formula of thermodynamics.

Since, with electrical circuitry or human physiology, we are faced continually with bi-stable elements (on or off), it is convenient to work in logarithms to base two. In this case the practical unit of information is the binary digit, or "bit."

Consider a closed vessel of gas. The gas quickly takes up an equilibrium in which its

*Professor Ian McDowell is Principal, Emmaus Bible School, Epping, New South Wales, Australia, 2121.

pressure and temperature are constant throughout. The entropy and disorder of the system are at a maximum, and this, by the Second Law of Thermodynamics, is irreversible.

Suppose, however, we stationed a "Maxwell demon" at a little door in the side of the vessel, with instructions to let molecules of gas of a certain velocity range through into another compartment. He would, by this sorting process, make them available to do work and decrease the thermodynamic entropy of the system of which he was himself a part. We will return to this system later.

Theoretical investigation of mono-molecular engines has shown that the relationship between information and thermodynamic entropy is: one binary digit is equivalent to approx. 2×10^{-16} erg/degree Cent. (This relationship occurs in mimeographed lecture notes issued to the writer during a course on information theory fourteen years ago).

Information has been called "comentropy" for the sake of the comparison, though it is opposite in sign from thermodynamic entropy. This means that if a message corrupts, its comentropy decreases. This equivalence gives the first lead to a "Law of Biological Conservation."

Chromosomes, the D.N.A. Molecule and Genes

Biological life begins with a division of a single cell into two identical cells, or with a fusion of male and female cells in such a way that each contributes exactly half the necessary number of chromosomes to the new individual. Cellular division under the control of the chromosomes follows, and the new individual forms.

The elements of a chromosome are its genes, and each human chromosome might possess some twenty thousand of them. The genes determine the genetic characteristics of the new individual by control, at the molecular level, of its development. The number of possible combinations of characteristics is so vast that the possibility of two identical individuals occurring is remote.

Each gene includes a very large and complex molecule called D.N.A., which has the characteristic that it divides along its entire length (like a zip fastener), at the same time picking up components from its environment in a way which duplicates exactly the original molecule, leaving virtually no scope for change, normally.

We have only begun to "crack" the genetic code. Nonetheless it is certain that a single cell which has a part in biological reproduction contains an enormous amount of information. This might be measured if we knew how to do it.

Since genes are transmitted to new generations in different combinations *but without change* from those of the parent, it follows that all genes which presently exist have always existed, unless something changed them while they were carried by the parent. This fact gives the second lead to a "Law of Biological Conservation."

Energy, Entropy and "Evolution" of Life

Every living cell contains the individual's D.N.A. "master tapes" and produces from them, R.N.A. "working tapes" which in turn "program" some 15,000 ribosome "factories" to manufacture, on a sort of "assembly line," the protein and amino-acid components of a growing creature. The slightest change in the D.N.A. "master tape" effectively destroys the component it specifies, just as a mistake in a computer program produces nonsense at the output stage.

Irradiation (e.g. by atomic particles or by X-rays) and a relatively tiny number of D.N.A. duplication mistakes destroy a few individual genes permanently. Such changes, called *mutations*, may be transmitted to subsequent generations. It is thought possible, for example, that each human individual carries one mutated gene not present in its parents, though it does not necessarily pass on this mutated gene to its offspring. Mutation reduces comentropy by corrupting the D.N.A. message, i.e. it decreases the information coded upon the chromosomes. It simplifies, but cannot improve the chromosome.

Some people feel that, given vast opportunity for mutations to occur, occasionally chromosomes *must* be improved, on the assumption that a legion of monkeys playing with typewriters for a very long time *must* type out all Shakespeare's sonnets correctly . . . but this is *not so.* In practice, such achievement would simply never happen.

Thus mutation is not a satisfactory mechanism with which to support a theory of the evolution of life from "simple" to "complex" forms. Any living creature is incredibly complex, and man is the most complex of all. To describe a man fully (i.e. to the extent that he might be precisely duplicated, if only by the description) would require an enormous amount of information in "bits" of any man-made code.

Nonetheless, since life began on our planet, more than a million species have populated it extensively, transforming less organized food into highly organized biological components. All this is *contrary to what we have come to expect from our extension of the Second Law of Thermodynamics* if we look upon it as a chance process, This contradiction is cited commonly to be opposed to the theory of evolution of life from disorder to order. Order cannot arise spontaneously from disorder.

Knowledge

The human race possesses extensive ability to obtain and store scientific knowledge, and to use that knowledge to modify the natural environment from a state of comparative disorder to a state of comparative order.

Yet man, for all his growing knowledge, cannot yet reverse the Second Law of Thermodynamics in its strictly thermodynamic form. He cannot use his knowledge to sort out the hotter molecules of a vessel of gas and put them to work. But the writer cannot prove that he will not be able to do it eventually.

Nonetheless man can, and does, increase the comentropy of his environment. This also, at first sight, is contrary to what we have come to expect from our extension of the Second Law.

A "Law of Biological Conservation"

Will the increasing numbers, ability, complexity and knowledge of our human race lead to the overthrow of the Second Law of Thermodynamics? The writer frames the following "Law of Biological Conservation" and its corollaries to rationalize the whole position.

The Law:

The total information implicit in all the bodies (excluding the total information coded upon the genes which they carry) of all creatures which are alive upon our planet at any given instant, cannot exceed the total information coded upon all the genes which they carry.

"Information" here means information in the sense used in this paper, measured quantitatively and expressed in units of comentropy.

"Bodies" includes brains, and the total information includes the measure of instinctive knowledge handed down biologically, but excludes knowledge gained from the environment subsequent to birth.

In practice, the total information implicit in the bodies excluding the genes, will be very much less than the total information coded upon the genes. It would take a very long time for the human race to produce all the individuals made possible by its total gene reserves.

Corollary No. 1:

The total information implicit in all the bodies (including the total information coded upon the genes which they carry) of all creatures which have lived since the original creation, live now, or ever will live upon our planet, cannot exceed the total information coded upon all the genes of all the creatures which came into being at the original creation.

The information loss is by destructive mutation, or by extinction of a gene through the death of its last carrier.

Corollary No. 2:

The total information implicit in all the knowledge added to all the brains of all living beings plus the total information implicit in all the order brought into being in their environments through the use of that knowledge, cannot exceed the total amount of information of all kinds which was required to specify the whole of the original creation.

This is a "Law of Conservation of Knowledge" comparable to and here linked with a "Law of Biological Conservation."

Creation Requires a Creator

Since vast amounts of information cannot arise out of nothing, rational laws in the scope of this paper require a starting point, which can be described objectively only for what it is—a creation. It follows uniquely that a Creator outside our closed system necessarily created it.

This is, of course, what the Bible tells us in any case: "In the beginning God created the heaven and the earth" (Genesis 1:1); "God created . . . every living creature that moveth" (Genesis 1:21); "God created man in his own image" (Genesis 1:27).

In addition, we would expect that the "Law of Biological Conservation" applies also to small sub-groups of the total biological creation. Wide variation may occur within sub-groups by selection from combinations of many, different available genes, but not from outside them.

Variation cannot increase the total information. Unlike mutation, variation is reversible by subsequent generations. The Bible says all this quite simply: "Let the earth bring forth the living creature after his kind" (Genesis 1:24).

The Creator may, of course, add knowledge to the system subsequent to creation. We call this special revelation, find it in the Bible, and notice that it is centered upon the Person of our Lord Jesus Christ. All knowledge is a re-thinking of the thoughts of our Creator, God.

Conclusion

The findings of this paper are exactly opposite to what a person who has studied only the theory of evolution of life would expect. Any such person who reads this paper should face and consider its implications.

If, as the writer has attempted to show, special creation is the only conceivable alternative to evolution and the "Law of Biological Conservation" herein expressed is true, had we not better look more closely at the practical implications of special creation?