

Creation Research Society Quarterly

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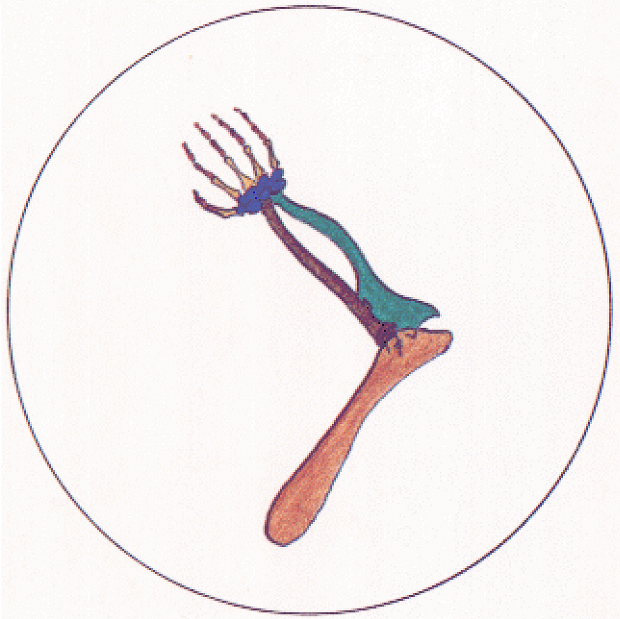
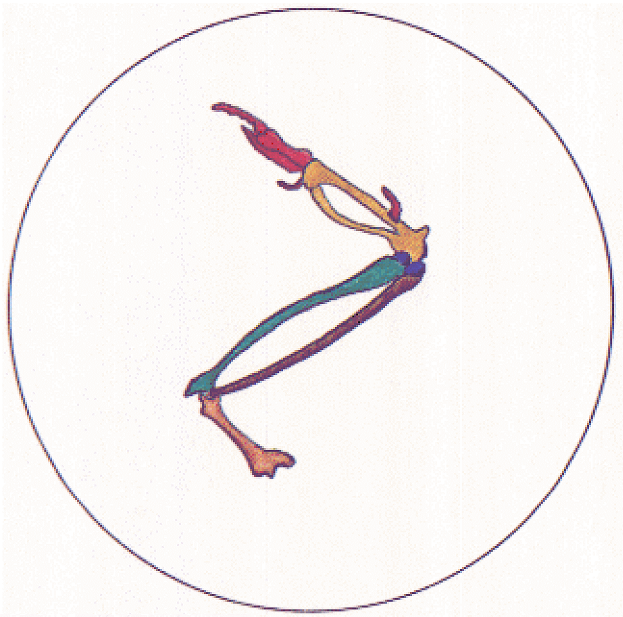
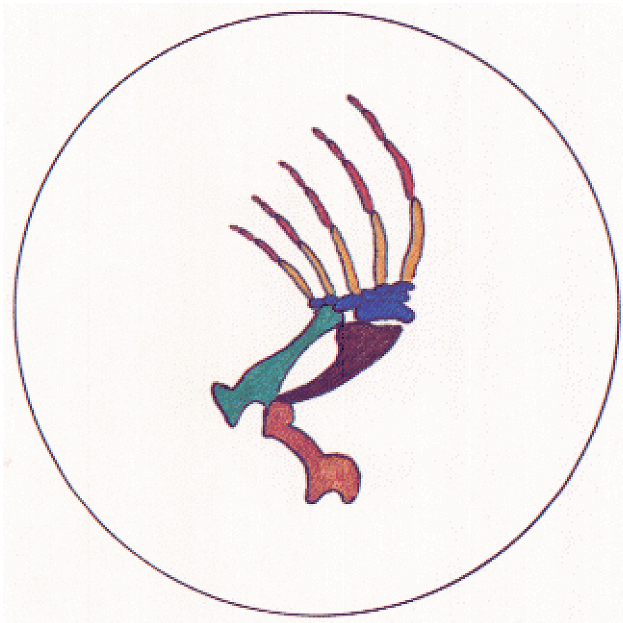
For in six days the Lord made heaven and earth, the sea, and all that in them is and rested on the seventh. - Exodus 20:11

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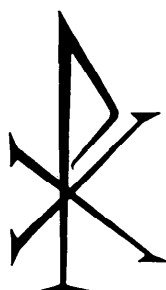
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COVER ILLUSTRATION

The picture on the cover of this issue of the *Quarterly* shows the bony structure of the fore-limbs of three vertebrates: upper left: a seal's flipper; upper right: a bird's wing; and lower: a man's arm. The resemblance is apparent.

(It is not suggested, of course, that the bones are coloured. The colours are just a way of distinguishing the various bones and parts.)

This similarity in the structure of limbs is discussed in the article *The Pentadactyl Plan*, elsewhere in this issue of the *Quarterly*. The similarity is evidence, not, as is sometimes alleged, for descent, but rather for design, by the Master Designer.

This picture was drawn by Mr. Paul Stanton, at the request of Mr. Colin Brown. Mr. Brown attended to getting it for the *Quarterly*. Mr. R. Meyers, of Queen's University, helped with the lettering on the picture; and he also helped similarly with the picture on the front of the *Quarterly* for June, 1982.

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ELECTION RESULTS

In the annual election, held earlier this year, 179 ballots were cast. The following persons were elected to the Board of Directors for a term of three years, 1983-1986.

Harold Armstrong
Thomas G. Barnes
David R. Boylan
Duane T. Gish
Emmett Williams, Jr.
Paul A. Zimmerman

The following person was elected for a term of two years, to fill a place left vacant by a resignation.
Glen W. Wolfrom

THE PENTADACTYL PLAN

COLIN BROWN*

Received 28 July, 1982, revised from 18 May, 1982

The pentadactyl plan of limb, the arrangement of limb with digits as we know it, is, as everyone knows, the regular thing among vertebrates. Evolutionists have maintained that this widespread use of the plan is evidence of a descent from a common ancestor. In this article it is shown that the plan is rather evidence of design. By consideration of many hypothetical alternate plans, it is shown that the arrangement actually found is by far the most satisfactory; and good design consists precisely of making a thing satisfactory for its purpose.

The pentadactyl plan of limb has often been cited by evolutionists as evidence of evolution through descent from a common ancestor. Having said this some go on to suggest that the plan could be bettered. Others state that it does an excellent job, and do not know whether it could be improved.

Creationists, on the other hand, have often said, with no further explanation, that the pentadactyl arrangement is a plan designed by God. Of course, that is true; but one may inquire further, whether God's design is purely arbitrary, or whether He has met the requirements for such a limb in a way not entirely unlike what a human designer or engineer might do.

In contemplating a design, it is good to keep two points in mind: "What are the materials, or components?" and: "What alternatives are there?" Let us, then, consider especially the second question. Some of the alternatives considered may be a bit far-fetched; but in design work it sometimes turns out that a seemingly far-fetched design is precisely what is needed. We need to look at the various aspects of the pentadactyl plan: variation within the plan, types of bone involved, and the mechanics of the plan itself.

Components: Types of Bone Used in the Plan

The pentadactyl limb is made up of the following. There are long bones in the arms and legs. (For definiteness, the plan as it appears in the human will be referred to.) The hands and feet are made up of "short and long bones" which are much like shorter versions of those in the arms and legs. Then, there are the joints. Also, of course, the muscles, without which the joints would be useless, should not be forgotten.

Variation Within the Plan

Variation within the plan can be seen in the various positions, proportions, and arrangements of the bones in the various organisms, all of which have limbs conforming to this basic plan. (It is not intended that any evolutionary significance be read into the use of the word "variation"; it is just noted that the plan is worked out in different ways in different creatures.)

Figure 1, for instance, shows the arrangement of bones in the flipper of a seal, the wing of a bird, and the arm of a man. It is apparent (and, of course, this is no new remark) that there is much resemblance.

Other examples of variation within a basic plan can readily be cited. For instance, consider the bones of a typical reptile and of a typical mammal. The bone cells are much larger in the mammals, having a much larger centre, surrounded by the Haversian canal. The

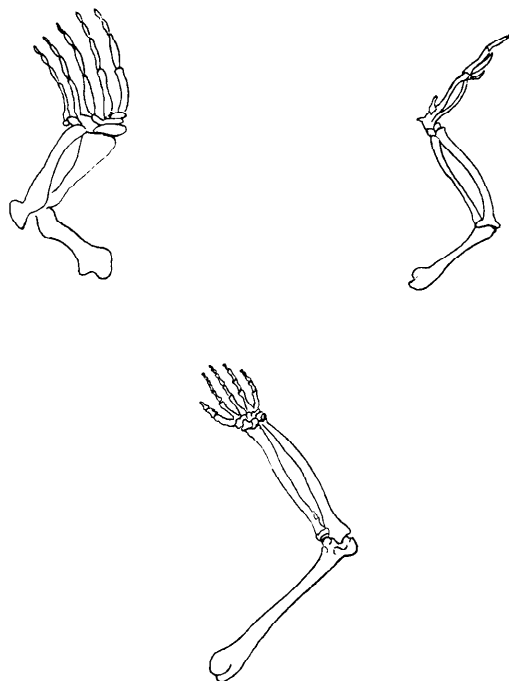


Figure 1. Variations of the limb. Upper left: seal's flipper; upper right: bird's wing; lower: man's arm. The similarity in design is apparent.

typical reptile has what looks like mere dots, a cross-section of bone giving a freckled appearance.

Again, the lower legs of birds have, on the bone, three articulating surfaces for the toes, a feature not found in mammals or reptiles. See Figure 2. It is worth noting, incidentally, that the archaeopteryx possessed this feature.

Some Hypothetical Alternate Models

Evolutionists cite the pentadactyl plan, common to so many creatures, as evidence of common descent; although it seems not to have been shown why, amid all the changes between amphibian and man, say, this particular feature should persist.

If, on the other hand, the plan is the best for the needs of these creatures, then it is evidence for design, rather than descent, or descent altered by random variations.

Consider, then, some of the hypothetical models suggested in Figure 3.

Model A has all long bones, with no joints. It has happened that people have been born in some such condition, having joints fused together. The only

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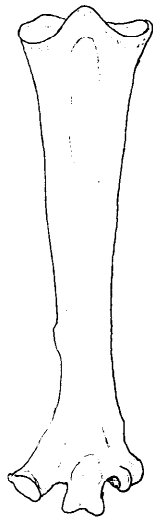


Figure 2. The lower leg-bone of a bird, showing the three articulating surfaces.

movement possible, then, would be that of the whole arm or leg; the hand or foot could not be moved separately. No one would argue that such a condition is desirable. Such a model, then, would be of no use.

Model B has joints in between the digits and in the wrist (or ankle), but no joint at the elbow (or knee). This model would be of no use.

Model C has no joint at the elbow or knee and none in the digits, although it does have a joint at the wrist or ankle. Neither would this model be of any use.

Model D has a joint at the elbow or knee and at the wrist or ankle, but none in the digits. It, too, would be of no use.

Model H is the basic plan for E, F, G, I, J, and K. Model E has two long bones and a section of "short long bones" with joints in between, a joint at the wrist or ankle and in the digits, but none at the elbow or knee.

Model F has joints at the elbow or knee, wrist and ankle, and down one side of the limb, as in model E; but it has no joints in the digits.

Model G has no joint at the wrist or ankle, but it does have joints in all other places.

The lack of joints in models E to G inclusive would render them useless; besides, we see more problems when we look at models I, J, and K.

At the back of our own leg there is a large muscle which leaves room for the knee joint to bend. In models I, J, and K, no matter where this large muscle might be placed, e.g. at the joint or above, problems arise. One side of the limb is rigid and the other has many "short long bones" with many joints. Even if the limb were to bend at all, these parts would press into the muscle and would thus hinder further movement.

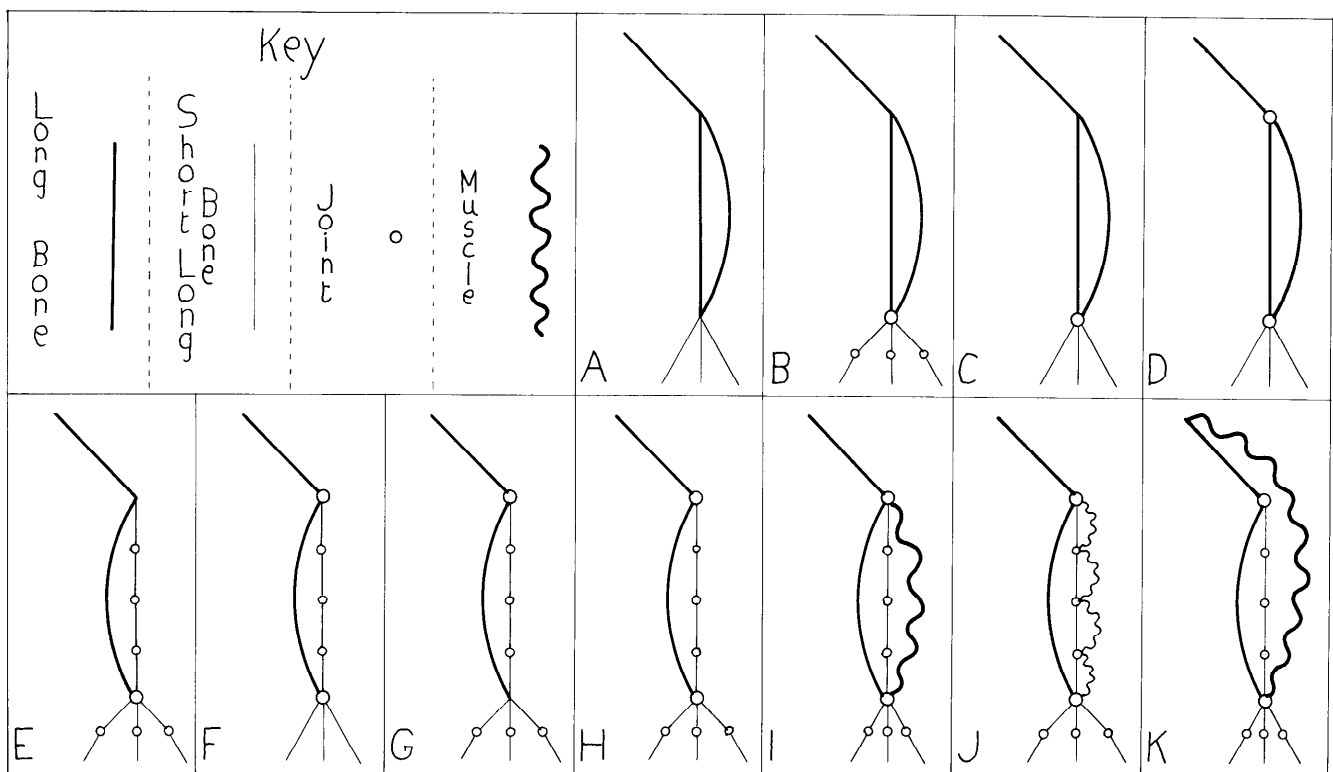


Figure 3. Some of the hypothetical limbs considered. Comments on them will be found in the text of the article.

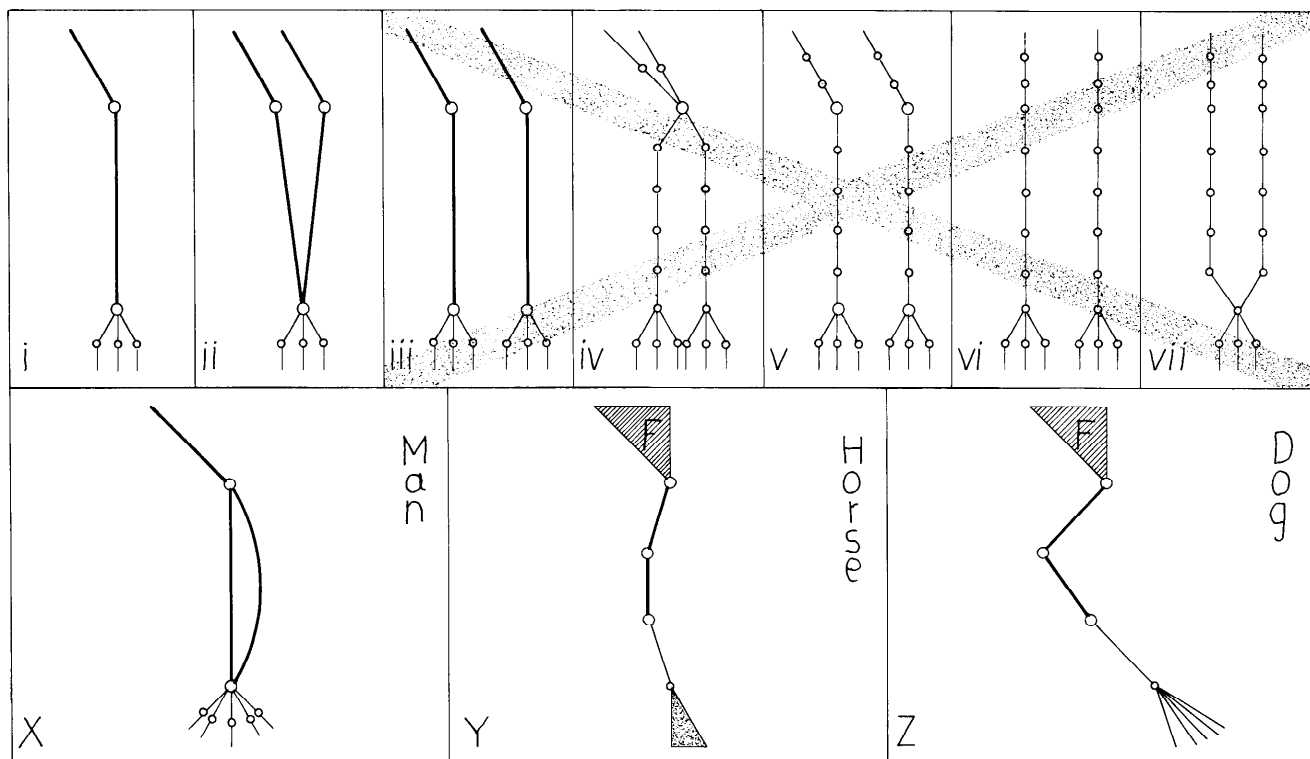


Figure 4. Parts i to vii, inclusive, show some more hypothetical limbs. Numbers iii to vii are shown crossed out (lightly) because they are so obviously unsuitable. Parts X, Y, and Z show arrangements which actually occur. The shaded triangle, marked "F," indicates a flat bone.

In model J, much smaller muscles are connected to the short long bones and between the joints. This limb would be far too weak to meet all the exigencies of life. Besides, the problems discussed for the other models would arise.

It is seen, then, that none of these hypothetical models discussed so far would be a suitable substitute for the pentadactyl model, let alone an improvement on it.

Now, let us go on to consider some of the hypothetical models suggested in Figure 4.

Models number iv, v, vi, and vii are all based on "short long bones," with a joint in between each two sections of bone. Number vii has no elbow or knee joint; and it is also lacking any sort of central joint.

This model is very clumsy and would most certainly not do.

Number vi is the same except for the novel wrist/ankle joint arrangement, there being two such joints, followed by two feet or hands. This model would also be very weak and clumsy.

Number v has a small double elbow or knee joint. This is still too weak and clumsy. Number iv, with one large elbow or knee joint, is no improvement.

These models, iv to vii inclusive, would have the same muscle fit as the models seen in Figure 3. All of them would be far too weak, and they could never meet all of the requirements of life. Number iii, likewise, would be, overall, too weak a model for every walk of life.

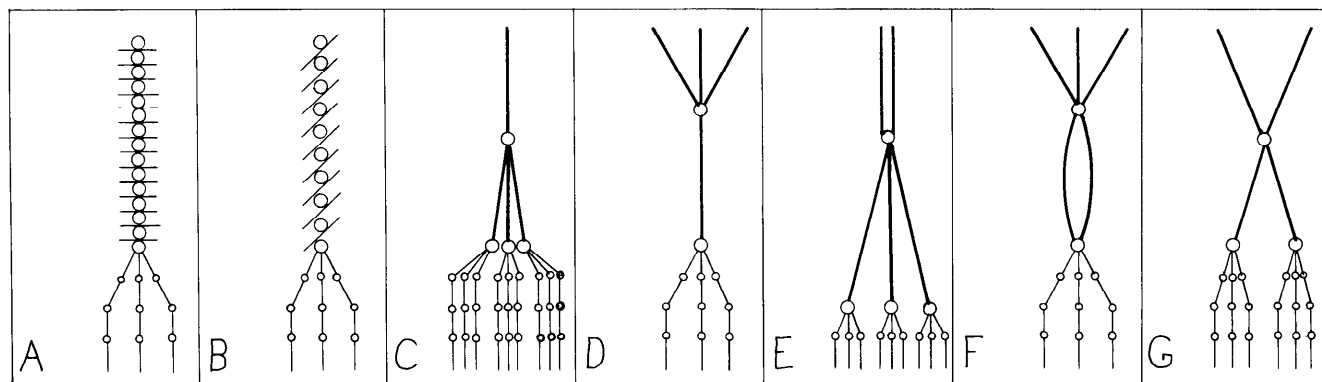


Figure 5. Some more hypothetical limbs. It is plain that these, too, are unsuitable.

Numbers i and ii would seem to be the most viable. It will be noticed that they come close to conforming to the pentadactyl plan. Number i is similar to X and Z, while number ii looks like X; and it would be even more so if there were one elbow or knee joint instead of two. The pentadactyl plan still outclasses Model ii as it stands; and the same goes for model i. And it is only in so far as i and ii resemble the present pentadactyl system that they come close to being viable basic plans.

Finally, we move on to Figure 5.

Here, model A consists of short long bones with joints. The musculature problems in this model are far greater than for those in Figure 3. This model, then, is useless.

Model B differs in having the short long bones set at an angle. This model is too weak and clumsy. Model C consists of long bones and has three feet on one leg (or three hands on one arm). It is clearly impractical, and would never suit all the walks of life.

Model D has three long bones on the hip or shoulder and one on the arm or leg. This model would be overall too weighty on top for one arm or leg bone to take. All existing limbs have one upper (arm or leg) bone, with two below, so that the animal can cope with the overall weight.

Model E has two bones at the top and three below, with three feet or hands. This model would not cope with all the many different modes of life.

Model F is perhaps the most viable of those in Figure 5, having three bones at the top and two at the bottom. There might, however, be too much weight at the top of the structure. There is one hand or foot at the bottom. Even this model would not be suitable for every mode of life. To adapt it to the mode of flying, i.e. to have a wing, many bones would have to go, while others would need modification. These changes, as might be expected, would lead us once more toward the present pentadactyl system.

Model G, like many others, becomes more and more outlandish, and would never do a satisfactory job.

In summary, then, permutations on long bones have been seen in Figures 3, 4, and 5. Permutations on short long bones on one side and short long bones with joints on the other have been seen in Figure 3. And permutations with numbers of long bones at the top and bottom, with several feet or hands on them, have been seen in Figures 4 and 5. This seems to cover the range of conceivable arrangements fairly well. The pentadactyl plan, without doubt, comes out on top.

Could the plan vary if need be? The answer is — possibly; but only within the limits of the plan. Indeed, it is difficult to imagine any variation which would be better than the present pentadactyl plan, in coping with the various environmental niches.

The Bird's Wing

The bird's wing is perhaps the most specialized case of the pentadactyl limb; and one might wonder whether a completely different arrangement might have been advantageous here.

For instance, why should there not be digits protruding from the wing, instead of being internal? An

evolutionist might hold that the reptilian ancestors did once have such digits, but that they were lost to improve the efficiency of flight. But it could have been possible for every flying bird to possess such digits without impairing flight. Neither, had God chosen to create birds with such digits, would their flight necessarily have thereby been impaired.

Again, why have bones at all in the wing? Could they be replaced by a structure of strong muscle?

The smaller, active birds, e.g. swallows, snipe, etc., have solid bones. It might be possible to replace these with muscle, etc., of about the same weight; so such a thing might work. Even for these birds, though, the bulk of muscle necessary might lead to increased weight, reducing the ability to fly or even preventing flight entirely.

Larger birds have hollow bones, with a high ratio of strength to weight, to permit flight. If these bones were replaced by muscle (which would surely need to be solid) over the relatively large area of wing, it seems likely that flight would be impossible.

Conclusions

We have seen that there are already variations on the existing pentadactyl plan of limb. However, variations which get away from the pentadactyl arrangement would not work, for the various reasons which have been given.

The hypothetical designs which come closest to being viable are precisely those which are most like the existing plan. If the limbs were to depart far from the existing plan, other bones in the body, such as the flat bones which make up the ribs, would have to be rearranged and restructured. Even then, if the result were to be of any service, the arrangement would have to come close to the existing plan.

All animals with boned limbs will have one basic design for foot or hand, viz., digit(s) connected to a jointed ankle or wrist, the rest of the limb being suited to this arrangement. This, one may be sure, will be the pentadactyl plan.

Therefore, Creationists can answer in some detail questions about the pentadactyl limb, as used throughout the vertebrate animals. It is indeed a plan created by God.

Appendix: About Stance

Someone may now say: "... fair enough; I can see your point that the plan of the limbs is the best that there is; but what about the stance of some animals, e.g. many reptiles and amphibians? Is this not a bad design, having the limbs outstretched, instead of having them positioned under the body, as in mammals?"

The answer, I believe, to this question is *no*; it is not a bad design for such organisms. In considering the creation of such an animal as a typical reptile or amphibian, it must be remembered that the animal is cold-blooded. Its mode of locomotion, then, would have to be of such a design as not to outstrip its temperature-control system. If one were to give a typical reptile the limbs of a swift-running mammal, problems would set in. Such a limb and stance might very well cost the organism its life; for overall it would take too much energy to use such a limb. The animal

in question may very well have a tendency to overtax its own physical resources.

There is another point. Many reptiles and amphibians live in muddy places, or half in water and half out. It may be that in such a situation, to glide along on the mud, in a way which is half walking and half swimming, is the most efficient way of moving about. And for such a way of moving, the outstretched limbs seem ideal.

So it is still true that the best possible boned limb is the pentadactyl design. Variations within that plan, including various stances, are very well designed for the animals which possess them, and for their particular niches.

Incidentally, reconstructions of the oldest crocodiles known, from the remains, seem to show that they had what some would call a better stance, i.e. a more

mammal-like one, than do modern crocodiles. (Although the stance was not by any means that of a mammal.)

This may serve as another example of variation on a theme. Also, the following consideration arises. If a mammal-like stance were truly better, crocodiles must have degenerated over their generations, becoming less fit, contrary to Darwinian theory. No, the stance of modern reptiles and amphibians is well suited to their mode of life, and to the niche which they occupy. As for the ancient ones, I suggest that we know too little in detail about the niche which they occupied to say dogmatically what stance would have been best for them.

Acknowledgement

Mr. Paul Stanton helped with the illustrations; and, in particular, he drew Figures 1 and 2.

THE VERTICAL TEMPERATURE STRUCTURE OF THE PRE-FLOOD VAPOR CANOPY†

JOSEPH C. DILLOW*

Received 17 June, 1982

In this article is described continued work on the possibility that a vapor canopy formerly surrounded the Earth, and on the conditions which would prevail in and under such a canopy. It is believed that it is shown that a canopy could indeed have existed; but more work is still needed on some aspects of the matter.

The early chapters of Genesis as well as other ancient writing testify to an ancient belief that the earth at one time was surrounded by a "water heaven."¹ It was this water heaven that supplied the source of the 40-day rainfall described in the book of Genesis. However, the physics of such a canopy presents rather immense problems for numerical modeling. While there have been some crude initial studies of this problem,² there have as yet been no attempts to model such a canopy in more rigorous ways for study by numerical simulation.

This paper presents a one-dimensional radiation transport model of a water vapor and air atmosphere with some preliminary results. The atmosphere under the canopy is assumed to be chemically the same as the present atmosphere. The canopy itself begins at an altitude of about 10 km and consists of 88% water vapor and 12% air. A Newton-Raphson iteration was employed for solving a coupled set of nonlinear radiation flux equations for the steady state vertical temperature structure.³ Fifty spectral intervals are employed using published values for the mass absorption coefficients and other data for the absorbers H₂, CO₂, and O₃. The convective adjustment was not included, although this is a relatively simple addition;⁴ neither was Rayleigh or Mie scatter modeled in a rigorous fashion.⁵ A more serious limitation however, is the fact that lateral advective heat flow involved with

global circulation was not included in the one-dimensional treatment and that oceanic coupling was only crudely approximated.

We assume a flood rainfall rate of 0.5 inches per hour. This implies that the ancient canopy contained 12.19 m of water (0.5 inches/hr × 24 hr × 40 days = 40 ft = 12.19 m). Thus, the surface pressure was 2.18 Atm.

The Canopy Temperature Profile

We first define a vertical coordinate system for the model calculations. In our model we divided the canopy atmosphere into 20 layers (Fig. 1).

In Fig. 1, P refers to the pressure, which for the canopy atmosphere varies from 2.18 atmospheres at the earth's surface to 0.05 (we defined 0.05 Atm as the "top" of the canopy); u refers to optical path or the product of the density and altitude; and z refers to altitude.

The solar input is denoted by Q . Here S_i refers to the Planck emission from the surface of the sun in spectral interval i ; θ is the zenith angle; and f is the fraction of daytime. Q_i is then the solar flux at the top of the atmosphere in spectral interval i . D , the solar distance factor, is explained below.

The chemical composition of each layer is given in Table 1.

We wish to calculate the set of layer temperatures that will cause the sum of the upward and downward radiation fluxes at each boundary to vanish. This is to be understood as the radiative equilibrium profile of the vapor canopy. The basic equations for the fluxes at each boundary are given by:⁶

†This article is based, in part, on the revised edition of *The Waters Above*. Moody Press, Chicago, 1983.

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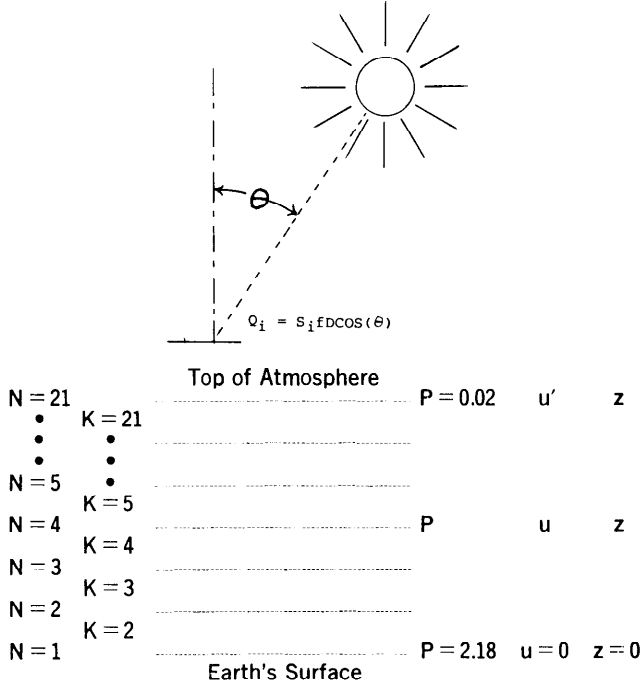


Figure 1 Vertical coordinate system for the vapor canopy computer model. (K = Layer no.; N = Node no.)

$$\left. \begin{aligned} F_{\uparrow}(u) &= \sum_{i=1}^{NI} F_{i\uparrow}(u) \\ F_{\uparrow}(u) &= \sum_{i=1}^{NI} \pi B_i(T_s) TR_i(u) + \int_0^u \pi B_i[T(u') TR_i(u - u')] du' \end{aligned} \right\} \quad (1)$$

and

$$\left. \begin{aligned} F_{\downarrow}(u) &= - \sum_{i=1}^{NI} F_{i\downarrow}(u) \\ &= - \sum_{i=1}^{NI} \int_{u_T}^u \pi B_i[T(u') TR_i(u' - u)] du + Q_i TR_i(u_T - u) \end{aligned} \right\} \quad (2)$$

where F represents flux, B the Planck emission, T absolute temperature, TR optical transmission, u optical path, n spectral interval and NI the total number of spectral intervals. Also, u_T denotes the optical path at the top of the atmosphere.

Equations (1) and (2) may be written in discrete form for numerical solution. As an illustration of the method (2) can be expressed in the following way:⁷

$$F_{\downarrow}(N) = \sum_{i=1}^{NI} \left\{ \sum_{K=N}^{NN} \pi B_i[T(K)] [TR_i(N, K) - TR_i(N, K-1) + Q_i TR_i(N, NN)] \right\} \quad (3)$$

where K and N are the node indices; and NN is the index of the top node. The Planck function is evalu-

Table 1. Volume fractions for each layer of canopy atmosphere.

Layer	H ₂ O	CO ₂	O ₃	AR	O ₂	N ₂
1	0.0002	0.0003	0.00	0.0093	0.1950	0.7952
2	0.0002	0.0003	0.00	0.0093	0.1950	0.7952
3	0.0002	0.0003	0.00	0.0093	0.1950	0.7952
4	0.0002	0.0003	0.00	0.0093	0.1950	0.7952
5	0.0002	0.0003	0.00	0.0093	0.1950	0.7952
6	0.0007	0.0003	0.00	0.0093	0.1950	0.7947
7	0.88	0.003	0.00	0.0093	0.05	0.0577
8	0.88	0.003	0.00	0.0093	0.05	0.0577
9	0.88	0.003	0.00	0.00	0.05	0.067
10	0.88	0.003	0.00	0.00	0.05	0.067
11	0.88	0.003	0.00	0.00	0.05	0.067
12	0.88	0.003	0.00	0.00	0.05	0.067
13	0.88	0.003	0.00	0.00	0.05	0.067
14	0.88	0.003	0.00	0.00	0.05	0.067
15	0.75	0.03	0.00	0.00	0.05	0.170
16	0.75	0.03	0.00	0.00	0.05	0.170
17	0.75	0.03	0.00	0.00	0.05	0.170
18	0.0009	0.00	0.01	0.00	0.19	0.7991
19	0.0009	0.00	0.01	0.00	0.19	0.7991
20	0.0009	0.00	0.01	0.00	0.19	0.7991

ated at temperature $T(K)$ which is an average temperature for layer K . $TR_i(N, K)$ is the optical transmission between nodes N and K in spectral interval i .

In order to solve (1) and (2), several things must be known. The most crucial item is the form of the transmission function, TR . In our model of the canopy we used four different formulations for the transmission depending on the spectral interval and the absorbing gas, H₂O, CO₂, or O₃. Table 2 describes the spectral intervals we employed and the transmission function used. The transmission functions are described below, where u is the corrected optical path.

$$(1) TR1 = \exp[-xu(1 + xu/y)^{-1/2}] \quad (4)$$

Here $x = S/\delta$ and $y = \pi\alpha/\delta$; where δ is the line spacing, S is the line intensity, and α is the half width of the line. The values of the parameters x and y were taken from the tabulation of Rogers and Walshaw (1966)⁸ as presented in Liou.⁹ They are listed in Table 3. For discussion of the actual meaning of these parameters the reader is referred to Liou.¹⁰

$$(2) TR2 = \exp(-ku) \quad (5)$$

Here k is a mean mass absorption coefficient, $m^2 \text{ kg}^{-1}$, for the spectral interval i . This form of the transmission function was used in spectral intervals not only where customary, but also in intervals where absorption is neglected. For example, in modeling the present atmosphere, absorption in the visible bands (.85 to .4 microns) is usually ignored. In an atmosphere as dense as the canopy, however, it is reasonable to include some absorption. We used values of k in these bands ranging from 10^{-3} to 10^{-5} , $m^2 \text{ kg}^{-1}$.

$$(3) TR3 = \exp(-\sum W_i / \Delta v) \quad (6)$$

where $\sum W_i$ is the sum of the equivalent widths of all the lines in the spectral interval; and Δv is the width of the spectral interval, m^{-1} . For full explanation the

Table 2. Spectral intervals and transmission functions for each absorbing gas.

Spectral Interval	Wavelength (microns)	Transmission Function			Cloud Albedo
		H ₂ O	CO ₂	O ₃	
1	****-250.00	1	0	0	0.01
2	250.00-62.50	1	0	0	0.01
3	62.50-35.71	1	0	0	0.03
4	35.71-26.32	1	0	0	0.03
5	26.32-20.00	1	0	0	0.03
6	20.00-16.67	1	0	0	0.03
7	16.67-13.89	1	1	0	0.03
8	13.89-12.50	1	0	0	0.05
9	12.50-11.11	1	0	0	0.05
10	11.11-10.00	2	0	0	0.05
11	10.00- 9.94	2	0	1	0.05
12	9.94- 9.87	2	0	1	0.05
13	9.87- 9.81	2	0	1	0.05
14	9.81- 9.75	2	0	1	0.05
15	9.75- 9.69	2	0	1	0.05
16	9.69- 9.62	2	0	1	0.05
17	9.62- 9.56	2	0	1	0.05
18	9.56- 9.51	2	0	1	0.05
19	9.51- 9.45	2	0	1	0.05
20	9.45- 9.39	2	0	1	0.05
21	9.39- 8.33	2	0	0	0.05
22	8.33- 7.41	1	0	0	0.05
23	7.41- 6.90	1	0	0	0.05
24	6.90- 6.45	1	0	0	0.04
25	6.45- 6.06	1	0	0	0.02
26	6.06- 5.71	1	0	0	0.02
27	5.71- 5.41	1	0	0	0.32
28	5.41- 5.13	1	0	0	0.01
29	5.13- 4.88	1	0	0	0.01
30	4.88- 4.55	1	0	0	0.01
31	4.55- 4.04	2	3	0	0.05
32	4.04- 3.57	2	0	0	0.10
33	3.57- 2.94	3	0	0	0.15
34	2.94- 2.38	3	0	0	0.20
35	2.38- 2.22	2	0	0	0.20
36	2.22- 2.04	2	3	0	0.18
37	2.04- 1.72	3	3	0	0.15
38	1.72- 1.52	2	4	0	0.25
39	1.52- 1.30	3	4	0	0.35
40	1.30- 1.22	2	0	0	0.30
41	1.22- 1.08	3	0	0	0.30
42	1.08- 0.98	2	0	0	0.30
43	0.98- 0.89	3	0	0	0.30
44	0.89- 0.75	2	0	0	0.30
45	0.75- 0.68	2	0	0	0.45
46	0.68- 0.60	2	0	2	0.45
47	0.60- 0.50	2	0	0	0.45
48	0.50- 0.42	2	0	2	0.45
49	0.42- 0.30	2	0	2	0.45
50	0.30- 0.21	2	0	2	0.45

interested reader is referred to Houghton.¹¹ The equation for ΣW_i is given by:

$$\Sigma W_i = \frac{2R^2}{S} \left[\left(1 + \frac{uS^2}{R^2} \right)^{\frac{1}{2}} - 1 \right] \quad (7)$$

The values of R^2 and S are tabulated in Table 3. Houghton¹² gives values of these parameters calculated from quantum mechanics for temperatures of 220, 260, and 300 °K. In some spectral intervals they

Table 3. Random model band parameters in the infrared region for transmission function TR1.

Spectral Interval	Wavelength (microns)	Transmission Parameters (X in m ² kg ⁻¹)	
		X	Y
H ₂ O			
1	****-250.00	57.90	0.093
2	250.00-62.50	721.03	0.182
3	62.50-35.71	602.48	0.094
4	35.71-26.32	161.41	0.081
5	26.32-20.00	13.90	0.080
6	20.00-16.67	2.164	0.068
7	16.67-13.89	0.292	0.060
CO ₂			
7	16.67-13.89	71.87	0.448
H ₂ O			
8	13.89-12.50	0.039	0.059
9	12.50-11.11	0.007	0.067
O ₃			
11	10.00-9.87	69.9	5.0
12	9.94-9.87	14.0	5.0
13	9.87-9.81	279.0	5.0
14	9.81-9.75	466.0	5.5
15	9.75-9.69	511.0	5.8
16	9.69-9.62	372.0	8.0
17	9.62-9.56	257.0	6.1
18	9.56-9.51	605.0	8.4
19	9.51-9.45	769.0	8.3
20	9.45-9.39	279.0	6.7
H ₂ O			
22	8.33-7.41	1.27	0.089
23	7.41-6.90	13.44	0.230
24	6.90-6.45	63.29	0.320
25	6.45-6.06	33.12	0.296
26	6.06-5.71	43.41	0.452
27	5.71-5.41	13.60	0.359
28	5.41-5.13	3.57	0.165
29	5.13-4.88	0.91	0.104
30	4.88-4.55	0.15	0.116

are highly temperature dependent. To include this effect, we fitted the mean value of the parameter to an exponential curve using the following formulation:

$$R_T = R_{300}(T/300)^n \quad (8)$$

where R is the parameter, T is temperature, and n is an exponent. It was found that in the range of 220 to 300 °K, the values of n reported in Table 3 yielded less than 2% error.

$$(4) \text{ TR4} = cu^{0.5}(P)^k \quad (9)$$

Here P is the total pressure, mm of Hg; and c and k are physical constants derived from the experiments of Howard *et al.* (1956) and reported in Liou.¹³ These data are summarized in Table 5.

The Corrected Optical Path

In equations 4 to 9 the variable, u , or optical path occurs. It is defined as follows¹⁴:

$$u = \int \rho dz \quad (10)$$

Table 4. Transmission function parameters for TR3 for H₂O and CO₂ bands.

Spectral Interval	Wave-length (microns)	Transmission S (kg ^{-0.5})	Function n	Parameter R (m kg ⁻¹)	n
H₂O					
33	3.57-2.94	3.61E3	0.265	1685	0.79
34	2.94-2.38	3.42E5	1.0	11025	0.209
37	2.04-1.72	3.397E4	1.0	2964	0.319
39	1.52-1.30	2.273E4	-0.015	2887	0.157
41	1.22-1.08	1.6E3	1.0	703	0.143
43	0.98-0.89	8.82E2	-0.026	642	0.055
CO₂					
31	4.55-4.04	1.323E6	0.238	11005	0.61
36	2.22-2.04	3.267E2	0.273	385	0.71
37	2.04-1.72	1.392E3	0.246	766	0.73

Table 5. Carbon dioxide transmission function parameters for TR4 in 1.4 and 1.6 micron bands.

Spectral Interval	Wavelength (microns)	c	k
38	1.72-1.52	0.063	0.38
39	1.52-1.30	0.058	0.41

where ρ is density, kg m⁻³; and z is altitude, m. In the model an optical path is computed for each layer and for each absorbing gas. However, the absorbing characteristics of a gas are sometimes significantly affected by temperature and pressure. The effect, generally, is to increase the absorption with increasing partial pressure of the absorbing gas up to a certain limit when the absorption lines become saturated.¹⁵ In order to take into consideration the temperature and pressure effects on the line intensity, S , and the half width, α , various empirical approximations are often used. The procedure is to first calculate the optical path for each absorbing gas in each layer and then modify it to incorporate the pressure effect into the transmission function.

The density is obtained through the equation of state:¹⁶

$$\rho = mP/RT \quad (11)$$

where m is the mean molecular weight, kg kmol⁻¹; P is pressure, Pa; R is the universal gas constant, 8314 J kmol⁻¹ °K⁻¹; and T is the mean temperature of the layer, °K. We make the assumption that each layer is isothermal so that we can describe the pressure variation in the layer in terms of a local scale height, H , given by:¹⁷

$$H = RT/mg \quad (12)$$

P , the pressure, is given by:¹⁸

$$P(Z) = P(Z_0)\exp[-(Z - Z_0)/H] \quad (13)$$

In (12) and (13), Z is an altitude in the layer and Z_0 is the altitude of the base of the layer; and g is the gravitational acceleration; 9.806 m s⁻². Inserting (13) and (12) into (11) and integrating over the layer thickness yields the optical path of the layer:

$$u = f_m(P_{k-1} - P_k)/g \quad (14)$$

where f_m is the mass fraction of the absorbing gas. The optical path is then multiplied by a correction factor, C_f , to yield the corrected optical path employed in the transmission function calculations.

$$C_f = \frac{P(N)}{P_0} \left(\frac{T_0}{T} \right)^n \quad (15)$$

where P_0 is standard pressure, 1 Atm; T_0 is standard temperature, 273.16 °K; n is an empirical constant; and T is the mean layer temperature. The values of n used are 0.9 for H₂O, 0.75 for CO₂, and 0.4 for O₃.¹⁹

Temperature and Pressure Correction for Line Half-Width

In transmission, TRI , the half width, α , was corrected for the effects of temperature and pressure by setting $n = 0.5$ and multiplying Y in 4 by C_f .²⁰

Diffuse Transmission Approximation

The integration of (1) and (2) should first be carried out over all angles before the integration over wavelength. This is necessary to include the effects of the diffuse nature of the infrared radiation in each layer. Fortunately, a simple approximation is available that saves the expense of this integration. It has been found that by multiplying the optical path by 1.66, the effects of diffuse transmission are accurately included.²¹

The Planck Function

In order to solve (1) and (2) the Planck function must be evaluated for the sun, for the earth's surface, and for each layer of the atmosphere. We used the Planck formulation given by Paltridge and Platt,²² to give, in Wm⁻² per unit spectral interval:

$$B = \frac{P_1 V^3}{\exp\left(\frac{P_2 V}{T}\right) - 1} \quad (16)$$

where P_1 and P_2 are the so-called first and second Planck constants: $P_1 = 3.74186 \times 10^{-16}$ (which includes the multiplication by π for flux units); $P_2 = 1.43884 \times 10^{-2}$; V is the wave number, m⁻¹; and T is the absolute layer temperature, °K. The integration of (16) over each wave number interval was carried out using four point gaussian quadrature.

Solar Flux at the Top of the Atmosphere

To determine the solar input into the canopy atmosphere we employed this formulation:²³

$$Q_i = S_i f D \cos(\theta) \quad (17)$$

where Q_i is the solar flux at the top of the atmosphere in the spectral interval i , W m⁻²; S_i is the solar flux at the surface of the sun; θ is the zenith angle, f is the fractional daytime; and D is a distance factor. For a global average, $\cos(\theta) = 0.5$ and $f = 0.5$.

We define the solar correction factor, SC as:

$$SC = f \cos(\theta) \quad (17a)$$

To determine the value of Q_i , the solar flux at the surface of the sun, S_i , was multiplied by a distance factor, D :²⁴

$$D = 1353/\sigma T^4 \quad (18)$$

where 1353 is the solar constant, $W m^{-2}$; T is the surface temperature of the sun, $5762^\circ K$; and σ is the Stefan-Boltzman constant, $5.6697 \times 10^{-8} J m^{-2} ^\circ K^{-4}$. Thus, $D = 2.165 \times 10^{-5}$.

Vapor Condensation and Cloud Formation

We incorporated the possibility of two cloud layers in our model. There are several factors that could produce clouds. The fundamental requirement, however, is that the saturation ratio (the ratio of the partial pressure of water vapor in a given layer to the saturation vapor pressure in that layer, i.e., the relative humidity) be greater than 1. (In the absence of condensation nuclei, saturation ratios of up to 6 may be necessary to induce condensation.) The saturation vapor pressure, E , is accurately represented by the expression:²⁵

$$E = (6.0278 \times 10^{-3}) 10^{aT/(b+T)} \quad (19)$$

where $a = 7.5$; $b = 237.3$, T is in degrees C, and E in mb.

Convective Stability

Once the vertical profile of temperature is calculated, the lapse rate of temperature in each layer is known. If this lapse rate of temperature exceeds a certain critical value, convection, which includes vertical lifting and expansional cooling will result. Cooling, in turn, may result in condensation and cloud formation. The dry critical lapse rate is given by:²⁶

$$L_d = -g/C_p \quad (20)$$

where C_p is the specific heat. C_p for dry air = $1005 J kg^{-1}$ per degree and C_p for water vapor = $1850 J kg^{-1}$ per degree. Thus the critical lapse rate for the lower atmosphere under the canopy would have been $9.75^\circ C/km$ and for the canopy $5.3^\circ C/km$. The actual lapse rate over a particular layer, K , is simply:

$$L_r = \frac{T(N-1) - T(N)}{Z(N-1) - Z(N)} \quad (20a)$$

The stability criteria for an unsaturated parcel of vapor are:²⁷

$$\left. \begin{array}{l} L_d > L_r : \text{Stable} \\ L_d = L_r : \text{Neutral} \\ L_d < L_r : \text{Unstable} \end{array} \right\} \quad (20b)$$

Thus, unsaturated parcels in canopy layers whose temperature lapse rates exceed $5.3^\circ C/km$ will be unstable and experience lifting, expansional cooling, and possible condensation and resultant mist or cloud formation in that layer. Once this occurs, a convective adjustment must be made in the calculations.²⁸ This may be done by setting the temperature lapse rate equal to the moist adiabatic lapse rate which includes the effects of latent heat. The moist adiabatic lapse rate may be approximated by:²⁹

$$L_s = (6.13 \times 10^{-8}) PT/E \quad (20c)$$

where P is the mean atmospheric pressure in the layer and T is degrees K.

In our model we assumed that the canopy atmosphere was mostly free of condensation nuclei and hence only homogenous nucleation is considered in the cloud physics. Under these conditions, saturation ratios of up to 6 may be needed to induce mist formation.³⁰

Method of Computer Solution³¹

We begin by specifying the pressure at each node. These are fixed throughout the calculation. From (1) and (2) the upward and downward fluxes at each node are calculated to arrive at the net flux at each node, $F(N)$. The aim is to find the values of T in each layer that will cause the net flux densities at each node to vanish. That is, we seek a set of values for T so that the following conditions are satisfied simultaneously

$$\left. \begin{array}{l} F(N, T(1), T(2), T(3) \dots T(N)) = 0 \\ \vdots \\ F(3, T(1), T(2), T(3) \dots T(N)) = 0 \\ F(2, T(1), T(2), T(3) \dots T(N)) = 0 \\ F(1, T(1), T(2), T(3) \dots T(N)) = 0 \end{array} \right\} \quad (21)$$

This is accomplished using an iterative procedure known as the Newton-Raphson method. For simplicity of notation, let $[F]^{(n)}$ represent nodal fluxes at iteration n ; and let $[T]^{(n)}$ be nodal temperatures. Furthermore let $[DF]^{(n)}$ be the matrix of derivatives of nodal fluxes with respect to temperature at iteration n ; and let $[DT]^{(n)}$ be a set of temperature corrections used to obtain the temperatures at iteration $n+1$.

The Newton-Raphson method involves solving the following matrix equation for $[DT]^{(n)}$:

$$[DF]^{(n)} \times [DT]^{(n)} = -[F]^{(n)} \quad (22)$$

The nodal temperatures for iteration $n+1$ are then given by:

$$[T]^{(n+1)} = [T]^{(n)} + [DT]^{(n)} \quad (22a)$$

One begins with an initial guess for the set of nodal temperatures and iterates the procedure until temperature corrections, $[DT]^{(n)}$, are smaller than a prescribed tolerance. To solve (22) we used a gaussian elimination algorithm with partial pivoting. Typically, the program converged after 3 to 5 iterations to within a root-mean-squared tolerance of 1 degree K and yielded the radiative equilibrium steady state vertical temperature structure of the canopy atmosphere.

Oceanic Heat Transport

Another factor of significance could only be guessed at in the present model, namely the coupling between the atmosphere and the oceans. In the present atmosphere, nearly half of the tropospheric heat in equatorial regions is removed from the lower layers of the atmosphere by coupling with the oceans and subsequent transport to the poles.³² In our canopy we simulated this effect by specifying a net flux, SF , through the entire atmosphere. This flux can be assumed to be coupled to the ocean and transported poleward by ocean currents as the atmosphere and ocean system attempted to balance the heat budget between the equator and the poles. We made no

attempt to calculate this effect on a rigorous basis as we only wanted to study the magnitude and include it as an approximation.³³

Analysis of Results

Numerous numerical experiments were performed to identify the various factors necessary for the obtaining of a viable canopy atmosphere.³⁴ The one-dimensional model described above although inadequate to quantify in detail some aspects of the problem, does demonstrate its main features. A two-dimensional model is clearly desirable to be able to treat atmospheric and oceanic dynamics. This is no simple task. Global climate modeling is an immense problem and very expensive in computer time.

Comparison with the Present Earth

In order to check the validity of the canopy calculation a calculation using the US Standard Atmosphere was performed. The program yielded a figure of 282 °K for the surface temperature. This compares favorably with the US Standard Atmosphere global average of 288 °K. The comparison was made with $SC = 0.25$ and a 50% cloud cover.

The Canopy Temperature Profile

We modeled the canopy in several ways. It was found that if the canopy had a thick cloud, the surface temperature would drop nearly 5 degrees for each layer added to the cloud. Also, it was noted, as would be expected, that the canopy temperatures were quite sensitive to the value of SC chosen which varies from .0 to 1. Because the angle of the sun is changing over the 24 hours and because the sun "turns off" for a fraction of the day over most of earth, no canopy profile derived from the present model accurately reflects the real condition. When the sun is shining directly overhead, the value of SC (from 17a) would be 1. However, after the sun "turns off" its value drops to zero.

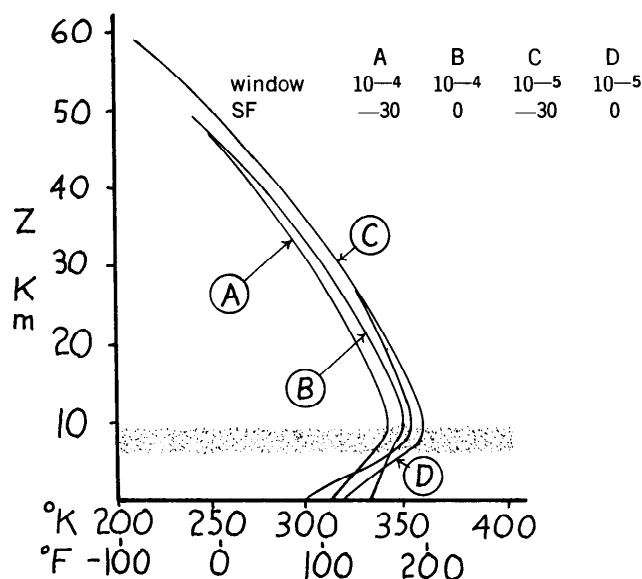


Figure 2. Annual average canopy at 45° latitude in July with various values of surface flux, SF , $W m^{-2}$, due to oceanic coupling, and window mass absorption coefficient, $m^2 kg^{-1}$.

In order to model the effects of the removal of surface heat, SF , by oceanic coupling, we assumed various amounts of absorption and subsequent transport to the poles by the oceans. With relatively small amounts of oceanic and atmospheric transport one can see a very nice canopy profile results with a cool surface and a strong temperature inversion (see Fig. 2 and 3).

For comparison, we modeled the canopy at the equator at high noon with a cloud fraction of 100%; $SF = -120 W m^{-2}$; and a window mass absorption coefficient of $10^{-3} m^2 kg^{-1}$. This produced the most viable canopy profile. The results are presented in Table 6.

Cloud Formation

In each of the canopy profiles calculated in Fig. 2 and 3 the saturation ratios were above 1 in the lower regions of the canopy. Also, beginning at about 12 km (just above the clouds in the present model) the temperature lapse rates exceeded the critical rate indicating that some convection, and subsequent expansional cooling would have occurred in the lower regions of the canopy. This effect coupled with saturation ratios greater than 1 should be sufficient to produce clouds in this region.

The major problem, however, is the value of k required, in the 8 to 13 micron "window" to achieve this inversion. The literature suggests values of 0.01 to 0.02 $m^2 kg^{-1}$ as typical of this region. When it is temperature corrected, the values in the canopy could be of the order of magnitude³⁵ $10^{-3} m^2 kg^{-1}$. While a strong inversion occurred with this value the best results were obtained when values of 10^{-4} or even 10^{-5} were employed. Values this small are not supported by current experimental data. There is of course, the possibility that more careful measurement may yield a lower value for the mass absorption coefficient in its continuum region. Measurements are difficult in this band where absorption is so small. Small losses

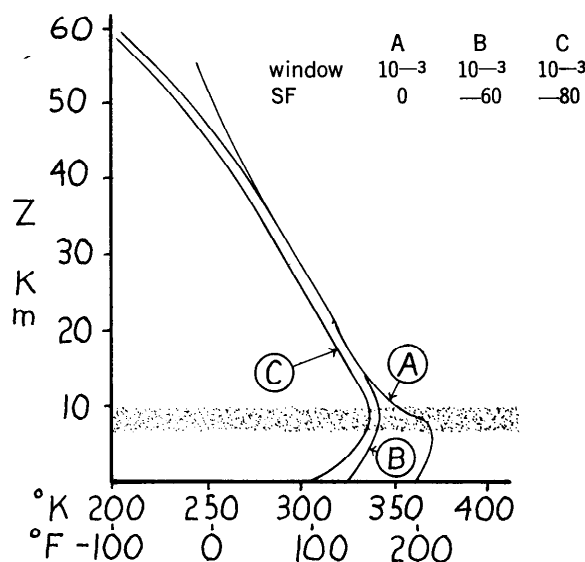


Figure 3. Canopy temperature profiles at 45° latitude for July with various values of surface flux, SF , $W m^{-2}$, due to oceanic coupling.

Table 6. Computer output of equatorial canopy profile.

Altitude (km)	Pressure (atm)	Temperature (°C)	Lapse Rate (°C km ⁻¹)	Saturation Ratio
0.0	2.18	19.54	0.0	0.0
0.12	2.15	37.94	15.000	0.011
0.78	2.35	36.44	0.082	0.007
1.50	1.85	46.84	11.5	0.005
2.30	1.70	51.14	6.5	0.003
3.19	1.55	57.04	6.4	0.037
4.18	1.40	64.34	7.4	0.037
4.93	1.30	74.74	14.00	0.045
5.76	1.20	82.54	9.73	0.042
7.20	1.10	94.34	7.9	1.68
9.77	0.95	111.24	6.74	0.917
12.82	0.80	99.64	-3.63	0.701
16.47	0.65	107.84	1.47	0.642
21.07	0.5	99.54	-1.23	0.513
24.92	0.40	92.24	-2.08	0.515
29.76	0.30	82.74	-1.96	0.558
34.81	0.22	68.24	-2.81	0.668
40.77	0.15	51.44	-2.81	0.940

not accounted for in the experimental apparatus can yield significant errors. There has in fact been a wide variation of reported values of k for the window region over the past 20 years. We leave this problem as a yet-to-be-resolved feature of our model.

Nighttime Visibility

A difficulty arises with the canopy model described above in that we are assuming a near total cloud cover (90 to 100%). This could lead to a conflict with the Biblical statements that indicate that the stars were created to be seen (Gen. 1:14). In the model we are proposing, a very thin mist constitutes our "cloud." During the day, this cloud will burn off due to solar heating and by sunset the sky would be clear. Then as the atmosphere cools, in the early hours of the morning, the cloud will gradually form once again only to be slowly burned away by solar heating in the day. The 24 hour cycle in heating and cooling sustains this effect. The effect is greatest at the canopy base where the cloud would reside. It should also be noted that the driving mechanism for convection at the canopy base, i.e., solar heating, will not be present at night. The lapse rate would probably go below the critical rate causing convection to cease and as a result no expansional cooling and cloud formation. (Apparently, in the equatorial profile, Table 6, no vertical convection occurs at the canopy base.)

The Emden Approximation

In an earlier publication a crude approximation for calculating the canopy temperature was employed. It has since come to my attention that I made a mathematical error which would yield canopy temperatures that were several times larger than what had been previously reported.³⁶ Canopy (and surface temperatures) that exceed 1000 °F derived from the Emden approximation are certainly far in excess of the values derived from the more rigorous approach taken above.³⁷ Some explanation is needed.

In its simplest form, the Emden approximation gives a relationship between total optical depth and the

temperature of the radiating surface of the planet (the surface or a cloud layer), where A is the albedo, S is the solar constant and σ is the Stefan-Boltzman constant.

$$T = \left[\frac{(1 - A)(S)(1 + 1.5\tau)}{8\sigma} \right]^{1/4} \quad (23)$$

The optical depth is given by:³⁸

$$\tau = \int k\rho dz \quad (23a)$$

where k is the mass absorption coefficient and ρ is density.

This formulation does indeed yield reasonable results when applied to the present atmosphere, however it fails when extremely dense atmospheres are involved unless there is some modification to include additional physics.

The first problem involves the selection of the proper value of k ; and second involves a modification to the optical path, u . The value of k used should be that k for the most transparent portion of the atmospheric infrared absorption spectrum. The value is of the order of 0.01 kg m⁻² to 0.001 kg m⁻² or smaller for water vapor.³⁹ In the previous study, that value was applied only to the 8 to 13 micron region of the spectrum but a correct use of the Emden approximation for a dense atmosphere requires that it be applied for the terrestrial spectrum as a whole. The physics behind this may be illustrated as follows.⁴⁰

Imagine that the flow of radiant energy from the surface upward through the canopy is analogous to the flow of water through a piece of cheesecloth which has a hole. The "window" region of the spectrum (8 to 13 microns) is illustrated by the hole in the cloth. The water will flow freely through the pores in the cheesecloth as well as the larger hole. Now if we begin to add layers to the cloth with the large hole in the same place, the pores become closed and more and more of the water will flow through the hole. Thus, even though the hole is reduced somewhat, the pores are closed almost entirely. In a similar manner as the optical thickness of the canopy increases, a larger and larger percentage of the radiant energy is transmitted through the window region. And for a very thick canopy the value of k for the window region would be the best value to choose for the grey approximation. If a value of 0.001 m² kg⁻¹ is used then the canopy base temperature of 421 °K results (assuming an albedo of 0.45)⁴¹ which accords well with the numerical model above.

However, a second factor needs to be taken into consideration. A glance at 4, for example, reveals that the value of the optical path does not increase linearly with increased amount of absorbing gas, but (for large amounts of precipitable water) with the square root. Thus the correct optical path to insert into 23a is considerably less than 12,190 kg m⁻² of precipitable water. The precise amount can only be determined by the more rigorous approach taken above.

Conclusion

The above study represents the first attempt to model the vapor canopy theory in a rigorous way by

computer simulation. It is my desire that the above be viewed more as a "progress report" than a complete solution to the problem. The perceptive reader has noted that in general the canopy seems to be a bit too cool when one moves away from the equatorial regions. If on the other hand, supersaturation is possible due to the relative purity of the atmosphere and absence of condensation nuclei, then saturation ratios of up to 6 may be allowed before condensation will occur. In that case, the canopy should be stable. Also, a key to producing the needed inversion was the removal of heat by coupling with the ocean and also the lateral heat flow due to atmospheric movement near the surface and in the upper regions of the canopy. The next step would be a precise calculation of this effect with a two- or three-dimensional model.

Acknowledgements

I would like to give special thanks to John Baumgardner who wrote the computer code upon which these studies were based. Dr. Baumgardner also read and critiqued the manuscript and offered many helpful suggestions. Also, Dr. Ed Holroyd, who is presently working on his own canopy model, read the manuscript and made many valuable observations.

An Offer

If anyone should be interested in carrying out some of the computation, Dr. Dillow will provide the information. Just send him a diskette, and he will return a fully documented copy of the program. The work would need a TRS 80 Model I or Model III with 48K of RAM. With twenty levels in the program, it takes approximately 10-13 hours to converge on a steady-state solution.

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- ³³Reference 16, pp. 270-272.
- ³⁴These calculations were done on an IBM 3033. The CPU time was typically about 9 seconds.
- ³⁵Reference 6, 4.68b.
- ³⁶Reference 1, 1st edition, p. 227. A conversion from CGS to SI should have given for the optical path of 12,190 kg m². I am indebted to Mr. Glenn Morton, of Texas, for pointing out this error to me, July, 1981.
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- ⁴¹The albedo of 0.35 to 0.6 is a common value for clouds. See Reference 5, p. 138.

PLACEMENT SERVICE

Do you know of academic vacancies to which Creationists might be directed? The Creation Research Society would like to be in a position to be able to inform Creation scientists of such vacancies. If you know of such positions, will you please inform Dr. John W. Klotz, 5 Seminary Terrace North, St. Louis, Mis-

souri 63105, describing the position, and the academic requirements and training required, and giving any other information which might be available?

Graduate students who are interested in placement may write to Dr. Klotz for information about any available positions which are known to the C.R.S.

THE AORTIC ARCH

BOLTON DAVIDHEISER*

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Comparative anatomy is considered one of the strongest evidences of evolution. The eminent Thomas Hunt Morgan said, "If, then, it can be established beyond dispute that similarity or even identity of the same character in different species is not always to be interpreted to mean that both have arisen from a common ancestor, the whole argument from comparative anatomy seems to tumble in ruins."¹

Horatio Hockett Newman, famous professor and evolutionist of the University of Chicago, said, "Now, a careful survey of the situation reveals the fact that the only postulate the evolutionist needs is no more or less than a logical extension of what the layman considers a truism or self-evident fact, namely, that fundamental structural resemblance signifies generic relationship; that, generally speaking, *the degree of structural resemblance runs essentially parallel with closeness of relationship*. Most biologists would say that this is not merely a postulate, but one of the best established laws of life. . . . If we cannot rely upon this postulate . . . we can make no sure progress in any attempt to establish the validity of the principle of evolution."²

Here is one more of many possible further quotations. In his textbook, Ralph Buchsbaum says, "The most important kind of evidence is that based on a comparative study of the structure and development of various groups. The use of such evidence is based on the assumption that the more closely the body plans of two phyla [taxa] resemble each other, the closer their relationship and the more recent their common ancestor."³

However, there are a number of cases where belief in close evolutionary relationships has been based on similarity of anatomy but later repudiated.⁴ Also there are examples which no doubt would be used as evidence for phylogenetic affinity if they fit the theory, but are neglected because they do not fit. They carry some weight as evidence against the importance of comparative anatomy as an evidence of evolution.

An illustration of this is the mammalian aortic arch. Taxa assumed to be closely related have a different arrangement of the chief blood vessels arising from the aortic arch, and taxa which are very different have the same arrangement. (There are anomalies, the most common being the rise of the right subclavian artery from the aortic arch distal to the others and passing dorsal to the trachea and oesophagus. The condition has been observed in rabbits, dogs, pigs, and man.⁵) Some of these arrangements are shown in Figure 1.

The arrangement number 1 is characteristic of the Perissodactyla: horses, donkeys, zebras, etc., and the Artiodactyla: cows, sheep, goats, pigs, deer, etc.

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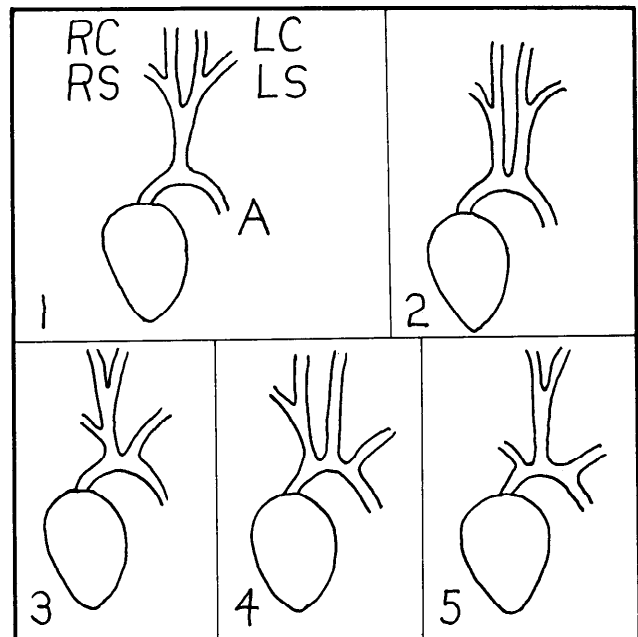


Figure 1. The mammalian aortic arch. The key is as follows: RC: right carotid; LC: left carotid; RS: right subclavian; LS: left subclavian; A: aorta. The kinds of animal which have the various arrangements are mentioned in the text.

The second arrangement is characteristic of some Cetacea: whales and porpoises, and some Insectivora: moles, shrews, hedgehogs.

Included in animals having the third arrangement are the Marsupials: kangaroos, opossums, wombats, etc., the Rodents: rats, mice, squirrels, beavers, porcupines, etc., Carnivores: dogs, cats, bears, skunks, weasels, raccoons, etc., Edentates: anteaters, armadillos, three-toed sloths, and some Primates: apes and monkeys.

The fourth arrangement is found in the Monotremes: the egg-laying duck-billed platypus and echidna; the Sirenia: sea cows and dugongs, and also some bats and man.

The fifth arrangement is that of African elephants and walruses.

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CREATIONISM DEFENDED

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Darwinism Defended, by Ruse,¹ is typical of recent books which attack Creationism, and also attack such non-Darwinian views as punctuated equilibrium. In this article, the charges made against Creationism are refuted, and it is shown that, just as Creationists have been saying, Darwinism rests on a shaky foundation indeed. Moreover, recent work is showing more and more that the Darwinian view is untenable.

For many years creationists have been told "creationism is not science, and probably never will be"; but until now evolutionists have not bothered to respond to the scientific arguments presented by creationists. It is for this reason that Michael Ruse's book *Darwinism Defended*¹ is of great interest, since, in his own words, it "is intended to be a refutation of the Creationist position" (p. 303).

The method of attack is to first give a presentation of "orthodox" evolutionary theory, which for Ruse is "Neo-Darwinism"; then to dispose of some challenges to the "orthodox" interpretation — e.g. the view that the principle of natural selection is a tautology, and the theory of 'punctuated equilibria' as an alternative to the gradualist interpretation of the fossil record. The final part of the book is a direct confrontation with creationism.

Naturally, in the space presently available, it is not possible to deal with all of Ruse's arguments, and hence I wish to confine myself to a brief review of a few of the most important topics covered in the book.

Most central to Ruse's concern and obviously to any discussion about evolution is the mechanism of evolution. In this area Ruse reveals himself as a staunch defender of the Darwinian principle of random variation and natural selection as the ultimate cause of all evolutionary change, over and against those in modern biology who believe that the recent developments in molecular biology, systematics and paleontology paint a somewhat different picture — not to mention the creationists, who of course deny the possibility of evolution altogether.

A great deal of time is spent on explaining the fundamentals of population genetics, the meaning of genetic variation and natural selection. Ruse may be surprised about the extent to which creationists will agree with his exposition; creationists have no quarrel with the existence of genetic variation, with the laws of Mendel or Hardy and Weinberg. The point at which Ruse's exposition turns weak is when we get around to asking the question to what extent the existence of microevolution can help us with understanding the mechanism of macroevolution. For him, the answer is clear: Macroevolution is nothing more than scaled-up microevolution. Population genetics is both necessary and sufficient to explain all known aspects of evolution.

Nothing in the book comes anywhere near a proof of this contention. That all is not as simple as it might appear becomes clear in R. C. Lewontin's study, where he freely admits, "It is an irony of evolutionary genetics that, although it is a fusion of Mendelism and

Darwinism, it has made no direct contribution to what Darwin obviously saw as the fundamental problem: the origin of species. . . . *we know virtually nothing about the genetic changes that occur in species formation.*"² The evolutionary concept postulates that all living beings on this planet have ultimately a common biological origin, and that complex organisms have gradually evolved from more primitive ones. This contention does not logically follow from microevolution as described by population genetics.

Obviously Ruse argues that random mutations provide a sufficient source of new genetic variation for macroevolution to occur. He doesn't think it necessary to provide a quantitative basis for this hypothesis. The reason is obvious: Any quantitative calculation that has been done to see if random mutations could generate enough new biological information for evolution to occur has been overwhelmingly against this hypothesis.³⁻⁵ M. P. Schützenberger from MIT concludes his quantitative study of evolution models by saying: "Thus . . . we believe there is a considerable gap in the neo-Darwinian theory of evolution, and *we believe this gap to be of such a nature that it cannot be bridged within the current conception of biology.*"⁶

Ruse hopes to bridge this gap by the action of selection on random variation: "Natural selection allows the successes, but 'rubs out' the failures. Thus, selection creates complex order, without the need for a designing mind. All of the fancy arguments about a number of improbabilities, having to be swallowed at one gulp, are irrelevant. Selection makes the improbable, actual." (p. 308)¹

However, the calculations cited *include* the operation of selection. Thus "now we have less excuse for explaining away difficulties by invoking the unobservable effect of astronomical numbers of small variations."⁶ Hence macroevolution does not follow even if we accept Ruse's views on microevolution. But it is by no means certain that those are true, either.

The amount of hidden variation is the most central problem of population genetics, and two principal predictions have been made. One is called the *classical theory*, defined by H. J. Muller, M. Kimura, T. H. Jukes and others. It assumes (in a simplified version) that at nearly every locus every individual is homozygous for a 'wild-type' gene; heterozygosity is rare; mutations are mostly deleterious and natural selection acts as a 'cleansing agent' to free the population from genetic defects. The *balance theory* pioneered by T. Dobzhansky and defended by F. J. Ayala and others maintains the opposite: Nearly at every locus every individual is heterozygous. Hence it must be assumed that some sort of 'balancing selection' is in operation

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that maintains the alternate alleles in the population. (Both hypotheses have of course been considerably refined.^{2, 7)}

The two hypotheses make different predictions about the amount of variation in a population; under the balance hypothesis, there is a great deal of variation in the population, to such an extent that one cannot really speak of a 'wild type' at all; the classical theory, in its most extreme form, predicts that there is very little variation within a population, and according to Lewontin the evolutionary program would be quite hopeless if the classical theory were true.

Naturally, Ruse supports the balance theory. But unfortunately, it is not really known whether or not the balance theory is true. Lewontin cites very strong reasons to reject both the balance and the neo-classical theory.² One can almost sense his frustration as he writes, in view of this dilemma: "How can such a rich theoretical structure as population genetics fail so completely to cope with the body of fact?" (p. 267)

For Ruse, the balance theory is a good stick to beat creationists with: "Most particularly, the Creationists fail through ignorance of the incredibly significant implications of the balance hypothesis. A group of organisms is not sitting around, waiting for a good new mutation to occur as the need arises, which mutation will then be cherished by selection. Rather, all the time, there is massive variation within populations, waiting to be drawn upon, as the need arises. . . . Thus selection can create new features, because there is a veritable bank or library of mutations, to draw on." (P. 307 f.)¹

Although there are some examples which support this statement, as an explanation for the origin of species it is almost certainly false. While it is true that there is a great deal of genetic variation in populations, on the other hand it can be demonstrated with many examples that the amount of variation present is very clearly limited.

In 1800, experiments were conducted in France to increase the amount of sugar in table beets (at the time around 6%). Artificial selection was conducted on a large scale, selecting the sweetest to produce seed for the next crop. By 1878 the average sugar content of the table beets had risen to 17%. However, further selection failed to increase the sugar content from there on; the limits of genetic variation had been reached.

A similar example is the reduction in the number of bristles on the thorax of fruit flies by artificial selection and breeding. In each generation, the number was reduced, until the 20th generation, after which the number remained the same. The limit of variation by artificial selection had been reached, and any experiment involving cross-breeding and artificial selection, even if it proves the existence of great genetic variations, always demonstrates the limits of the potential for variation fairly soon.

In the opinion of the well-known zoologist Pierre Grassé, the limits of variation established by artificial selection are in profound contradiction to the Neo-Darwinian argument.⁴ For 10,000 years, the dog has been subjected to artificial selection, revealing a great amount of variation, but not allowing the emergence

of a new species. The genetic potential is limited. Grassé applies a similar argument to other domesticated animals (cows, bred for 4000 years; chickens, bred for 4000 years; sheep, bred for 6000 years).

Grassé furthermore argues that artificial selection produces a much greater variety than natural selection. As an example he compares the dog and the jackal which he considers to be closely related. The dog (*Canis familiaris*) and the jackal (*Canis aureus*) are genetically related (in the evolutionary model) and are subject, with some minor differences, to the same kind of mutations. The jackal, however, appears to be very stable genetically, whereas the dog species is divided into numerous races and sub-races. Grassé concludes that this is due to the fact that the dog has been subject to artificial selection whereas the jackal has only been subject to natural selection. The action of natural selection may differ from the way postulated by the Neo-Darwinian view. For example, it is not at all clear to what extent the evolution of enzymes and other molecules is due to natural selection and to what extent it is the result of the chance accumulation of mutations. Lewontin explains that "it has proved remarkably difficult to get compelling evidence for changes in enzymes brought about by selection, not to speak of evidence for adaptive changes . . ."⁸

Quite compatible with Grassé's view, but incompatible with Ruse's understanding of the action of natural selection, is the Red Queen hypothesis formulated by Leigh Van Valen. It postulates essentially that the environment is constantly decaying with respect to existing organisms. The function of natural selection then is to enable the organisms to maintain their state of adaptation, rather than, as Neo-Darwinism would have it, to improve it. Van Valen obtained evidence for his hypothesis from paleontological data. He plotted the extinction rates of two classes of marine invertebrates and compared them with the duration of survival of living types. The curves compared very well with the predictions of the Red Queen hypothesis, and contradicted the model that natural selection improves the state of adaptation of the organisms.⁸

This brings us to the subject of paleontology. The dilemma of modern paleontology is described very succinctly and honestly by Stephen Jay Gould: "The history of most fossil species includes two features inconsistent with gradualism: 1. *Stasis*. Most species exhibit no directional change during their tenure on earth. They appear in the fossil record much the same as when they disappear; morphological change is usually limited and directionless. 2. *Sudden Appearance*. In any local area, a species does not arise gradually by the steady transformation of its ancestors; it appears all at once and 'fully formed.'⁹ Simpson already explained that 'there is in this respect a tendency toward systematic deficiency in the record of the history of life. It is thus possible to claim that such transitions are not recorded because they did not exist, that the changes were not by transition but by sudden leaps in evolution.'¹⁰

To explain the lack of evidence of gradual transitions in the fossil record, Niles Eldredge and Stephen J. Gould formulated the theory of 'punctuated equilibria.' The main tenets of this theory could be briefly

summarized as follows: (1) Intermediate forms exist only in small populations, which are less likely to leave a trace in the fossil record than large ones. (2) Speciation occurs rapidly in small isolated populations, followed by long periods of stasis. (3) Intermediate forms did not exist in the same place as their ancestors and were hence not likely to be preserved alongside them.^{11, 12} Instead of gradual evolutionary change, this theory predicts periods of long stasis interrupted by sudden bursts of rapid evolution — hence punctuated equilibria.

Ruse goes to great lengths to demonstrate that the theory of 'punctuated equilibria' is in conflict with orthodox Darwinian theory, and then, as defender of this orthodoxy, proceeds to attack this new threat.

The attack on the Eldredge/Gould model proceeds along two lines:

(1) 'Gradualists' try to demonstrate that gradual transitions actually do occur in the fossil record.

(2) Critics of the 'punctuated equilibria' approach attempt to show that the mechanism of evolution implied by this theory is implausible.

Considering the fossil evidence certainly makes Ruse somewhat uncomfortable. Nonetheless he argues: "Although it is conceded that there are many gaps in the fossil record, it is countered, nevertheless that there is a sizeable number of well-established gradual changes to be found in the record. Hence, given all the factors making fossilization improbable, Darwinism remains totally plausible." (p. 218)¹

To use one of his own metaphors, he is "putting on a little bit of a brave face" considering that it becomes apparent from his own words that the "well-established gradual changes" which he quotes are actually quite vigorously disputed. One of the foremost defenders of the "gradualist" approach in recent times has been P. D. Gingerich, a vertebrate palaeontologist at the University of Michigan. Gingerich believes that sequences of fossil mammal teeth which he has analyzed in detail show gradual changes in size which in some branching lineages lead to a new species. Gould and Eldredge have replied that the evolution Gingerich believes to have observed in the genus *Hyopsodus* is too slow to be of any significance.¹³ Chris Paul comments that even in Gingerich's best data, *Hyopsodus simplex* and *Hyopsodus miticulus* appear suddenly: "even if Gingerich is correct and his new species can be traced back to their points of origin . . . the fact remains that most appear abruptly in the fossil record, many with no trace at all of an ancestral form."¹⁴ Recently West published a study in which he followed the descendants of Gingerich's *Hyopsodus* through a middle Eocene formation which in evolutionary terms covers at least one million years, and found no evidence of evolutionary change.¹⁵ The implication is that even if *Hyopsodus* did evolve gradually in Gingerich's study site, they manifested prolonged stasis soon afterwards. It appears that Gingerich's results are very tenuous at best.

The words of G. G. Simpson are still true to this day: "Nearly all categories above the level of families appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequences."¹⁶

S. M. Stanley explains the evidence in the following way: "The examination of any well-fossilized invertebrate group will show that many family level transitions have occurred during intervals in the order of 50 My. Thus, documented rates of large-scale evolution are so high that, for phyletic evolution to have played a major role in large-scale transformation, phyletic transitions from genus to genus within about 5 My would have to be commonplace in phylogeny . . . In fact, only rarely has a lineage been found to yield what is considered to be a new genus. On the contrary, an average *species* of marine echinoids, bivalves, gastropods, or brachiopods has survived for at least 5 My without even evolving enough to be regarded as a new species."¹⁷ Furthermore, "The only invertebrate taxon for which phyletic intergeneric transitions have been claimed with any frequency, however, is the *Ammonitina*, and as Hallam noted, taxa of this group are grossly oversplit, so that most lineages treated in this way should actually be assigned to single genera. In fact, many ammonite species exhibit an extraordinary degree of variability. Morphotypes previously regarded as representing discrete genera have been found to occur, with intermediate forms, in single populations."

One frequently cited example of progressive evolution in the fossil record is the progressive decoiling of ammonites during the Cretaceous. This was supposedly the final phase in the evolution of ammonites, in which they began to change their form and structure. As is well-known, ammonites became extinct at the end of the Cretaceous period. However, next to the 'heteromorphous species we also find those with normal shells. The latest explanation postulates that in what could almost be called reverse evolution' coiled shells re-appeared. Uncoiled ammonites are not only known from the Cretaceous, but can also be found in the Jurassic and Triassic formations. The whole gradualistic explanation collapses.¹⁸

The ammonites are a particularly rich field of disputable gradualistic interpretation (see for example David J. Tyler's recent article on "The Evolution of *Gryphaea Arcuata*"). Another example concerns the development of lobe formations. What started as a wavy structure line at the point where the chambers were separated, progressively changed into a zig-zag line and finally into a complicated pattern — that's the evolutionary model, as recently described in *The New Scientist*. Scheven, however, has demonstrated that "in contradiction to this rule, the Permian genera *Cyclolobus* and *Perrinitis* exhibit the complicated lobe formation, just like the Triassic genera *Ptychites*, *Sturia*, *Pinacoceras* and *Rhacophyllites*, while *Neolobites* — one of the latest ammonite genera in the Upper Cretaceous — exhibits the most primitive suture lines, and the Cretaceous genera *Engonoceras*, *Tissotia*, *Platylenticeras* and *Buchiceras* exhibit the lobe lines of the Triassic Ceratites, as an 'early' stage in the evolutionary sequence."¹⁸ (p. 88) Thus Scheven has disproved one of the most impressive examples of progressive evolution in the fossil record.

Ruse believes that one of the best transitional forms has been preserved in *Archaeopteryx*, 'firmly intermediate between reptiles and birds' (p. 220)¹ He cas-

tigates Stephen Jay Gould and the Creationists alike for not taking it seriously.

Unfortunately for this argument, the days of *Archaeopteryx* as a "missing link" are coming to an end. In a series of studies, L. D. Martin and his co-workers have demonstrated the similarity between *Archaeopteryx* and other Mesozoic birds, and have also compared them to various groups of reptiles. It appears that the pioneering studies by J. H. Ostrom on which the current interpretation of *Archaeopteryx* is based, were mistaken in certain crucial points. "We think that many of these 'coelurosaurian' features are incorrectly identified. This is certainly true of the tarsal region, where *Archaeopteryx* has a pretibial bone, fibula and calcaneum of the avian type. In the dentition, *Archaeopteryx* has unserrated teeth with constricted bases and expanded roots like those of other Mesozoic birds."¹⁹ If the phylogeny of birds is as far removed from the currently accepted model as Martin and co-workers claim, then *Archaeopteryx's* status as missing link goes by the board.²⁰⁻²³

Stanley's observations on the invertebrate fossil record also apply to vertebrates. Thus Stanley writes that "phyletic evolution will seldom accomplish a genus-level transition within a mammalian lineage spanning 5 My. Even in 20 My, rather little phyletic change is to be anticipated, and, in fact, few mammalian lineages survive as long as this."¹⁷ (p. 129)

An interesting example of the problems gradualists have with the empirical evidence of the fossil record is an interesting fossil bat studied by Glenn L. Jepsen from Princeton University. The bat was found in early Eocene deposits in the Green River Formation in Wyoming. The bat was very well preserved and remarkably similar to modern bats. In a public lecture Jepsen described the following problem that this fossil poses: If one has a fully developed bat which resembles modern bats very closely (including the highly developed echolocator equipment that modern bats have) in the early Eocene, ie. 60 My old, at a time when the Class Mammalia was in the relatively early stages of its evolution, it follows that the evolutionary precursors of that bat would have had to extend down into the Paleozoic Era. In the evolutionary scheme of things, this would be completely out of the question.²⁴ (Lubenow 1980).

It appears therefore that on the whole the fossil record would support the model of 'punctuated equilibria' rather than the gradualist model. Indeed, Creationists would go much further than that. The gaps in the fossil record are far too persistent for the Eldredge/Gould model to be adequate. As Anderson and Coffin explain, "The Punctuated Equilibria model would not predict that we would find an abundance of transitional forms. However, even organisms that are evolving in isolated populations would have some probability of fossilization. Occasionally, some fossils would be fossilized and discovered to provide some "stepping stones" in the valleys between the hills of fossil finds.

This prediction is even more reasonable when we realize that it would take numerous species transitions to bridge the gaps between organisms that have evolved major adaptive structures (wings, flippers).

According to Steven Stanley of Johns Hopkins University, 'ten or so species-to-species phyletic transitions are insufficient to produce the enormous degree of change that occurred in the origin of such divergent taxa as bats and whales.'²⁵

Gradualists generally cite the improbability of fossilization and the resultant incompleteness of the fossil record as an explanation for the absence of transitional forms. "Punctuated equilibria" theorists argue that the fossil record is complete enough to make reliable statements about the course of evolution.

A. B. Shaw (see additional references) has attempted to demonstrate on a statistical basis that for all practical purposes, we can rely on the ranges of fossil species for accurate correlation.

Chris Paul¹⁴ comments, "Although correlation was Shaw's main concern, it follows that if the fossil record is reliable for this purpose, it is probably reliable for other purposes as well. Indeed the very fact that we can correlate, recognize faunal provinces, reconstruct past climatic belts and so on argues strongly that the fossil record is adequate for all our purposes. To cite ludicrously obvious examples, literally millions of Mesozoic and Tertiary fossils are known, yet not one of them is a Trilobite. On the other hand, hundreds of thousands, perhaps millions of Palaeozoic trilobite specimens are known. If this distribution is due to the imperfection of the fossil record, as Lyell once suggested, why are all known trilobites only one part of the record. How did they become un preservable and where are they now? It is common sense and the simplest hypothesis to assume that trilobites only occur in Palaeozoic rocks because they only existed in the Palaeozoic."

This general argument was supported by Shaw with a more rigorous statistical analysis in which Shaw sought an estimate of the probability that an observed distribution of fossils is due to failure of preservation or collection.

There are other ways of testing the completeness of the fossil record than a large-scale statistical analysis of faunal provinces.

Consider for example known gaps in the fossil record. It occurs sometimes that a species appears at a certain level, then there is a gap and then it reappears. It seems reasonable to assume that the species in question actually existed during the time represented by the gap and that its absence just represents an incompleteness in the fossil record.

As a test of the fossil record of cystoids (extinct Palaeozoic echinoderms), Chris Paul plotted the record at series level of all families known from one or more series. It turns out that on average for every five families known to have existed during any one series representatives of only four have been found! Chris Paul concludes that at this level the fossil record is at least 23% incomplete. Similarly the fossil record of modern groups of amphibians is at least 30% incomplete when the same method is used at epoch level during the Mesozoic and Tertiary.

However: "The incompleteness of the fossil record of cystoid families may be higher than usual for a shelly group. They are relatively rare and their skeletons fall apart very rapidly after death. Rapid burial

is particularly necessary for their preservation, whereas this is less vital to the preservation of ammonites, gastropods, bivalves, brachiopods, etc. The records of these groups may well be nearer the 90% end of the spectrum."¹⁴

The meaning of this is that even in groups where it is considered that the record is fairly incomplete, it is still 70% complete when a statistical analysis is made.

In the context of the observations made by Stanley and others, such estimates are a strong argument against any gradualistic interpretation of the fossil record.

Paradoxically, the observations by Gingerich, Kellogg, Ozawa²⁶⁻²⁸ and others of small gradual changes argue *against* a gradualistic interpretation, because of the absence of such a large number of transitional forms required in the gradualistic model. If their gradualistic model is true, and if the fossil record is complete enough to allow us to see such small-scale change as Gingerich, Kellogg and others have claimed to demonstrate, how is it possible then that larger scale change which requires a good number of transitional forms, is completely unrecorded?

Strangely enough, the arguments by Gingerich and others can be used against the gradualistic model, rather than for it, unless the fossil record contains statistical fluctuations so large as to make it completely impossible to decide between alternate theories. This is also the result of a study by David J. Rodabaugh in which he argued on a rigorous statistical basis that given the large number of missing links we can say that the probability that they ever existed is vanishingly small.²⁹

Furthermore, consider the 'Cambrian explosion,' i.e. the sudden appearance of a great diversity of life forms in the Cambrian without signs of many precursors, when "the entire system of life arose during about 10 percent of its history surrounding the Cambrian explosion some 600 million years ago."³⁰ Gould successfully demolishes one attempt after another to explain this phenomenon. However, that the model of punctuated equilibria should successfully account for the Cambrian explosion also stretches credulity to its limits. Paleontologist Chris Paul, by no means a creationist, admits that "the Eldredge and Gould model helps to explain the sudden appearance of fossil species, but it is inadequate to explain the simultaneous appearance of many forms of life . . . or, for that matter, the sudden disappearance of many unrelated species."¹⁴ (p. 215) Thus the new theory fails precisely at the points where it counts most.

The second criticism of 'punctuated equilibria' by gradualists concerns their model of speciation. Anderson and Evenson³¹ (1978) have done a study on the sizes of the geographic ranges of species of North America terrestrial vertebrates which are considered to have diverged recently. Mark Ridley comments, "Although uncertainty exists about just how recently the pairs of species diverged and about the relation between range and population size, Anderson and Evenson's data does not support Eldredge and Gould's claim that speciating populations are very small."¹² John Maynard Smith has argued that the total rates

of mutation are lower in smaller populations, and this may lead to lower rates of evolution.³²

Naturally, the creationist arguments against the Neo-Darwinian mechanism of evolution apply with a vengeance to the theory of 'punctuated equilibria.' If quantitative calculations make gradual evolution appear inconceivable, rapid evolution is quite impossible.

Eldredge and Gould are aware of this problem and realize that they must find mechanisms of speciation that go beyond Neo-Darwinian microevolution. A change in a chromosome (eg. a translocation or an inversion) within one local population is suggested as a mechanism for rapid speciation. Mark Ridley comments: ". . . even given a correlation between chromosome differences and speciation, it is not obvious which is cause and which effect, nor can we be sure that chromosomal speciation would necessarily produce punctuated evolution."¹² Ruse is quite scathing: "Again, if one looks at some of the proposed chromosome species mechanisms that so excite Gould, one suspects that orthodox evolutionists would like more proof as to their universal nature." (p. 218)¹ More recently, Gould has proposed large mutation as the main cause of punctuated equilibria; this strikes me as a counsel of despair in the absence of a plausible mechanism.

Another concept introduced by Gould and Stanley is the concept of "species selection." They believe that "species play the same role in an evolutionary trend that individual organisms, which do not change evolutionarily during their life, play in the adaptive processes of microevolution."³³ Species selection is said to direct evolutionary trends within clades.

However, species selection does not really address itself effectively to the problems of the mechanism of evolution in the model of "punctuated equilibria," for the following reasons: (1) By definition, species selection does not explain speciation. It is an evolutionary process above the species-level. The problem of speciation hence remains unresolved.

(2) It may also contradict the model of speciation in the 'punctuated equilibria' interpretation. Species selection as a way to explain evolutionary trends within clades obviously only makes sense if the competing species are reasonably closely related. However, the Eldredge/Gould model claims that the speciation occurs rapidly in small isolated populations, and that intermediate forms did not exist in the same place as their ancestors and were hence not likely to be preserved alongside them. In that case, however, it is hard to see how species selection can take place, because it presupposes that two closely related species compete for the same niche.

Many of the gaps in the fossil record which the theory of 'punctuated equilibria' is supposed to explain are of such a nature that none of the accepted mechanisms of evolution, including the ones proposed by Eldredge, Gould and Stanley, is sufficient to account for rapid evolution on such a scale.

We are hence faced with a remarkable paradox: The paleontological evidence overwhelmingly favors the interpretation of 'punctuated equilibria' over against the 'gradualist' model, whereas the evidence from

population genetics overwhelmingly favors, *if any*, the gradualist model.

For creationists, the answer is clear: Neither model accounts for the fossil record. Only the creation model will do.

Ruse, of course, does not leave us in doubt about his views on creationism: "I believe Creationism is wrong: totally, utterly and absolutely wrong." (P. 305)¹

This statement does not become true just by repeating it again and again, which is what evolutionists have confined themselves to doing until recently. Ruse devotes the final part of his book to his critique of creationism. Let me briefly touch on some of the main arguments.

Creationists have often argued that the 2nd law of thermodynamics is in contradiction to the concept of evolution. Ruse attacks this argument on the basis that the law only applies to isolated systems. If one reads the technical literature on this subject, eg. by Prigogine, Nicolis and Eigen, one realizes that it is not as simple as Ruse would have us believe. Prigogine is very well aware of the problems the 2nd law causes for evolution; hence his valiant efforts over many decades to find a way to overcome them. Creationists have, of course, dealt quite effectively with Ruse's objections.^{34, 35} Of course thermodynamics does apply also in non-isolated systems (albeit in somewhat different form). It is difficult to believe that random forces acting on a system like the pre-biological earth-sun system can produce order. The longer a system is subject to random forces, the more random the distribution of molecules is likely to become. Over time, the system is considerably more likely to approach equilibrium rather than to consistently depart from it. What Ruse would have to show is that the energy influx from the sun causes the earth in its pre-biotic stage to systematically deviate from equilibrium, and that he cannot do.^{34, 36} I have written a survey of the various evolutionary self-organization models in thermodynamics advanced in recent times.³⁷ Hence I am reasonably familiar with the literature in this area. While Ilya Prigogine, Manfred Eigen and others have obtained interesting and useful results, I am not convinced yet that the thermodynamics problem of evolution has been solved or will be solved in the foreseeable future. Creationists argue that the self-organization of matter seems to be against the laws of nature as we know them.

Ruse does not seem to quite understand the second argument from thermodynamics as applied to evolution, which considers the correspondence between entropy in statistical mechanics and information theory. The argument is that the coded order which is present in DNA is not a property of matter itself; it is information given by the arrangement of nucleotides which is not contained in the physico-chemical properties of DNA *per se*. Creationists have argued that the information content of such codes cannot have developed from random processes or 'noise.' Ruse seems to be unaware (p. 307) that an analogue to the 2nd law of thermodynamics exists in information theory.^{5, 35, 38, 39}

It would appear that Ruse has overlooked a great deal of creationist literature. The next issue dealt with concerns the origin of life: "We know full well that

work on this problem has far to go. But, present progress surely merits detailed treatment, not a back-of-the-hand dismissal. Take the Creationists' claim that Stanley Miller's synthesis of amino acids proves nothing, since amino acids are not living things. Whoever said they were? Miller himself certainly never did want to claim that amino acids are living things. The point is that their synthesis does seem to be an important stage in the natural production of life, and can rightly be respected as such. Take also the Creationists' flat claim that amino acids would not have survived — "protection would not have been available on the primitive earth." At the very least, this claim needs justification. Simply stating your position is no argument." (p. 307)¹

It appears that Ruse has not considered the detailed analyses of modern theories of chemical evolution given by, for example, D. T. Gish,^{36, 40} and A. E. Wilder-Smith.^{35, 41} The argument that the amino acids formed by a Miller-type synthesis under primitive earth conditions could not have accumulated in great concentrations because their rate of destruction would be of the same order as their rate of production has been well-supported by empirical calculations.³⁶ Apparently Ruse hasn't read these technical papers by creationists on this issue.

Again, Ruse says, "it would be nice to see the Creationist take on the question of the horse, which is one of the best documented cases of evolutionary change." (p. 311)¹ Ironically, the horse is discussed in one of the books that he cites.⁴² Of course, more thorough treatments of the phylogeny of the horse from a creationist standpoint are available, see for example Cousins,⁴³ and Scheven.¹⁸

About the Galapagos finches Ruse writes: "They are nowhere to be found in the Creationist discussion!" (p. 309)¹ He must not have spent much time looking, because a number of creationist discussions on this topic exist.^{18, 44, 45}

The question of human footprints in Cretaceous formations in the Paluxy River Bed, Glen Rose, Texas, is discussed. The impression Ruse gives is that they might be misinterpreted dinosaur footprints. It is very clear to anyone who has actually seen the prints (and Ruse must have at least seen photographs of them in the books he cites) that some of the footprints must be human or forgeries. Analysis has shown that a good number of them appear to be genuine and are certainly not carvings.¹⁸ They were not actually discovered by creationists, but rather by a very orthodox paleontologist by the name of R. T. Bird in 1939. Bird described his findings in his publications, but since they didn't fit into his scheme of things, he declined to ascribe any particular interpretation to them. If Ruse had read Creationist literature thoroughly, he would also know that human footprints were discovered in Carboniferous rocks.^{46, 47}

If any of these findings are inadmissible or falsely interpreted, this would need to be established and argued rather more conclusively than has been done in the book.

The example of radiometric dating techniques is revealing. Ruse claims that "no proof is offered for the Creationist claim that processes of decay may have

speeded up . . ." (p. 317).¹ The context makes it clear that he is saying that creationists are suggesting that rates of radioactive decay have not been constant, but have not made any attempt to give reasons for this. Quite to the contrary: Creationists have specified both the mechanism of the change in the rate of radioactive decay and *empirical evidence that this actually has occurred*.^{48, 49} Ruse may disagree with these theories, but his comment that no attempt has been made to explain the changes in the rate of radioactive decay is plainly false. Furthermore, he seemingly does not think it necessary to deal with examples of discrepancies in radiometric dating results cited in creationist literature. Some of this material is covered in *Scientific Creationism* by H. M. Morris, which Ruse refers to frequently, but apparently has not read thoroughly.

Since Ruse's book is "intended to be a refutation of the Creationist position" it is truly astonishing that among the approximately 290 books and papers cited in his bibliography there are merely six creationist titles! One is left wondering whether he has read a single technical study by creationists on any of the major issues under discussion. The net effect is that to this day the arguments by creationists have remained unanswered, and Ruse's book has not really changed the situation.

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A ROSE BY ANY OTHER NAME WOULD SMELL AS SWEET — MYSTERY OF PRESENCE

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The presence of anything is not explained by either naming it or manipulating it.

The presence of the world, sun, moon and stars is not self-explanatory. The phenomena of life are manifest. We can study and research their actions and reactions. However, all such activity has not accounted for their presence. All phenomena are the data, the given of experience. The most fundamental and important decision in all of life is the decision of the soul as to both its own source and the source of the manifest phenomena. This is a decision for the phenomena do not demand a given attitude.

To decide that the source of phenomena is chance is to attribute the manifest orderliness of human thinking and the world about which we think to a foundation of arbitrary and meaningless patterns of atoms which have no teleological design or purpose. This despite the manifest physical evidence of intentionality toward an end in the development of both plant and animal from seed or sperm to mature individual. This decision finally undermines any ontological basis for maintaining that any pattern of thought is true or false since the basis underlying thought is random atomic patterns.

The chief, and finally the only, reason for asserting that thought and all other phenomena are based in chance and not an intelligent Creator is that the creature may assert that his pattern of thought transcends his lifetime and is, in fact, the organizing thought of all reality — usually called God in believing contexts. To put it bluntly, the denier of revelation is presuming to give his own "better" revelation of the origin of all things. In so doing, he asserts his ego to be transcendent of his own experience and lifetime and begins to make "definitive" statements about processes and actions taking place before he was born and without reference to any historical human record. His *hubris* is *literally* boundless.

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Careful thought, however, makes clear that the pattern by which *any* phenomenon (building, rock formation, species distribution) came to manifest its present phenomenological appearance can only be *known* if one of three conditions is true:

1. The observer has watched the phenomenon in its manifestations through time.
2. The observer has access to historical records of observation of the phenomenon (which may be more or less accurate and therefore any deduction must be tentative).
3. There is a manifest logic to the pattern of the phenomenon which is extrapolated into the past.

The last seems to be the favored method of the evolutionists. Extrapolation, however, is only as accurate as the initial perception of the pattern. If the gestalt used for extrapolation is false, the entire "knowledge" structure regarding past events crumbles.

This takes us back to the fundamental question of assumption. Am I to assume the final authority of my own thought, which logically must be then based in chance, or am I willing to submit my thought to a linguistic action claiming to have its source in the Creator of all things?

If I take the first choice I end up in Bertrand Russell's (And Sartre's and Heidegger's and . . .) "the unyielding foundation of modern science is despair" because I have no linguistic act which transcends the decay of the creature. If I submit my thought to the Creator and His marvelous promises of eternal life and a new heaven and a new earth my life deepens and grows brighter towards His manifest glory daily.

As a bonus, I find that the Word of God accurately reflects both the behavior of man and the submission of the world to entropy — but without a counsel of despair. Truly a man's choice of the fundamental linguistic structure to which his soul attends makes *all* the difference.

A THOUGHT

The farther out into scattered space we look, the further back in time we should be seeing. And as we look further back in time, we should (according to the current theory) see a more densely packed universe, as it was then much younger. *In fact, we find*

just the opposite. This might be called the Big Bang Paradox; and it shows that the Big Bang Theory *cannot* be correct.

Suggested by A. W. Mehlert, Dip. Th.

HUMAN GROWTH AND DEVELOPMENT, AND THERMO II

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A brief explanation of the two laws of thermodynamics is presented. Thermo II applies only to open systems, since there is no such thing in the real world as a closed system. The four criteria for increasing order in a system are presented by comparing a building, growing plant and growing animal. The failure of the evolution model to provide for a directing program and conversion mechanism to achieve order from disorder is noted, also the qualifying criteria for creative order and degeneration of the creation model was presented. Since the starting cell is more complex or at least equal in complexity than any cell in the mature organism, human growth and development are not violations of Thermo II. Although entropy is never zero, creationists should practice health fitness in order to decrease the rate of increase of entropy in their lives and to witness for the Gospel of Christ and its corollary doctrine of creation.

Thermodynamics in a Nutshell

Thermodynamics is a branch of science that "is concerned with the relations between heat and mechanical energy or work, and the conversion of one into the other."¹⁰ Historically, it developed from the study of converting heat by heat engines into mechanical work which is the basis of our modern industrial operations. It is of prime importance to the various models of origin.

The study of thermodynamics has resulted in the promulgation of two physical laws of nature: the first law of thermodynamics (Thermo I) and the second law of thermodynamics (Thermo II).

Simply stated Thermo I declares "energy can be neither created nor destroyed: it is transferred from one place to another many times changing its form." In other words, the loss of energy anywhere is always accompanied by an equal gain of energy someplace else. In the total view, the energy of an isolated system always remains constant. The totality of matter and energy is always conserved. When some form of matter is converted to energy, e.g., the Einstein equation $E = mc^2$, c being the velocity of light, the matter is not destroyed but merely transformed into some other form of energy.

Thermo I correlates neatly with the creation model. The reason why no energy can now be created is because only the Creator, the Divine Intelligence behind the universe, can create energy. This Creator has revealed to us that He has "rested from all His work which He created and made" (Genesis 2:3). The reason why energy cannot now be destroyed is because the Creator is now "upholding all things by the word of His power" (Hebrews 1:3). The writer of Ecclesiastes (3:14) alludes to Thermo I: "I know that, whatsoever God doeth, it shall be forever: nothing can be put to it, nor anything taken from it."

Thermo II is sometimes called the law of increasing entropy. Entropy is a thermodynamic quantity that measures the randomness of a system — the greater the randomness (disorder) within a system, the greater the entropy.¹⁴ Simply stated, whenever there is an energy transformation, there is a loss of usable energy. Lindsay clarifies this law as follows: "There is a general natural tendency of all observed systems to go from order to disorder, reflecting dissipation of energy available for future transformation — the law of in-

creasing entropy."⁴ According to Prigogine: "Entropy, in short, is the measurement of molecular disorder. The law of the irreversible increase in entropy is a law of progressive disorganization, of the complete disappearance of the initial conditions."⁹

Heat will naturally flow from a hot object to a cold object, but not from a cold object to a hot object. This is because in order for work to be accomplished, the available energy has to flow from a higher level to a lower level. When it reaches the lower level, the energy is still in existence, but no longer available for performing work. This is an example of the total irreversible flow of heat in quantitative terms. For this reason, no natural process can be 100% efficient, with all of the expressed energy converted to work. Some energy must be used to overcome friction while other amounts of energy are given off as heat. For the non-scientific layman, this means there is a natural law, proven both by statistics and experience, that causes all systems to "evolve" from order to disorder or complex to simple.

Thermo II is devastating to the evolution model as it infers that evolution in the vertical direction, i.e., from one degree of order and complexity to a higher degree of order and complexity, is highly improbable. Entropy is in direct contradiction to the "natural increase in order" necessary for the veracity of the evolution model.

Most evolutionists tend to ignore the damaging effect of entropy to their model of origins; others seek refuge in an "open system" argument. They argue that Thermo II applies only to closed systems from which external sources of information and energy are excluded. They argue that the earth and its biosphere are open systems with a free supply of solar energy and other environmental conditions. They claim there are examples of systems increasing in order and complexity — such as the development of a crystal from a solution, the growth and development of a seed or embryo into an adult plant or animal or the development of a primitive culture into a large complex modern culture — as evidence that Thermo II does not always prevent the development of higher-ordered systems. None of these examples is a proof that entropy is not always in effect. Crystal are not the same as highly-ordered organic molecules. These "dead-end" crystals actually contain less "information" than the solution from whence they came. It is questionable whether they are an "advance" to a higher chemical

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level. Also, the growth from seed to plant, embryo to adult animal and primitive culture to technological culture are not examples of the violation of the law of entropy as will be demonstrated later in this paper.

The "open system" argument of evolutionists is invalid as Thermo II applies only to open systems, since there is no such thing in the real world as a closed system. Layzer has pointed out that "Borel showed that no finite physical system can be considered closed."³

Morris has proposed a comprehensive definition of Thermo II: "In any ordered system, open or closed, there exists a tendency for that system to decay to a state of disorder, which tendency can only be suspended or reversed by an external source of ordering energy directed by an informational program and transformed through an ingestion-storage-converter mechanism into the specific work required to build up the complex structure of that system."⁶ He further stated: "If either the information program or the converter mechanism is not available to that 'open' system, it will not increase in order, no matter how much external energy surrounds it. The system will decay in accordance with the Second Law of Thermodynamics"⁷

Is Human Growth and Development a Violation of Thermo II?

Some evolutionists claim that Thermo II does not apply to living systems. They are motivated by their zeal to claim an entropy decrease during the growth and development of living organisms. They claim that during growth and development there is a definite increase in cellular order and complexity. Growth of a cellular organism can occur in two ways:

1. hypertrophy — increase in cell size
2. hyperplasia — increase in cell number

In both of these processes the complexity and genetic information necessary for growth was initially within the original cell (zygote) of the organism. The original cell in no way acquires this order from any extracellular source. The capacity to achieve maturity is inherent in the starting state of the original cell. Therefore, the starting cell must be more complex or at least equal in complexity than any cell in the mature organism.

Most creationists hold that the original living organisms were created fully grown. As generations of organisms were reproduced, there was an attempt to replicate the original created order. From the initial

Table 1. Creative Order and Degenerative Theories for Creation Model

Criteria	All Living Organisms Creative Order	Degenerative Processes
Open System	All Forms of Matter and Life	All Forms of Matter and Life
Available Energy	Supreme Being's Creative Energy (Thermo I)	All Forms of Matter and Life
Directing Program	Supreme Being's Will (DNA Genetic Codes)	Thermo II (Law of Entropy)
Conversion Mechanism	Supreme Being's Creative Powers	All Energy Conversion Processes

to the final state there is no increase in order. Original order is at best being duplicated. When sin entered the world, the disordering effects of Thermo II started to reduce the order in successive generations by mutations.

McDowell, arguing from information theory, stated: "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 our genes of all of the creatures which came into being at the original creation."⁵

From this standpoint growth, both hypertrophic and hyperplasmic, cannot be considered a violation of Thermo II or an increase in complexity of the organism. The original order (full-grown adult organisms) with their DNA directing programs had to be created by the intelligence of the Divine Designer. Table 1 presents the creative order and degenerative theories for the Creation model.

To put it another way, the increase in order from the observations of growth and development is only apparent and not real. The zygote (fertilized egg) is as complex, or more so, than any future cell in the growing organism. All of the coded information needed for the production of the adult is present in the zygote. No new information is required or added. It appears that almost from the moment of conception, loss of information and order by means of mutations results in the start of various degrees of wear and tear on the cells. This loss of order, or the rate of increase in entropy, may slow down during growth and development, but it never ceases. Evolutionists erroneously tend to believe that this decrease in the rate of increase of entropy is actually a total cessation of increase.

After a certain "peak time of life" is reached by an adult organism in which there is a very small rate of increase of entropy, the rate of increase of entropy accelerates. This is manifested by what we call the "aging process" and finally culminates in death, whereupon the organism attains its maximum state of entropy — a pile of dust.

Williams, a creationist authority in thermodynamics, classifies natural processes into three categories:

1. improvement processes — structures get better and more complex
2. conservative processes — structures remain the same
3. degenerative processes — structures get worse and become disordered¹²

Information theory casts doubt on the possibility of any improvement processes under naturalistic conditions. Therefore, all natural processes that are observed are either conservative or degenerative processes. Both reproduction and growth are conservative processes.

Reproduction merely guarantees conservation of kind. Scientists may never agree on the exact definition of kind (Genesis 1:11, 12, 21, 24, 25); but whatever it is, it was to reproduce itself. Essentially, living organisms were meant to be preserved on this earth through reproduction. Therefore, the activity of reproducing is conservative.

Likewise, in an attempt to preserve the original created order both hypertrophic and hyperplasmic growth are conservative processes. During growth to maturity the organism is simply replicating to a limited degree the original created order. "As the number of organisms increases, the quantity of order increases but not the quality."¹³

The Natural War in Nature — Conservation Versus Degeneration

All through the life of an organism, created order is eroded by various degenerative processes. Conservative processes, however, tend to counter degenerative process, but at best, they can only physiologically "hold even" with the "wear and tear" of degenerative processes. Physical exercise and training have a positive effect on many tissues and bodily systems, but still there is some energy waste during the metabolic processes. It is true that proper nutrition, exercise and rest can have a beneficial health effect on the human individual, but the long-term overall net trend is one of slow degeneration. Even the most pure and disciplined athletes will eventually "wear away and die" because of the natural supremacy of degenerative processes over conservative processes.

The food chain is an attempt to achieve conservation. However, there is a long-term loss of conservative results as the chain is extended. A cow eats thousands of pounds of grain or vegetation to provide man with a few hundred pounds of beef. The energy transfer from plants to protein-in-cow to protein-in-man is a wasteful process. Humans attempt to maintain health through nutritional ingestion, yet our physiological processes are so inefficient that a large amount of the food we eat is thermodynamically wasted.

What may appear to be improvement is in actuality the result of conservative processes overpowering degenerative processes. There is no structural or functional improvement as any apparent improvement would have to result through genetic recombination or some positive change in a cell's directing program.

A Plug for Christian Stewardship

Intelligence and common sense can facilitate conservative processes. Man has conquered some diseases and has the ability to prevent many other diseases that would eventually destroy him.

The creation model starts with the premise that matter and life were created perfect, but since sin entered the world, matter and life are not improving naturally, as evolutionists erroneously believe, but in reality are degenerating. During our early lives, conservative processes may decrease our rate of increase of entropy, but we still have some loss of usable energy although it may not be apparent. At a certain time in life called "physiological maturity" we reach the point of lowest entropy rate, and we appear to be at "peak health." After this peak time of metabolic efficiency is reached, the degenerative processes increasingly outperform the conservative processes. This sudden "downhill trend" is what we recognize as "the aging process."

Therefore, the creationist is concerned about conserving the efficiency of his physiological processes,

because he wants to serve his Creator and fellowman. This should be the incentive and provide motivation to be a good steward of his bodily structures and functions. He also has the command of his Savior to strive for perfection in all things (Matt. 5:48). This can best be done by following the formula for health fitness:

$$\text{Personal Health Fitness} = \text{Nutrition} +$$

Exercise + Rest - Stress - Drugs - Pollution which was discussed in detail in a previous paper.² If we are to spread the truth of creation and the Gospel of Christ to a doubting world, we must "walk the way we talk." We must nurture conservative processes and inhibit degenerative processes in our personal and professional lives. It is my hope and prayer that each reader do his best to inhibit the effect of Thermo II and promote healthful growth and conservation in his life.

Can Thermo II Be Overruled?

Thermo II is overwhelming in its natural tendency to direct nature and life from order to disorder. How do Neo-Darwinian evolutionists deal with this? They commonly by-pass it with the simple statement that the earth is a system open to the energy of the sun, and this proclamation resolves the problem. This response is totally inadequate as much more is needed than an open system and available energy to produce order from disorder. There are four essential criteria that must be met in order to supersede Thermo II and produce order out of disorder. These criteria are:

1. an open system
2. available energy
3. a directing program (code)
4. conversion mechanisms

The evolutionist argument fails to supply the necessary directing program and conversion mechanisms for the overpowering of Thermo II and production of complex materials and life from simple materials.

Table 2 demonstrates how buildings, plants and animals increase from disorder to order using the four criteria. We are all familiar with the way a building is built, and we know that if any one of the four criteria is not met the building will not be built. The same goes for the growing plant or animal.

Table 2. Criteria for Increasing Order System

Criteria	Building	Growing Plant	Growing Animal
Open System	Construction Materials & Environment	Seed & Environment	Zygote (Fertilized Cell) & Environment
Available Energy	Electrical & Mechanical Energy & Manpower	Sunlight	(Proteins, Fats, Carbohydrates—ATP)
Directing Program	Architectural Blueprints	DNA Genetic Code	DNA Genetic Code
Conversion Mechanism	Workmen & Equipment	Photosynthesis	Hyperplasia & Hypertrophy (Messenger & Transfer RNA, & Enzyme Activity)

Table 3 demonstrates the failure of the evolution model of origins to provide for all the criteria necessary for order to result from disorder in the case of

the first living molecule and a population of complex organisms.

Table 3. Disorder-to-Order Theory for Evolution Model

Criteria	First Living Molecule	Population of Complex Organisms
Open System	Complex Inorganic Molecules	Population of Simple Organisms
Available Energy	Sun	Sun
Directing Program	None Known	None (Natural Selection???)
Conversion Mechanism	None Known	None (Mutations, Crystals, Growth of Plant or Animal???)

The evolutionists have a real problem. For how can unordered, unthinking, non-living chemical elements be combined naturalistically into an extremely sophisticated ordered information system? Angrist and Hepler present a balanced view of the problem:

"Life, the temporary reversal of a universal trend toward maximum disorder, was brought about by the production of information mechanisms. In order for such mechanisms to first arise it was necessary to have matter capable of forming itself into a self-producing structure that could extract energy from the environment for its first self-assembly. Directions for the reproduction of plans, for the extraction of energy and chemicals from the environment, for the growth of sequence and the mechanism for translating instructions into growth all had to be simultaneously present at that moment. This combination of events has seemed an incredibly unlikely happenstance and often divine intervention is prescribed as the only way it could have come about."¹

These authors admit that the doctrine of evolution cannot come up with any plausible sources for a directing program or conversion mechanisms that are required for the first self-assembling of the first living organism. In the wonderland of evolutionary thinking — plans draw up themselves, mechanisms design themselves, auto-catalytic conversion mechanisms appear and life generates itself!!! In the real world, every effect must have a cause. Yet, evolutionists call creationists unscientific and anti-intellectual, because they postulate an adequate cause (divine intervention) to account for the marvelous phenomenon of life.

DNA and Information Theory

Deoxyribonucleic Acid (DNA) is the molecule of heredity, and proteins are the basic molecules of structure and function. Both DNA and protein are combinations. In all living systems a directed, inherited sequence of bases of DNA molecules directs production of the specific sequence of amino acids characteristic of each kind of protein. It is this directed information inherent in the DNA molecule that causes proteins and other chemicals to grow and have metabolism. Evolution argues that through time, chance probabilities cause these unthinking molecules to react correctly for growth and development to occur. They claim that living systems can be derived from random,

spontaneous chemical processes. However, left to time, chance and their own natural, chemical tendencies, DNA and protein react in ways that *harm or destroy* a living system and prevent any postulated "evolving" of life. Parker claims that "natural cross links between DNA and proteins contribute somewhat to gene inactivation during aging, and base-amino acid reactions are part of the wholesale chemical catastrophe that occurs in a dying cell."⁸

Yet, once living systems are created and the programmed DNA-protein relationship is established, living cells, which are coordinated sets of non-living molecules, continue to multiply, after their kinds in understandable and predictable ways that certainly violate no laws of chemistry. Given a living cell with favorable environment (open system), sunlight or nutrients (available energy), the DNA genetic code (directing program) and a set of coordinated (not random) translating molecules (conversion mechanisms), living cells use the DNA informational program to continuously make proteins which, in sequence, regulate other cell activities, growth and even the replication of DNA in reproduction. The ability of a living cell to grow, develop, react and reproduce does not derive itself from the properties of the molecules involved, but from the unique features of its directing program (DNA code) and conversion mechanisms (messenger and transfer RNA, ribosomal activity and amino acid activating enzymes or photosynthesis).

Protein synthesis, growth, development and reproduction do not just occur by random reactions. Without a highly organized directing program and precise conversion mechanisms, the cell would have no chance for development and function. Just as the original plan of a building is preserved by the human architect in the drawings and specifications for the building, so the plan of the cell has been stored by the Master Architect in long molecules of DNA inside the cell's nucleus. The DNA molecules act as genetic blueprints, and the precise arrangement of atoms in the DNA molecules contain all of the exact specifications for the construction of all cellular parts. The DNA molecule is somewhat analogous to a language, with four groups of atoms acting as its alphabet. These groups of atoms are arranged in three-letter "words," resulting in a total vocabulary of some 64 words. Sentences in the DNA language system can range from 50 words to hundreds of words in length. During the process of protein synthesis each DNA sentence is translated into a specific protein compound. To make a particular protein, specific enzymes inside the nucleus make a copy of a DNA sentence. The copy, itself a molecule of ribonucleic acid (RNA), migrates out of the nucleus to special organelles called ribosomes, which are able to "read" the nucleic acid language. The reader (ribosome) travels along the RNA molecule, and as each nucleic acid word is read, a particular molecule is added to the growing chain of protein. When the ribosome reaches the end of the RNA sentence the protein is completely synthesized, and it can perform its specific function in the cell.

The salient question is: how did this precise directing program originate? The plan for a building originates in the intelligence of the human architect. Since

no building ever produced itself by random methods over a long period of time, is it plausible to postulate that the directing program in the DNA molecule of the first living cell or groups of living cells was self-produced by random methods? To the rational mind, operating on observable evidence alone, it is much more plausible to believe that this wonderful cellular planning and development was produced by a Divine Designer.

Neo-Darwinism claims that during the original biogenesis of the first living organism the production of information from non-information occurred. Yet, it is common knowledge that according to information theory, codes and simulated information can never arise spontaneously from non-information.

It is clear that cellular chemistry is in no way random in nature, for it is most strictly controlled by "information chemistry" — the chemistry which is directed by codification and information inside the genes and not by random occurrences. According to Wilder-Smith "Codification and information exclude chance and disorder in cell chemistry. Thus the planlessness of Darwinian primeval cell chemistry is eliminated by the planned cell chemistry of codification."¹¹ Evolution lacks a scientifically acceptable explanation of the source of the precisely planned codes within

cells without which there can be no specific proteins and hence, no life.

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A TEST OF THE GENERAL PRINCIPLE OF CREATION

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A recent paper suggested a set of three biological principles for creationism.¹ The first of these is the General Principle of Creation which states that, "increasing levels of complexity of an organism requires increasing amounts and/or detail of information." This principle, like all scientific principles, is tested as to its validity by its conformity to the observed data and its power in making predictions. This paper will test the validity of the General Principle of Creation by comparing it to some observations on the DNA of animals.

If the General Principle is correct we would expect to observe an increase in the amount of DNA in a cell as its level of organization increases. This is a reasonable expectation since the DNA is the information containing portion of the cell and the General Principle requires an increase in information with increased complexity. Thus we should find that animals containing organs have greater amounts of DNA per cell than those having only tissues.

First let us review the taxonomic classification of animals (Table 1). It is interesting to note that taxonomic classification is, at the higher end of the scale, based largely on the systemic organization. Thus the Subkingdom Protozoa consists of organisms which are free-living cells or which form colonies. As examples

consider the paramecium and the volvox² respectively. The Subkingdom Metazoa is filled with multicellular organisms and is divided into three branches. The first of these is the Mesozoa in which the organisms have tissues and the adult is a blastula (ball of cells). These organisms are endoparasites of invertebrates and have not been well studied. Consequently we will be more interested in the Branch Parazoa in which the organisms have tissues and the adult is more than a blastula. This branch is entirely filled by the sponges. The Branch Eumetazoa contain all animals which have organs and organ system construction and is divided into two grades. The first of these grades is the Radiata which contains animals which have radial symmetry such as the hydra, jelly fish, corals and sea anemones. The Grade Bilateria contains the remain-

Table 1. Taxonomic classification of animals

Classification	Morphology
Subkingdom—Protozoa	Cellular & Colonial
Subkingdom—Metazoa	Tissue, adult blastula
Branch—Mesozoa	Tissue, adult more than blastula
Branch—Parazoa	
Branch—Eumetazoa	Organ with radial symmetry
Grade—Radiata	
Grade—Bilateria	Organ system with bilateral symmetry

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ing animals and is itself divided into three subgrades. All of these animals have bilateral symmetry and, unlike the Radiata, have their organs grouped into systems. Subgrade Acoelomata is typified by the flat worms; Subgrade Pseudocoelomata by the rotifers and nematodes and Subgrade Coelomata all the other animals including man.

When we examine the DNA content of animals classified into these subkingdoms, branches and grades we find there is a definite trend of increasing amount of DNA with greater complexity (Fig. 1).³ There should also be considerable segregation within the Class 3 of figure 1 as nearly all the animals are included here. This is demonstrated in Table 2. It can be seen from here that the Parazoa (tissue grade) have more DNA than the Protozoa (colonial grade). Likewise the DNA amounts per cell for the Radiata (organ grade) is still higher and the Bilateria (organ system grade) ranges still higher. While there is considerable overlap within the Bilateria, there is still an evident trend of greater amounts of cellular DNA with progressively higher organisms.

The significance of this increase in genome size with increased levels of organization may be better appreciated by considering the minimal amount of DNA per cell. Britten and Davidson⁴ have compiled a list of organisms and show that there is an increase in the minimal amount of DNA per cell with increased taxonomic grade. They also show that the minimal amount of DNA increases within the grade bilateria as we progress upward from the echinoderms to the mammals. These increases do not fit a mathematically smooth curve; but a definite trend is obvious. They attribute most of this increase to increased genetic regulatory apparatus necessitated by the increased complexity of the organism.

Much of the above argument depends on the assumption that information content is directly related to the physical amount of DNA present. That this

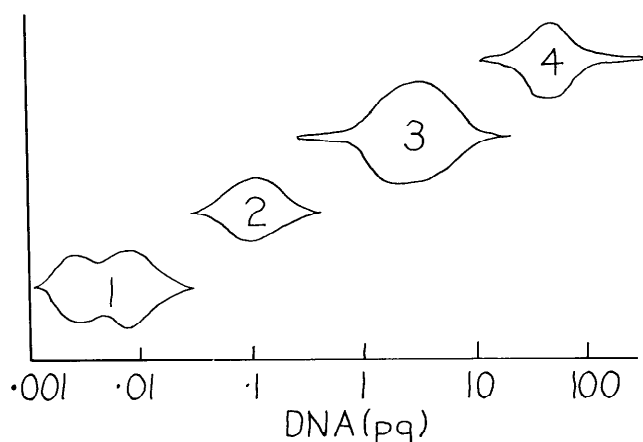


Figure 1. All plants and animals may be divided into the four classes shown when grouped according to the amount of DNA in their cells. Class 1 includes bacteria; 2, fungi; 3, most animals and some plants; 4, plants, salamanders, and some non-teleost fish.

"pg" means "pico-gram," a unit of 10^{-12} gram. The vertical positions on this chart are of no significance; the regions have been arranged thus so as not to run into one another.

A similar representation may be seen in Reference 3.

Table 2. Comparison of DNA content with taxonomic classification

Organism	DNA (haploid pg per cell)	Classification
Protozoa	0.003-0.01	Protozoa
Sponges	0.05	Parazoa
Coelenterates	0.35-0.73	Radiata
Annelids	0.09-5.3	Bilateria
Echinoderms	0.54-3.3	Coelomata
Teleost Fish	0.39-4.4	"
Amphibians	1.2-7.9	"
(anurans)		"
Reptiles	1.5-3.5	"
Mammals	3.0-5.8	"

assumption may not be totally valid can be demonstrated by a simple illustration. Consider two pages of print of equal size with the same number of words on each. On one the words are correctly spelled with correct grammar and punctuation. On the other, half the words are nonsense words. Thus while we have pages of equal size, the one will have a much greater information content. This argument could reasonably be applied to the size of the genome as there is considerable uncertainty about the role of the repetitive DNA which is present in some cells in large amounts.

We can avoid the necessity of this assumption by looking directly at the genome information content using information theory. While this science originally was applied to communications technology it is also possible to apply it to information storage and processing in biological systems.

It is probably intuitive to most that for a signal to contain information it must be non-random in character. Hence the static found between radio stations is easily distinguished from the music obtained when the radio is properly tuned. It is less obvious that there are two ways in which the non-randomness of the signal may be obtained. Gatlin⁵ discusses this in relation to the information content of the genome. A random signal (DNA base sequence) will be at maximum entropy, while a base sequence that contains information will have a lower entropy. This reduction in entropy will be via two components. The first is simply non-randomness in total base composition, or deviation from randomness. The second is the possibility that one base might tend to be preferably followed by a certain other base, or deviation from independence. Deviation from randomness can be detected in base composition data. Deviation from independence is detected from 'nearest neighbor' experiments.⁶

When the total information content is calculated for a variety of organisms it is found that there is not a simple increase in information with higher organisms as shown in Table 3. This would seem to be a violation of the general principle. However, when the two components mentioned above are examined with respect to the total information content a different picture emerges. When the lower organisms increase their information content it is mostly by an increase in the deviation from randomness. In contrast the vertebrates have held deviation from randomness relatively constant and increased their deviation from independence. The minimum value for vertebrate de-

Table 3. Ranges of total information content. See Reference 7. "Bits" are units of amount of information, according to information theory.

	Range (bits)
Bacteria	0.01 - 0.07
Vertebrates	0.02 - 0.03
Invertebrates	0.01 - 0.11

viation from independence is greater than the maximum value for all other lower organisms examined. Significantly it is this deviation from independence that is the most important single measure of the ordering of a sequence of symbols, i.e., information.⁷

Not enough samples have been calculated to determine if there are differences in information content at the various grades mentioned in the first part of this paper. Nevertheless it seems reasonable to conclude that information theory demonstrates a tendency for increased information content with higher organisms.

These observations support the general principle of creation. However, this does not constitute proof of creation. The trend noted here can also be explained in evolutionary terms. This paper does show that the principles upon which neutral scientific creationism⁸ are based are consistent with the observed world.

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THE LIMITS OF HUMAN THOUGHT AND THE CREATION MODEL

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The results of Goedel's Theorem and some of its implications regarding the limits of human thought are examined, especially as they relate to science and origins. The parallel thinking of others is presented and similarities between Goedel's Theorem, the Second Law of Thermodynamics, and language are given. It is concluded that human reason is essentially incomplete and can be validated only by reference to a higher Reason. Hence all "self-explanatory" systems, such as presented by atheistic evolutionists, are ultimately irrational. The creationist paradigm is seen to be the only fully consistent alternative. Two appendices are provided for more detailed discussions of statistical thermodynamics and the essential non-neutrality of science.

Introduction

In 1931 the young mathematician Kurt Goedel presented a proof relating to the nature of mathematical thinking. It is called Goedel's theorem. Ernest Nagel and James R. Newman in their presentation of Goedel's proof suggest that this theorem applies to the axioms of any discipline and, indeed, that it has profound epistemological implications.¹

In this paper the results of the theorem will be briefly presented and then, by analogy, the parallel thinking of others, working independently and using different lines of reasoning, will be shown to have arrived at similar conclusions. It is suggested that such commonality of thought implies a general principle of the limitation and contingency of human reason. This principle will also be related to the second law of thermodynamics and to the question of origins.

The Results of Goedel's Theorem

There are two main results of Goedel's theorem. The first result involves the consistency, or logical orderliness, of a system of axioms (or assumptions). It is always desirable to know that the system is free from contradiction so that any theorems or conclusions drawn from the system will be consistent. Goedel

showed, however, that the consistency of a non-trivial mathematical system of axioms cannot be formally proved or determined from the axioms themselves, i.e., from statements derived from the axioms. Rather, the only possible proof, or determination, of consistency would be one whose rules of inference were *essentially* different and *more powerful* than those of the system in question, i.e., such rules would then be independent or "outside" the system. This would further mean that these new, independent rules of transformation would themselves require a proof of consistency and so *ad infinitum*. There could be no formal, finitistic proof of consistency!

The second result was considered even more astounding since it indicates a limitation of the axiomatic method itself, or incompleteness of the method. Given any consistent set of arithmetical statements, Goedel showed that there are true arithmetical statements that *cannot* be derived from the set. To put it another way: any consistent nontrivial mathematical system is *essentially* or *necessarily* incomplete because there will be true statements (or features, characteristics) of the system which can be determined only by statements outside the system of axioms in question.

An example may help capture the spirit of this dilemma. Consider the statement from a Cretan that Cretans always lie. If the statement is taken as true (Cretans do lie), the problem immediately arises that

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this "true" statement is delivered by a Cretan who is *not* lying in which case the statement is false. Thus, if the statement is true, it is false. In order to evaluate the honesty of Cretans, someone who is not a Cretan but is undoubtedly honest must be used, i.e., someone outside the class or system of Cretans.

Dr. Victor F. Weisskopf, in a recent paper, described the theorem this way:

"The mathematician Goedel proved that a system of axioms can never be based on itself: in order to prove its validity, statements from outside the system must be used."

He then extended the theorem to science:

"It must be pointed out that science itself has its roots and origins outside its own rational realm of thinking. In essence, there seems to exist a 'Goedel Theorem of Science,' which holds that science is possible only within a larger framework of non-scientific issues and concerns. . . . Science itself must have a nonscientific base . . ."

Science, like mathematics, is not "self-validating." Weisskopf goes on to argue that poetry, music, philosophy, etc. are all part of the "larger issues and concerns." Exclusive reliance on science is detrimental to culture and ultimately to science as well. We must pay attention to the larger framework without which science could not exist.

In short, then, Goedel's theorem states that no system of axioms is self-validating but requires statements external to the system, and perhaps more complex, and which constitute a larger framework or matrix to justify it.³

Parallel Thinking of Others

Other thinkers seem to have reached similar conclusions in other areas but from different perspectives.

For example, Michael Polanyi indicates that

"Physics is dumb without the gift of boundary conditions, forming its frame; and this frame is not determined by the laws of physics."⁴

A scientist imposes certain fixed conditions which constitute a "frame" surrounding his experiment but which are outside his immediate interest and which cannot be explained by the physics and chemistry of the experiment.

Polanyi uses the example of a watch to make his point. A complete physical-chemical topography or description of a watch would not identify it as a *watch* nor *define* a class of watches. He writes:

"The impossibility is of a logical kind, similar to that by which a poorer deductive system cannot define the terms of a richer one. For example, propositional calculus cannot define arithmetics."⁵

Only by referring to its operational principles, its purposive function, which constitutes its boundary conditions can the object be identified and a class defined.

More importantly, living organisms have a similar "frame" which Polanyi calls the boundary condition, namely, their morphology which delimits the domain within which physical and chemical laws operate but which are not reducible to those laws. Such irreducible boundary conditions (morphology) lie outside the system of physics and chemistry and constitute, Pol-

anyi says, "a profoundly informative intervention."⁶ In fact, he states that

"All objects conveying information are irreducible to the terms of physics and chemistry."⁷

Polanyi also tells of the impossibility of reducing all things to the behavior of matter by recounting the futility of one such attempt. Ernest Nagel tried to eliminate the purposive character of physiological functions; he tried to reduce them to purely physical/chemical terms. However, Polanyi notes:

"Moreover, despite his reductionist claims, Nagel admits irreducibility of vital functions by using their biological names for talking about them. He must do so, for the mere shape of a living being defeats any physical-chemical definition and this is true throughout the anatomical features of life."⁸

This is especially interesting since Nagel's attempt to explain everything in terms of physics and chemistry is similar to mathematicians trying to explain mathematics or validate it in terms of itself.

In a manner similar to Polanyi and at about the same time, Armstrong considered whether DNA was merely a material cause in the Aristotelian sense.⁹ He concluded that it was not; rather, its form or morphology was a non-material cause and could not be completely explained by a system of pure matter/energy. In a later paper Armstrong presented a more comprehensive argument from form and showed that all form comes from pre-existing form and ultimately comes from the Mind of God. For example, the form of a typewriter can only be determined (defined) by that which is not "typewriter," such as a lathe which is a more complex form and is independent of or outside the system "typewriter." As Armstrong writes:

"Indeed, it is not too strong a statement to say that the admission that forms can come only from pre-existing forms logically compels one to admit that there is a Creator."^{10, 11}

Richard Weaver also places science in a matrix or framework which validates or defines its sphere of activity. Using the classical philosophical approach of dialectics and rhetoric to analyze the Scopes trial, Weaver showed that to evaluate the function or role of science in society (but not to evaluate its empirical content) requires a system of thought or statements outside of science. In this case the system was the law which constitutes a broader set of statements of philosophical opinion about a narrower set of statements, science. Clarence Darrow didn't understand this. He thought he could win the case for "science" just by being scientific, i.e., by calling on scientists to present their "empirical" arguments. Weaver observes:

"But in doing this, one assumes that there are no points outside the empirical realm from which one can form judgments about science. Science, by this conception, must contain not only its facts, but also the means of its own evaluation, so that the statements about the statements of science are science too."¹²

Or in a more general way as Weaver later stated:

". . . experience does not tell us what we are experiencing . . ."¹³

The judge eventually realized this and on the 6th day of the trial banned the scientists' testimonies. The

issue could not be decided by the recitation of the "facts," experiences or empirical content of science or of the two opposing propositions, evolution vs. creation, but only by determining the legal relationships between science and society and between the two propositions. The matter was not self-defining but required the broader, independent statements of the law to delineate science's social "boundary conditions." (Weaver thus anticipated Weisskopf by about 25 years.)¹⁴

C. S. Lewis also investigates the problem of validating human reason. He concludes that rational thought must be left outside any discussion or inquiry:

"All arguments about the validity of thought make a tacit, and illegitimate, exception in favour of the bit of thought you are doing at that moment. It has to be left outside the discussion and simply believed in, in the simple old-fashioned way. Thus the Freudian proves that all thoughts are merely due to complexes except the thought which constitutes this proof itself. The Marxist proves that all thoughts result from class conditioning — except the thought he is thinking while he says this. It is therefore always impossible to begin with any other data whatever and from there to find out whether thought is valid. You must do exactly the opposite — must begin by admitting the self-evidence of logical thought and then believe all other things only insofar as they agree with that. The validity of thought is central: all other things have to be fitted in round it as best they can."¹⁵

In other words, reason serves as an external standard to evaluate or validate, a discussion. It can therefore never be the subject of reasonable inquiry.^{16, 17}

Lewis also shows that the orderliness of nature is due to reason and that reason must be imposed on the natural ramblings of consciousness. He concludes that though human reason is independent of nature, it is dependent on a higher, self-existent Reason which must be the source of one's own imperfect and intermittent rationality: human thought is not God's but it is God-kindled.¹⁸

Lewis also argues that experience is not self-explanatory but must be validated by the sound reasoning of philosophy:

"What we learn from experience depends on the kind of philosophy we bring to experience. It is therefore useless to appeal to experience before we have settled, as well as we can, the philosophical question."¹⁹

May we not say the same about human culture, identity and existence in general? Determining life's "consistency" or meaningfulness, and if meaningful, its other basic features, is not within man's power alone for man is essentially incomplete. Man's existence cannot be validated by himself.

Frederick Wilhelmsen seems to have pointed out a Goedel's theorem of human identity when he criticized modern man's thought or attempt to justify himself in his own terms. To find out who he is, modern man has turned inward in a rationalistic effort to determine his own way. This attempt has been modern man's

crisis. Speaking of modern man, Wilhelmsen writes: downfall and has led to the present cultural identity "He looks within and he now finds, after so many centuries, that there is simply nothing there to hold him up, to sustain him, that — looking through the mirage of the rationalist ego — there is only a bottomless pit."²⁰

The answer to this dilemma lies in recognizing the limits of the self:

"I am the self I am thanks to what is not self but other."²¹

Man must look outside himself to the "other" to discover his identity, to determine the "boundary conditions" of his existence, to find meaning, to be "validated." However, what is the "other"? Wilhelmsen gives his answer:

"Bereft of any internal ontological identity of our own, constituted dynamically even as the selves we are through our marriage to the other, the final secret of the search for identity is the identity of Being, God, . . . the 'I am Who I am . . .' (Exodus 3, 14)."²²

Man's identity then lies outside of man in the Self-Identified, Self-Defined God Who alone validates man's existence.

Goedel's Theorem and the Entropy Law Form and Order

There is an important similarity between Goedel's theorem and the entropy law as it relates to the concept of "order." Thermodynamically, disorder is related to the mathematical concept of entropy in the familiar equation $S = k \ln w$, where w is the disorder parameter. But this gives no complete definition of "order" or "disorder," especially as it is applied in creation/evolution discussions.

Armstrong notes the need to define entropy according to the context of the discussion and uses the word "arrangedness" to clarify the meaning of "order" which he defines as,

"... conformity to some plan. In something which has parts, it is adaptation of the parts to the whole, and of the whole to some plan . . .

"If the system in question should be one for which entropy is already defined through thermodynamics or statistical mechanics, that entropy may as well be used. If not, an entropy may be invented for the purpose . . ."²³

The definition of order, then, includes a concept of plan: an intentional, purposeful design. Without reference to such a plan the concept of order is not always intelligible. And the purpose and function of that which is planned is embodied in its form. Speaking in biological terms, Wightman comments:

"From the organisms point of view, *form* is the embodiment of *function*, which in turn is the mode of realisation of *end*. If this sounds Aristotelian, let it be so . . ."²⁴

A natural system is said to be ordered when its parts are properly related to one another and it conforms to some plan, i.e., conforms to its intended purpose. Order is form and the breakdown of order is a loss of form. The rusting of an automobile is an example: unless some external, intelligent agent intervenes, the

form (order, "arrangedness") will be lost. The entropy law, in this sense, does not deal with matter and energy *per se*, but more precisely deals with the unique or distinctive *distribution* of matter and energy.²⁵ The entropy law is a statement of form.²⁶ To put it another way, form (order) is informative because it communicates, or makes intelligible, purpose.²⁷

Like the axiomatic method, the existence of order is not "self-explanatory" or "self-validating," i.e., it cannot be accounted for in terms of itself or by purely physical-chemical laws to which it is irreducible. It is fully comprehensible only in terms of a broader, encompassing context of order.

Time and Origins

Of course, entropic processes are further divided into reversible and irreversible. The calculation of the change of entropy in an irreversible process is dependent upon finding a reversible process whose path connects the same initial and final states. Yet in the case of the irreversible process of life there is no comparable reversible process nor can the system be restored to its earlier state. As Kestin notes:

"... systems like biological ones cannot be analyzed in terms of the equations of thermodynamics because no earlier state of such a system can ever be restored from a later state. . . . A given state of the system is always described by its properties as they are measured at that state, and not by the details of the process, which enable the system to assume the state under consideration."²⁸

The independence of path coupled with its irreversible nature, renders the evaluation of the entropy of living organisms largely qualitative. And yet it is just such irreversible systems which are indicative of the direction of time. For example, a film of a perfectly elastic bouncing ball could be run backward without being noticed by the viewer. Only when compared with an irreversible or irretrievable process, such as the growth of a plant, could the direction be determined. C. S. Lewis writes:

"The movement from more order to less almost serves to determine the direction in which Time is flowing. You could almost define the future as the period in which what is now living will be dead and in which what order still remains will be diminished."²⁹

For a total, comprehensive chronology indicative of time's direction a single birth/death sequence is insufficient. As Georgescu-Roegen observes:

"For a complete chronology we need a continuous time's arrow of at least one category of individuals the lives of which overlap without interruption . . . the process of the entire universe is unidirectional, i.e., irreversible, because that of its individual members is irrevocable."³⁰

This complete chronology of irretrievable events marks the unidirectional or irreversible flow of time. But it must be emphasized that one cannot validate the increasing randomness as a universal tendency by claiming that the tendency is itself random. To do so is to explain randomness in terms of itself: a fully irrational endeavor. (See Appendix A for further discussion.)

It is, therefore, the fact that the dependability of increasing entropy of irretrievable processes is itself *not* contingent upon chance that gives a reliable indication of time's arrow and the sense that time proceeds in an "orderly" fashion. Only thus can the events of time be understood as sequentially arranged in a definite pattern, i.e., in a forward direction. Taken as a category, as a whole, they constitute a kind of "morphology" of time, its boundary conditions being an absolute beginning and possibly an end. Speaking of this, Sir James Jeans writes:

"[Entropy] is still increasing rapidly, and so must have had a beginning; there must have been what we may describe as a 'creation' at a time not infinitely remote."^{31, 32}

Furthermore, there is the implication of a purposive operation which points to something outside time itself. The purposefulness or meaningfulness of time cannot be understood or determined by exclusively referring to events within time. As Jastrow writes:

"... you cannot describe the purpose of an entire series of events by looking [exclusively] within the events themselves."³³

Therefore, the "beginning," if it is to validate time as meaningful, must stand "outside" time and be uniquely different from its successive events. The beginning must be a broader, more complex event than all succeeding events. The present, then, cannot account for its own origin; it is not the key to the past, if by past we include the beginning of all things. The present is derivative of the past and ultimately from that beginning. The validity of a complete chronology can be established only by reference to an ultimate origin extrinsic to it. As Timmerman states:

"Why is it so important to view life with a sense of origin? . . . The events [of time] are shaped by, and gain meaning from, the one Creative Event. [A true account of origins] seeks to bring the light of the primordial, cosmogonic Event that shaped time to bear upon the events of the present. . . . Consider that the incarnation of Christ is meaningful insofar as it is understood in the total order of God's revelation. . . . Furthermore, without the prior fall of man, the incarnation of Christ is meaningless. Without the sense of a created perfection by God, the fall of man is meaningless."³⁴

That one "Creative Event" which shaped time could have been generated only by Someone powerful enough and standing "outside" the resulting creation. Jeans describes it:

"... Modern scientific theory compels us to think of the creator as working outside time and space, which are a part of his creation, just as the artist is outside his canvas . . ."³⁵

As with a complete arithmetic system, the events of the present, including the irretrievable entropic processes which shape time, become meaningful only in the larger context of a purposeful beginning, which is, to borrow Jaki's imagery, "the womb of time."³⁶

General Similarities

Finally, the attempt to validate a system of axioms by using statements from within it may be considered

a kind of introversion which turns the system on itself. It is therefore interesting to note that the phrase "turning in" is the literal meaning of the word "entropy." Some very general similarities or analogies between Goedel's theorem and the entropy law are thus suggested and include the following:

1. Both deal with the *orderliness* of a system. One pertains to the orderliness of a mental (logical) system, and the other deals with the orderliness of a material system (matter/energy).
2. Both deal with the *breakdown* of that order. One involves the breakdown to circular thinking (irrationality), and the other involves the breakdown (dispersion) of a physical system.
3. Both modes of "decay" result when an external restraint is removed. Decay occurs in the first case when the independent statements outside the (mental) system are removed. In the second case decay occurs when some physical-chemical restraint is removed.
4. Both types of external restraints involve intelligence acting through the medium of language. This suggests that language is the ultimate boundary condition (form or pattern) which defines or shapes mental as well as material reality.

The Validity of Language

Ultimately, the questions discussed so far are inseparably linked to the problem of language. In the case of entropy, for example, the observation has been made that it involves a qualitative dimension. This ought to be especially clear from the previous discussion of form: since form is qualitative, so is the loss of form or order. Tykodi discusses the problem of thermodynamics and mentions its independence from an "exact kinetic mechanism." He concludes that the thermodynamics of steady states should not place its main emphasis on the problems of matter and motion. In this context he adds:

"Furthermore, the fundamental experimental system is the container plus the contents plus the interaction of container and contents with the surroundings. The experimenter would prefer a *global language* that reflects the laboratory realities. Now the experimenter never measures directly what happens at a single point in space, and a *language* couched in terms of local properties and gradients makes his life that much more difficult and gives him little or no guidance in dealing with the effect on the container or the process being studied and in deciding on ways to minimize that effect."³⁷ (emphasis added)

His reference to a "global language" for the experimental system is reminiscent of Polanyi's "fixed conditions" in a physical experiment. Bridgman comments:

"One may anticipate that the extension of the entropy concept to more complicated phenomena, . . . is coextensive with the discovery of *macroscopic* parameters adequate for the *exhaustive description* of these phenomena."³⁸ (emphasis added)

The "exhaustive description" of life in terms of entropy will require the use of language capable of handling "macroscopic parameters." This underscores the notion that entropy includes a qualitative, macroscopic

dimension and that the language of the thermodynamicist must reflect this fact. He can no more speak exclusively in terms of mere molecular motion, than Nagel could describe morphological features without using qualitative, macroscopic, biological names. Entropy defines a class or category of qualitative changes in objects, like Polanyi's class of watches, and therefore requires the use of universal concepts and terms which are irreducible to particular instances of the class or to physical/chemical analysis. Speaking thus of definition and language Weaver observes:

"First, one must remark that the language of definition is inevitably the language of generality because only the generalizable is definable. Singulars and individuals can be described but not defined, e.g., one can define man, but one can only describe Abraham Lincoln."³⁹

Similarly, the entropy law defines a class of general, qualitative changes between a system and its "boundary conditions." Because it is not reducible to or derivable from mere kinetic considerations, the concept and the terms referring to it must stand outside the system or class in question in order to define it, similar to the validation of a complete, nontrivial mathematical system.

Just as Tykodi's statement mentioned above applies not only to thermodynamics experiments but to science in general, so too the link with language applies to science generally. Science as an intelligible, purposeful endeavor is dependent upon language. Or as William Urban Marshall concludes:

"It is part of my general thesis that all meaning is ultimately linguistic and that although science, in the interests of purer notation and manipulation, may break through the husk of language, its nonlinguistic symbols must again be translated back into natural language if intelligibility is to be possible."⁴⁰

Language provides a framework which defines and validates science. To paraphrase Weaver, the empirical community of science avails nothing without the metaphysical community of language.^{41, 42} (See Appendix B for further discussion.)

If Weiskopf's "Goedel Theorem of Science" is true, that science is validated in terms of the "broader issues and concerns" of the surrounding culture, then it is clearly contingent upon the validity of the language which expresses those issues and concerns. Furthermore, this contingency is true for all human knowledge or as Oller points out:

"Natural discourse logically exceeds the complexity of any knowledge expressible in it. Any knowledge which can be expressed must be less abstract and less complex than the language in which it is expressed."⁴³

If, however, the purpose of words is to deal with matters other than words, as Bertrand Russell stated,⁴⁴ then the question arises as to how words can be used to explain words. Or, what validates language? We cannot define a word in terms of itself but require something "outside" the word in question in order to set boundary conditions around it, thus giving it meaning and rendering it comprehensible:

"The limits of the definition are thus the boundary between the things and the non-thing."⁴⁵

But we can define words in terms of other words only so far without becoming tautologous; we eventually begin to repeat ourselves. Thus, Weaver refers to language as a closed system and observes:

"If we can never succeed in [ultimately] getting out of the circle of definition, is it not true that all conventional definitions are but reminders of what we already, in a way, possess? The thing we have never heard of is defined for us by the things we know; putting these together, we discover, or unbury, the concept which was there all the while. . . . Finding the meaning of the *definiendum* is finding what emerges naturally if our present concepts are put together in the right relation. . . . Such conclusions lead to the threshold of a significant commitment: ultimate definition is, as Aristotle affirmed, a matter of intuition. Primordial conception is somehow in us; from this we proceed as already noted by analogy, or the process of finding resemblance to one thing in another."⁴⁶

The materialistic evolutionist, however, tries to break out of this circle by defining the richer system of language in terms of the poorer system of science or human language in terms of animal communication. He feels compelled to break through the "veil" of language to "get at" reality and does not realize that it is language which ultimately shapes material reality.⁴⁷

The reason for this seems to lie in the nature of language. All forms have inclinations as Aquinas said and language is a complex system of mental forms and thus is tendentious, i.e., it has purposeful, philosophic quality to it:

"... language is intended to be sermonic. Because of its nature and of its intimacy with our feelings, it is always preaching."⁴⁸

But the materialist's desire to break away from the philosophic quality and reduce all language to purely neutral, positive terms would be possible only with a formless language, i.e., it would be no language. Without linguistic form a mental system, like a material one, is disordered:

"The reason lies in one of the limitations imposed upon man: unformed expression is ever tending toward ignorance."⁴⁹

His passion for a philosophically neutral, self-validating language is irrational and leads to ignorance. It is not at all surprising to find that he has no explanation for the origin of language,⁵⁰ nor any guarantee that language corresponds to anything in material reality or that it conveys any knowledge or truth. In short, he is not sure he knows what he is talking about. His attack on the validity of language undermines the validity of all subsequent thinking including science and math.

The only satisfactory explanation is to recognize that language, like logic, is not self-validating but requires a more complex cause external to it. It requires the recognition that language is ultimately neither created nor evolved but is *given* and *received* from God in whose image man is formed and which ever points

to the Supreme Linguist, the One Who created and sustains all things by His Word.

Conclusion

The commonality between Goedel's theorem and these other statements, including the entropy law, when taken together indicate a general principle of the limitation and contingency of human thought. The ordered operations of the human mind, like the orderliness found in nature, are not "self-validating" but are instead dependent upon some external agency more highly ordered and powerful than man. Only in terms of such an agency can the "boundary conditions" that define and delimit the mind and the material world be explained.

As far as science is concerned, the materialistic evolutionist attempts to explain the entire universe in terms of itself, i.e., by purely physical/chemical interactions. Not only does this approach fail to explain much of reality (morphology for example) but more importantly such reductionism is tautologous, and in that sense, irrational. As J. B. S. Haldane succinctly put it:

"If my mental processes are determined wholly by the motions of atoms in my brain, I have no reason to suppose that my beliefs are true . . . and hence I have no reason for supposing my brain to be composed of atoms."⁵¹

This irrationality actually constitutes a threat to modern science, for it robs science of the metaphysical foundation needed for its validation.^{52, 53}

The theistic evolutionist's position is also untenable. Though relying on God as the explanation of ultimate origins, he tries to validate the broader, more powerful explanation of Scripture in terms of the narrower one of so-called science. Actually, it is an attempt to evaluate and re-interpret the traditional concept of origins in terms of a secular scheme of purely human thought, the product of men devoted to an anti-God ideal. This position is as irrational as the atheist's with the additional fault of tending to promote the beliefs of the latter while claiming belief in Scripture.

The creationist perspective, on the other hand, is fully rational *precisely* because it relies ultimately upon validating statements external to science, namely, divine revelation. It is thus both logically and theologically consistent. This allows the creationist to determine the consistency or meaningfulness of science and to discover other properties which cannot be determined strictly scientifically, e.g., the problem of origins. The creationist recognizes that science is essentially incomplete and must be based on something more profound. Therefore, creationism is the preferred frame of reference within which science should be conducted.

More generally, all closed systems of thought, i.e., those which refuse to recognize man's inherent limitations and contingency, as well as that of the material world, upon a superior, external agent are also tautologous. Attempts to find "self-validating" explanations for such fundamental properties of human nature as language, reason and identity are doomed to failure. They are exercises in futility as the human mind turns

ever inward and undergoes a kind of mental entropy, decaying to formlessness, ignorance and irrationality.

The issue of origins is not a matter of neutrality or indifference because man is not an indifferent or neutral being. Men make commitments which deeply affect their lives. C. S. Lewis rightly noted that man tends to worship whatever is considered eternal and self-existent.⁵⁴ If nature is self-existent and eternal, then nature will be worshipped. If nature requires a Maker, then He will be worshipped. Origins concepts are thus inherently religious for they help determine the object of man's worship. One is either for the Christ of creation or one is most definitely Christ's enemy. The consequences of the commitment are irretrievably permanent. There is no middle ground.

Only by recognizing man's limits and hence his necessary dependence upon something greater than himself can a satisfying and realistic view of life and the natural world be attained. This implies, among other things, the admission that the world is contrived, purposeful, designed and hence must have a Contriver, Purposer, Designer. It is fully reasonable to expect that this same Creator has revealed Himself to man, and for the Christian, this involves recognition of the Word, the Logos, Who in the beginning created and formed all things. He alone is self-existent, self-defining, and without limit;⁵⁵ the "Form of Forms." He is the source of the "profoundly informative intervention" which constitutes the very nature of things. A return to such a belief means a return to a theistic and theocentric view in both science and culture generally. If broadly adopted, it would have the profoundest impact on the future of Western society. To lead the way in this direction is the task of the creationist.

Appendix A: Statistics and Thermodynamics

Richard Weaver once observed that sometimes people outside a discipline are needed to solve its problems. He writes:

"It requires an unusual degree of humility to see that the solution to our problem may have to come from someone outside our number, perhaps from some naive person whose advantage is that he can see the matter only in broad outline."⁵⁶

Perhaps such an individual brings the "broader issues and concerns" to bear upon the matter, to borrow Weisskopf's wording. An example of this is lawyer Norman MacBeth's recent work in the area of biology and his evaluation of the "Modern Synthetic Theory" which was an attempt at a synthesis of classical and neo-Darwinism. In a similar fashion economist Nicholas Georgescu-Roegen has presented a critical evaluation of the synthesis of classical and statistical thermodynamics.⁵⁷ Just as creationists have used Norman Macbeth's work, so too, they may benefit from Georgescu-Roegen's work.

In his analysis Georgescu-Roegen points out that Ludwig Boltzmann, one of the chief architects of statistical mechanics or the kinetic theory of gases, believed in eternal cycles of the universe. This belief did not allow him to accept the implication of classical thermodynamics, namely, that the universe was moving to-

ward a definite end. To circumvent the problem, Boltzmann advocated the stochastic approach, believing that if enough time were available even the impossible would happen sooner or later, including the spontaneous reversal of entropy which would allow universe to retrace its steps in never-ending cycles.⁵⁸

Georgescu-Roegen discusses the mathematical and conceptual problems involved in placing classical thermodynamics on a probabilistic basis. This includes a consideration of the meanings of randomness and order and especially what he believes to be the logical contradictions of the stochastic approach. He argues that statistical mechanics has no empirical basis and that the classical approach is the only legitimate one. He also maintains that the entropy law is not reducible to mere molecular motion and that there is no way to bypass it.

While creationists will not agree with everything he says, the insights should prove helpful in dealing with thermodynamics and origins. Since the Society is dedicated to the task of "re-evaluating science" from a creationist perspective, this could be a fruitful examination by those creationists interested in thermodynamics. This is especially so since evolutionists frequently cite infinitesimally small probabilities as arguments that evolution could have happened by chance.

In addition it should also be observed that statistics and probability theories are idealizations of the real world and therefore depart from reality to some extent. One such departure is the concept of infinity which is a statistical convenience for ease of calculation. No population or sample is *literally* infinitely large. Evolutionists can no more appeal to this than an engineer could hope for a 100% efficient machine by appealing to Carnot's ideal heat engine, or an economist could hope for perfect competition by appealing to some of the idealistic assumptions of a free market. These are mental constructs which are needed to serve as points of departure for analyzing the *real* world but ought not to be confused with it.

Furthermore, probabilities are validated by empirical observation or as Georgescu-Roegen put it:

"Only factual evidence can endow a probability computed by a paper-and-pencil operation with physical significance."⁵⁹

For example, it is known that all people die even though the exact time of death or age for any particular individual is unknown, but this can be treated statistically. No one, however, would be justified to conclude that because of the stochastic treatment perhaps people will live forever or that the trend is reversible. Perhaps this is what Dampier had in mind when, speaking of stochastic thermodynamics, he declared that it is a form of "statistical determinism" even though individual uncertainty remains.⁶⁰

Even the choice of a statistical distribution must be done in a non-probabilistic manner. Only after the choice has been validated, can probability statements be made. But the resulting probabilities cannot then be used to validate (or invalidate) the choice of distributions from which they were derived. Probabilities are not self-validating. The specific form of a density function is determined by constants (parameters of the distribution law). In other words the prob-

abilist and the statistician must assume an orderliness in nature before their probability calculations have any meaning. The certainty of the overall trend must be established before probability can be considered. Ultimately disorder and uncertainty are intelligible only in the larger context of order and certainty. Otherwise, the reasoning is circular as Georgescu-Roegen observes:

"And if we accept the other prevalent view that the Entropy Law means only that 'the higher the entropy, the greater is its probability of occurring' — 'entropy' meaning 'thermodynamic probability' — then instead of a law of nature we hold only a tautological application of the definition of probability."⁶¹

He later concludes,

"... the irreversibility of the entropic process is not a manifestation of chance."⁶²

C. S. Lewis also spoke to this problem in terms of uniformity of nature:

"Can we say that Uniformity is at any rate very probable? Unfortunately not . . . Unless Nature is uniform, nothing is either probable or improbable. And clearly the assumption which you have to make before there is any such thing as probability cannot itself be probable."⁶³

And he adds:

"Probabilities . . . hold inside the framework of an assumed Uniformity of Nature. . . . No study of probabilities inside a given frame can ever tell us how probable it is that the frame itself can be violated."⁶⁴

What, then is the probability of an event that has never been known to occur, such as a spontaneous decrease in entropy resulting in life? As far as a scientist is concerned, in the absence of any supporting observations, not to mention its inconsistency with what is known about the natural world, the probability is quite literally zero.⁶⁵ Until some such event does occur, no matter how long the wait, the calculation of non-nul probabilities is physically meaningless.

Appendix B:

The Non-Neutrality of Science

As indicated previously, the scientist is dependent upon language and language is not a neutral system of forms which the positivist can use to evade metaphysical commitment. Language is inherently teleological. The scientist cannot describe all phenomena without using words which imply purpose or have some emotional loading.

Evolutionists Baker and Allen confess as much when they state they must occasionally "slip" and use teleological expressions. For example, a cell takes in glucose "in order to" increase its energy supply.⁶⁶ The phrase "in order to" is regrettable to them because it suggests purpose. But the nature of language makes it impossible to completely avoid teleological expressions.

The empirical content of science also makes it difficult to be metaphysically neutral. As indicated above, morphology is the embodiment of function which is the mode for the realization of end (purpose). Mor-

phology can only be explained in terms of purposeful design. As Jaki observes:

"It is that perspective of [morphological] wholeness which reveals purpose and ultimately permits a genuine reference to the Creator, . . ."⁶⁷

And Polanyi comments that attempts to eliminate the purposive character of physiological functions by considering them mere events that happen to be beneficial to the organism without actually, purposefully serving this benefit, will not work:

"But the fact remains that a process can be regarded as a biological function only if it does benefit the organism. This remains its essence, as much as it is the essence of a machine to serve a purpose acknowledged by its designer."⁶⁸

As a result of his empirical studies, then, the scientist is driven, sooner or later, to recognize the explanatory value of teleology. But since teleology enjoins from above it is also profoundly metaphysical.

Baker and Allen confront this problem again when they admit:

"Most, if not all, animal behavior is goal-oriented."⁶⁹

They add in a footnote, however:

"Though the statement is not teleological, what it asserts is, since teleological means 'goal-oriented.' There is a sticky semantic problem here. Evolution is not teleological, because those organisms that survive, survive, and that's all there is to it. Certain forms of behavior, on the other hand, are teleological because of their goal-oriented nature. . . . In an effort to avoid the connotation that an animal 'knows' that reaching the goal will increase the probability of its own survival and that of its descendants, the term *teleonomical* has been suggested."⁷⁰

Here is a combination of the linguistic and the empirical problems. Linguistically, the scientist cannot find a word which isn't tendentious: "goal-oriented," "teleological," or "teleonomical," all suggest the same thing, namely, purposive action. Empirically, the scientist has observed that animals do indeed behave in purposeful ways. The refusal of the materialistic evolutionist to recognize purposeful activity in nature (without making profuse apologies) is not without its own purpose. The goal is to suggest that man's life is also purposeless. And so the teleological quality of both language and nature forces the natural scientist, one way or another, to ultimately make a non-neutral metaphysical commitment.

Such commitment, of course, can cause divisions among men and the problem becomes how these divisions can be resolved. Weaver indicates two ways: (1) by developing a complacency which makes possible the ignoring of contradictions and (2) by referring to first principles, which finally will remove the difference at the expense of one side.⁷¹

The creation/evolution debate has forced both sides to refer to basic principles about the nature of science and religion. Each side tries to establish itself at the expense of the other. Even the balanced treatment of the origins problems in the public school science classroom is, in this sense, non-neutral for it requires the admission that evolutionism is not the only valid

frame of reference within which to conduct science. The presentation of both sides can occur only at the expense of the prestige and reputation of evolutionism.

Theistic evolutionists, on the other hand, have sought the first solution, i.e., the establishment of harmony by developing a complacency which makes the ignoring of contradictions possible. They seek the excluded middle ground and are, therefore, not welcomed by either creationists nor atheistic evolutionists. They are doomed to play the role of odd-man-out. But the very complacency over contradictions, theologic or scientific, is a kind of emasculation which renders their position impotent. This means it has the effect of working with atheistic evolutionism. By not opposing it, they promote it, no matter how much intellectual arm-waving they may do.

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- ¹⁴Weaver points out that Socrates, the great dialectician (logician), was brought to trial to justify his dialectics. Socrates, however, presented his usual arguments to the Athenians, i.e., he tried to validate his dialectics by using dialectics. Something more was needed: "Unless [the dialectician] is sustained by faith at one end or the other — unless he embraced something before he began the dialectical process or unless he embraces it afterward — he remains an unassimilable social agnostic." See Weaver, Richard M. Visions of order, 1964. Louisiana State University Press, Baton Rouge, (in) *Omnibus* Volume 6; Conservative Book Club, New Rochelle, New York, p. 225.
- ¹⁵Lewis, C. S., 1947. Miracles: a preliminary study. Macmillan Publishing Co., Inc., New York, p. 23.
- ¹⁶Or, to use Gilson's expression, one must recognize "the paradoxical experience of the unintelligibility of intelligibility." See Jaki, Stanley I., 1978. The road of science and the ways to God. University of Chicago Press, Chicago and London, p. 259.
- ¹⁷Bass notes there is evidence suggesting that consciousness, while real, is nevertheless non-physical. He also states von Neumann's proved and accepted theorem shows that the "hidden variables in quantum mechanics can never be measured." Would this not suggest that the human mind studying itself can never fully comprehend itself? See Bass, Robert W., 1976. Quantum psycho-physics. *Creation Research Society Quarterly* 12(4):215-216.
- ¹⁸Lewis, *op. cit.*, pp. 27-29.
- ¹⁹*Ibid.*, p. 7.
- ²⁰Wilhelmsen, Frederick D., 1980. Modern man's myth of self-identity. *Modern Age* 24(1):44.
- ²¹*Ibid.*
- ²²*Ibid.*, p. 46.
- ²³Williams, Thermodynamics, *op. cit.*, pp. 23, 29.
- ²⁴Wightman, William P. D., 1953. The growth of scientific ideas. Yale University Press, New Haven, p. 430.
- ²⁵Georgescu-Roegen gives the following interesting observation: "And even the founder of cybernetics protested that 'information is information, not matter or energy' . . ." See Georgescu-Roegen, Nicholas, 1971. The entropy law and the economic process. Harvard University Press; Cambridge, Massachusetts; p. 406.
- ²⁶Armstrong seems to suggest something similar in his paper on form and thermodynamics. See Armstrong, *op. cit.*, p. 121.
- ²⁷This qualitative, macroscopic dimension of entropy may be the reason that an entropy flow meter has not been forthcoming. How can the loss of form or order be measured over time (ds/dt) as "flowing"? Both Williams and Georgescu-Roegen comment on the non-existence of any "entropometer." (The latter compares it with the inability of physicists to give pointer-readings to the quality of "hardness".) See Williams, Thermodynamics, *op. cit.*, pp. 91-92, 95, 98, and Georgescu-Roegen, Entropy law, *op. cit.*, p. 101.
- ²⁸Williams, *op. cit.*, p. 94.
- ²⁹Lewis, *op. cit.*, p. 157.
- ³⁰Georgescu-Roegen, *op. cit.*, p. 202.
- ³¹Jeans, Sir James, 1930. The mysterious universe. The Macmillan Company, New York, p. 154.
- ³²Lewis also implies the necessity of a beginning when order was impressed upon nature when he writes: ". . . A Nature which is 'running down' cannot be the whole story. . . . If a Nature which disintegrates order were the whole of reality, where would she find any order to disintegrate?" See Lewis, *op. cit.*, p. 157.
- ³³Durbin, Bill, 1982. A scientist caught between two faiths. *Christianity Today* xxvi(13):15.
- ³⁴Timmerman, John H., 1980. The making and meaning of myth. *Modern Age* 24(2):182-183.
- ³⁵Jeans, *op. cit.*, p. 155.
- ³⁶Jaki, Road of science, *op. cit.*, p. 296.
- ³⁷Williams, *op. cit.*, pp. 99-100.
- ³⁸*Ibid.*, p. 94.
- ³⁹Weaver, *op. cit.*, p. 190.
- ⁴⁰Weaver, Richard M., 1948. Ideas have consequences, University of Chicago Press, Chicago. Pp. 158-159.
- ⁴¹*Ibid.*, p. 165.
- ⁴²Weaver also considers the use of ultimate and uncontested terms in modern society. One important category of such words he calls "god terms," i.e., words which evoke high emotions and serve to validate all other things. In this secular age the god term is "progress": "This seems to be the ultimate generator of force flowing down through many links of ancillary terms. If one can 'make it stick,' it will validate almost anything." Weaver, Ethics of rhetoric, *op. cit.*, p. 212.
- ⁴³Oller, John W., 1981. Words: Genetic and Linguistic Problems for Evolution. *Impact* (#92, February), p. IV.
- ⁴⁴Jaki, *op. cit.*, p. 226.
- ⁴⁵Weaver, Ethics of rhetoric, *op. cit.*, p. 190.
- ⁴⁶Weaver, Ideas have consequences, *op. cit.*, p. 157.
- ⁴⁷Scripture indicates that God, by means of His Word, produced and sustains the material world (John 1:1-3; Heb. 1:3). In this connection Sir James Jeans offers an interesting comment: "If the universe is a universe of thought, then its creation must have been an act of thought. Indeed the finiteness of time and space almost compel us, of themselves, to picture the

creation as an act of thought. . . . And yet, so little do we understand time that perhaps we ought to compare the whole of time to the act of creation, the materialisation of thought." Jeans, Sir James, 1930. *The mysterious universe*. The Macmillan Company, New York, pp. 154-155.

⁴⁸Weaver, *Visions of order*, *op. cit.*, p. 228.

⁴⁹Weaver, *Ideas have consequences*, *op. cit.*, p. 25.

⁵⁰Regarding the notion that human language originated or evolved from animal "language" Noam Chomsky remarks: "... a careful look at recent studies of animal communication seems to me to provide little support for these assumptions. Rather, these studies simply bring out even more clearly the extent to which human language appears to be a unique phenomenon, without a significant analogue in the animal world. ... "In fact, the processes by which the human mind achieved its present stage of complexity and its particular form of innate organization are a total mystery ... " Thompson, William Irwin, 1971. *At the edge of history*. Harper and Row Publishers, New York, p. 188. Subsequent research underscores the above statement.

⁵¹Lewis, *op. cit.*, p. 21. He concludes: "Hence every theory of the universe which makes the human mind a result of irrational causes is inadmissible, for it would be a proof that there are no such things as proofs. Which is nonsense."

⁵²Elsewhere, he also notes the limitations of science: "Christian theology can fit in science, art, morality, and the sub-Christian religions. The scientific point of view cannot fit in any of these things, not even science itself." Lewis, C. S., 1980. *The weight of glory*. Macmillan Publishing Company, Inc., New York, p. 92. (Original copyright 1949.) Revised and expanded edition.

⁵³Another illustration of how the evolutionist invalidates his own argument comes from his view of reason and logic. Evolutionary economist Ludwig von Mises writes: "Nothing suggests that logic as we know it is the last and final stage of intellectual evolution. Human logic is a historical phase between pre-human nonlogic on the one hand and superhuman logic on the other hand. Reason and mind, the human beings' most efficacious equipment in their struggle for survival, are embedded in the continuous flow of zoological events. They are neither eternal nor unchangeable. They are transitory." von Mises, L. 1949. *Human action*. Henry Regnery Company, Chicago, pp. 33-34. But if reason is so ephemeral, is there any realistic hope of knowing the truth? For example, how can an evolutionist know that his present evolutionary view is valid or that it will not be invalidated in the future? He thereby undermines his own case.

⁵⁴Lewis, *op. cit.*, p. 66.

⁵⁵The existence of non-self-validating entities logically requires the existence of a self-validating entity. It is in the one un-

limited, uncreated Being that the limited and created world has any meaning. Jaki writes: "The metaphysician knows, of course, that the totality of perfections, which entails the exclusion of all singularities, is reserved for the noncreated Being for whom the capability of creating things, that is, concrete singularities, is exclusively reserved. The only being he cannot create is his infinitely perfect being with no trace of those singularities which are always signs of existential limitations that in him alone find their ultimate explanation." See Jaki, *op. cit.*, p. 273.

⁵⁶Weaver, *Ethics of rhetoric*, *op. cit.*, p. 207.

⁵⁷See reference 25.

⁵⁸Speaking of statistical thermodynamics, Jaki summarizes Max Planck's view: "True, the theory permitted Boltzmann to conjure up cosmic processes running backward, but as Planck pointed out, they were not scientifically meaningful because they could not refer to *our* universe taken as a whole and in the broadest sense." He also presents Eddington's view of the matter: "... Eddington made shambles of the major counter-argument based on the idea of statistical fluctuations. He termed it a blind alley to assume that since there is an infinite time ahead, very rare but sufficiently large reversals in the increase of entropy should take place with the result ... that the present meeting of the Mathematical Society should occur by chance an infinite number of times while time flows on endlessly." See Jaki, *op. cit.*, p. 176. And, respectively, Jaki, Stanley L., 1974. *Science and creation*. Science History Publications, New York, p. 339.

⁵⁹Georgescu-Roegen, *op. cit.*, p. 165.

⁶⁰Dampier, Sir William Cecil, 1948. *A history of science and its relation with philosophy and religion*. Cambridge University Press (4th edition), Cambridge, England, p. 230.

⁶¹Georgescu-Roegen, *op. cit.*, p. 166.

⁶²*Ibid.*, p. 169.

⁶³Lewis, *Miracles*, *op. cit.*, pp. 105-106.

⁶⁴*Ibid.*, p. 106.

⁶⁵Nobel Laureate E. P. Wigner does present a calculation from group theory to show that the probability of a self-reproducing system occurring by chance is indeed zero. See Wigner, Eugene P., 1967. *Symmetries and reflections*. Indiana University Press, Bloomington, pp. 203-206.

⁶⁶Baker, Jeffrey J. W. and Garland E. Allen, 1971. *The study of biology*. Addison-Wesley Publishing Company, Reading, Massachusetts, p. 729.

⁶⁷Jaki, *Road of science*, *op. cit.*, p. 286.

⁶⁸Polanyi, *op. cit.*, p. 59.

⁶⁹Baker and Allen, *op. cit.*, p. 746.

⁷⁰*Ibid.*

⁷¹Weaver, *Ideas have consequences*, *op. cit.*, p. 154.

WHAT IS SCIENCE?

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The nature of science is investigated. It is concluded that science is a tool, a means of learning about reality. Any pretensions beyond this, made in the name of science, should be discounted.

The word "science" is used for many reasons and purposes. Among these are to imply an idea is proven, a concept is based upon empirical data, or a conclusion is based upon objective observation. The word is also often currently used as a catchword to lend credibility and authority to some conclusion. In advertising, statements such as "our brand has been scientifically proven to be superior to brand y" or "in a recent scientific study, more people preferred Mitz milk than ordinary milk," are often heard.

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So-called "religion-science" conflicts, such as the recent "creation-evolution" controversy, often include claims that evolution is "science" and therefore the implications are that evolution is more true and valid than the "non-scientific" theories, being supported by the facts and empirical data. The other side, or "creationism," it is claimed, is "religion" and therefore not supported or supportable by testable empirical data, etc. As to this problem Hardin notes:

The polarization "science versus religion" is largely in the eyes of the beholder. Unfortunately a perceived polarization can breed a real one. By

1920 a real polarization inspired the creation of the word "Fundamentalism" to stand for the minority of churchmen who were consistently opposed to Darwinian evolution.¹

A problem with this dichotomy is that there is only one ultimate reality, and all "means of knowing" are only different ways of learning about this one reality. The goal of science is "to produce a description of the universe so complete that everything that occurs can be understood as an instance or instances of regularities which we call laws."² As Spinoza said: "The Universe is ONE. There is no supernatural [non-real entities]: all is related, cause and sequence. Nothing exists but substance and its mode of motion." Today most researchers recognize that much more than "substance" and its mode of motion exists; but the observation that "all is related" and there is one reality is still quite valid. It would seem in the search for knowledge, all methods of knowing should be utilized (and in fact all methods are often utilized). Brena concludes that "science" traditionally defined as a method can carry us only so far:

As soon as the scientific process outgrows the analytic investigations which constitute its preliminary stage and passes on to synthesis, it naturally culminates in the realization of unity beyond apparent diversity, of harmony above contrasting theories. Different paths of scientific investigation must necessarily lead to the same Truth, since Truth must be only One, and beyond the different aspects of the same Truth there is but one Revelation . . .³

What is Science?

Science is actually nothing more than a *method* by which knowledge is obtained. Most commonly it is the collection of objective empirical data obtained by observation and measurement via the senses which is then summarized. From this summary some principle or generalization is produced (The process of induction.) For example, one might drop a few thousand items of different weights, sizes and so on, inside a 20-foot evacuated tube placed vertically and discover that they all fall with an acceleration of 32 feet per second per second (in other words, the speed increases by 32 feet per second for each second the object drops). A key factor needed to merit the label science is "can the hypothesis, law, summary, or principal be proved false" (falsifiability)? The theory must lend itself to the construction of a *null hypothesis* or a contradictory statement which can in some way, disprove one's assumption.⁴ For example, one can easily construct a null or contradictory hypothesis, or a hypothesis which, if true, disproves the statement that matter falls in a vacuum with an acceleration of 32 feet per second, per second regardless of the weight: "The rate of fall of 10 lb. objects does not equal the rate of fall of objects with a weight of 20 lbs."

Generally, science refers to knowledge obtained by the scientific method. Although there is no one scientific method, the following steps are generally included:

1. Observation — or awareness of certain aspects of the environment. This quality may be im-

proved by training designed to help the person carefully observe a certain phenomenon, especially that which regularly occurs. Knowledge is useful in taking special note of phenomena which are regular, and which are different, intriguing, etc. This helps researchers discover new laws, modify existing laws, specify under what specific conditions known laws operate under, and develop hypotheses which help explain reality.

2. Construction of some type of hypothesis — i.e., a statement of a possible relationship between two events such as the relationship between the amount of education a person has and his or her income. Data are then collected to find out if there is, for example, a positive correlation between income and education or if, in fact, as income goes up education increases.

Haas notes that scientific investigators generally begin with a model which, he stresses, is incomplete, inexact and framed on the basis of "a hunch, intuition or subconscious thought, perhaps suggested by considerations of an apparently unrelated field."⁵ Then experiments are developed to evaluate the validity of this model.

3. Establishing an experimental design in order to test one's hypothesis is the next step. In the case above, this step would entail gathering data on income and education and then correlating the data using the appropriate correlation formula. The researcher may take a random sample of taxpayers, such as every 10,000th case, or draw names out of a hat, etc.; find out the income and educational level of each person, and then correlate the two.
4. Developing some type of statement which generalizes the relationship found. In the above example, one might state that "there is a positive correlation between education and life income." This generalization enables us to predict what we can expect to occur under a given set of conditions in the future. For example, if we know that a person has a high level of education, given the data above, by use of regression analysis we can say that his or her income will probably be above average; although a certain percent will have an average, and a smaller percent, a below average, income. Thus, the empirical method may give us *trends*, and, especially in the social sciences, probabilities with many exceptions.

As Robertson notes "Science relies for its generalizations, explanations, and predictions, on careful, systematic analysis of verifiable evidence — that is, evidence that can be checked by others and will always yield the same results."⁶ In carrying out scientific research, it is important that the experimenter specifically delineate what he or she did to achieve the results found, so the study can (one hopes) be replicated.

Actually, science is not quite so restrictive as the above definition implies. Anthropology, sociology, and even many areas of psychology are difficult to replicate. For this reason some prefer a broader definition of science such as, "Science is a branch of study that

is concerned with discovering and organizing facts, principles and methods."

Most researchers divide science into two types, the hard or natural sciences, such as math, physics, biology, chemistry and astronomy, and the soft, or social sciences, such as sociology, anthropology, history and the like. Psychology would be included in both the hard and the soft sciences because psychology includes both research similar to that found in sociology using similar methods, as well as that in biology, using like methods (physiological psychology for example).

When a study is completed, often a number of other scientists will replicate it to determine under what specific conditions the findings are true — and to determine whether the findings are true — unfortunately there has been fraud in scientific research.⁷

Whether through fraud or through honest mistakes, there are examples of breakthrough research in which *all* attempts at replications have failed to reproduce. A good recent example is the research on planaria worms. "Naive" planaria worms were randomly fed either trained or non-trained planaria worms. Those with the trained planaria worm diet did better, it was reported, in subsequent training than those fed non-trained planaria worms. The implications were that learning could be transferred via eating "intelligent" worms or "educated" worms. Subsequent studies *failed* to confirm these results. The null, or contradictory, hypothesis which stated "there is no difference in the performance of planaria worms between a group which ate trained and one which ate non-trained planaria worms" was not disproved.

All science research rests on the important assumption that once a relationship is found, it describes a natural and consistent reality. Robertson notes that:

All science, natural and social, assumes that there is some underlying order, or regular pattern, in the universe. Events, whether they involve molecules or human beings, are not haphazard. They follow a pattern that is sufficiently regular for generations to be made about them. It is possible to generalize that all human societies created some system of marriage and family. Generalizations are crucial to science because isolated, meaningless events must be placed in patterns or groups that we can understand.⁸

Probably one of the most important aspects of science is that its findings should be treated as *provisional*, never revealing the final truth. Historically, what has been accepted as scientific truth — even scientific laws such as the laws of Newton — have repeatedly been modified or overturned by subsequent investigation. Some assumptions which were firmly believed for centuries have now been totally discarded as a result of subsequent research. Robertson summarizes this as follows:

For centuries common sense told people that the world was the center of the universe and that the earth was flat. Using scientific methods, Copernicus found that the world is simply one planet among others, and the investigations of Columbus and other geographers proved that the earth is round. In making their factual investigations, these men and others like them risked their repu-

tations and sometimes even their lives, for their findings were at odds with important social beliefs of the time. But their challenge to ideas held dearly by their societies tells us something else about science: there are no areas so sacred that science cannot explore them. Any question that can be answered by the scientific method is, in principle, an appropriate subject for scientific inquiry — even if the investigation and the findings outrage powerful interests or undermine cherished values. Yet science is not arrogant: it recognizes no ultimate, final truths. All scientific knowledge is provisional. The body of scientific knowledge at any particular moment represents nothing more than the most logical interpretations of the existing data. It is always possible that new facts will come to light or that the available data will be reinterpreted in a new way, shattering the existing assumptions. Science, therefore, takes nothing for granted: everything is always open for further testing, reinterpretation, correction, and even refutation.⁶

Yet, if one claims something is "science" or scientific, it is often incorrectly understood by the public as "proved," "true," and not just a guess or claim or probability. Conway noted:

The scientist is regarded as a genuine authority, an expert in esoteric matters that are quite unintelligible to the lay person. Further, the scientist is regarded as expert in matters of "hard fact." The scientists' knowledge is seen as demonstrably correct, else how could polio have been eliminated and men have been landed on the moon? Thus, the scientist, speaking as a scientist, can be a powerful authority on any topic.⁸

Science is rarely seen for what it is, a method or means to finding out knowledge, which itself is always subject to modification and further testing. It is not final truth.

The major conflict between philosophy/religion and science is that philosophy/religion attempts to develop statements that are universally true (the major premise)⁹ in all areas such as "all animals are warm-blooded" but science only to summarize limited aspects of reality (the sample). Unless they are arbitrarily defined as such, there are very few major premises in science. All mammals are warm-blooded only because scientists define mammals as warm-blooded, but there are many animals similar to mammals which are not warm-blooded. And thus scientists are more apt to state "according to the Linnean classification system, mammals are, by definition, warm-blooded." Aside from definitions, the word "all" is used tentatively in science. A scientists would be more apt to state "according to present research, animals which have certain characteristics are warm-blooded," or "Taylor, 1981, Jones, 1980, and Smith, 1978, found that animals with certain characteristics . . .".

Summary

Science, then, is a method, a tool, used to learn about reality, and only this. It is a way of finding out what "is," what exists; and how parts of reality interact.

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⁷See, e.g., *Time*, 29 April, 1974, 3 and 10 June, 1974, 26 August, 1974, and 7 December, 1981. Also *U.S. News and World Report* 2 March, 1981 and *Science and Government Report*, 1 October, 1976.
⁸Conway, David, 1982. Jastrow and Genesis. *Free Inquiry* 2(1):32.
⁹It will be recalled that in the first figure of syllogism, which Aristotle called the most scientific, the major premise must be universal. See any work on logic.
 Incidentally, Aristotle's discussion of the scientific method, in his *Posterior Analytics*, is well worth reading.

PANORAMA OF SCIENCE

Concerning Mimicry

A most interesting article on the coevolution of a butterfly and a vine in the *Scientific American* discusses various types of mimicry which occur in the passion-flower vines which are members of the genus *Passiflora*.¹ A careful study of the facts presented in this article would seem to indicate that mimicry from the creationist's viewpoint is of two basically different kinds. One kind is no doubt part of God's original creation and is exemplified by the type shown in the pair of butterfly species known as the monarch (*Danaus menippi* or *Anosia plexippus*) and the viceroy (*Basilarchia archippus*). Evolutionists claim that because the monarch has a disagreeable taste to birds it is mimicked by the viceroy butterfly, and so is protected from birds. But actually another species of the genus *Basilarchia*, the Lorquin's admiral (*B. lorquini*) is a very conspicuous black and orange brown butterfly with a pattern of very prominent white spots extending through the middle of both wings. And this species gets along just as well as the viceroy! Also there is no clear evidence that birds are important predators of moths and butterflies. Rather it would seem that these two species of butterflies were simply created as 'look alikes' to demonstrate that very distinct generic types could actually be made to look quite similar in appearance. In other words though God usually did use a very definite plan in creating the marvelous diversity which we see in nature, He at times created very similar plants and animals from genera and even families which are basically different. Or it might well be said that He was not a slave to His own laws. Actually the fact that such genetically distinct creatures could end up looking so much alike is a strong argument for their creation. For surely it would seem to be most difficult to explain exactly how two unrelated butterflies could ever come to look so superficially similar by the natural selection of mutations. Thus it is hard to see how a mutation giving a resemblance in some one part of the wing would be of enough protective value to become fixed in the population. Many such mutations would have to occur to cause such a complete similarity in wing color and design as is shown in the monarch and the viceroy butterflies.

Similar types of mimicry are exhibited by the walking sticks and especially the amazing "walking leaf,"

a *Phyllium* species. This insect has its wings and flattened expanded body and legs all green except for irregular yellowish spots which look like the fungus and rust growths which often occur on leaves. Even the usual midrib of the leaf and the lateral veins diverging from it are clearly shown. These remarkable examples of mimicry of which there are many undoubtedly were part of God's original creation, and fortunately have been preserved until now. They should cause us to marvel at the remarkable ingenuity of our Creator.

But another type of mimicry occurs which can hardly have been part of the original creation, since it has to do with God's preservation of His creatures. It is this type which is described in a most interesting way by Lawrence E. Gilbert. The butterflies which he discusses are species of the genus *Heliconius* and the plants are the tropical members of the passion flower-vine family or *Passiflora* species. *Heliconius* butterflies deposit their eggs only on the passion-flower vine. And the vine has features which appear to mimic the distinctive bright yellow eggs of the butterflies. Now interaction between the vines and their butterfly parasites, or caterpillars, is highly detrimental to the plants; for occasionally so many leaves are eaten by them that the defoliation is fatal to the plant. One species, *Heliconius hewitsoni*, deposits its eggs only on one species of passion-flower, namely *P. pittieri*. So then the butterfly's opportunities for egg laying are limited. Thus the island of Barro Colorado in Panama has 113 families of plants, represented by 1369 species. Only 11 of these are passion-flower vines. So the butterfly has available to it only about 1/10 of one percent of the plant life on the island. The mere discovery, then, of an appropriate egg-laying site is a difficult and time-consuming process for the egg-laying female butterfly! Furthermore, field observation shows that even after the female has found its host plant and good fresh growth, it may not deposit an egg. For the site must not only suit the female but also be both suitable and safe for the caterpillar that will emerge from the egg. Just how is this accomplished? First of all, it has been found that the leaves of the passion-flower vine give off an odor that attracts butterflies of the *Heliconius* type. But this would bring the butterfly only to the general vicinity of the vine. Now actual determination of which sort of leaves to use is made by a specially

modified pair of front legs that can "drum" on the surface of a leaf. This direct sampling enables the butterfly to recognize the right host plant. However, finding the right plant does not necessarily mean that the female will deposit its cluster of eggs on the leaves of this plant. For the plant may or may not have appropriate egg deposition sites. For if the eggs are deposited too early the hatching caterpillar may devour the shoots before its leaves appear; and because they are too small to eat tough old leaves they will starve. Another consideration is whether or not there are predators or competitors at the chosen site. For the caterpillars of most *Heliconius* species are cannibalistic. So one may suppose that a major criterion affecting the decision of the female would be the presence or absence of another female's eggs at the selected site. It is Gilbert's claim that a mechanism favoring the avoidance of such sites could easily evolve because mutants having such a mechanism will have more progeny than those which deposit their eggs at occupied and unoccupied sites randomly. Now it is an observed fact that among *Heliconius* species which deposit single eggs their deposition is not random. Field studies showed that vines having only one egg outnumbered those having two or more eggs in a proportion greater than statistics would predict for random events. Thus behavior known as "egg load assessment" is a well documented occurrence not only in *Heliconius* species but other insects as well.

Now what are the cues that enable the butterfly to make its decision? One stands out above all others. The eggs are deposited in conspicuous places such as the tip of a shoot, and they are bright yellow. Certain species of passion-flower vines have yellow markings similar in color and shape to the eggs of *Heliconius*. Gilbert's hypothesis is that such markings would reduce the probability of any eggs being deposited on the vine, for to the butterfly it would appear that eggs had already been deposited there. Oddly enough these presumably egg-mimicking features are found quite sporadically, that is they are found in some populations of a *Passiflora* species but not among others of the same species, or subgenus. According to Gilbert this indicates that egg mimicry evolved recently. Gilbert and one of his students, Kathy Williams, did an interesting experiment in which four shoots of *P. oerstedii*, two bearing conspicuous yellow eggs and two bearing no eggs, were exposed to *H. cydno* females in a greenhouse. Inspection by the female was followed by egg deposition in 70% of the visits to egg-free shoots and only 30% of the visits to egg-bearing ones. This experiment certainly supports the reality of assessment. To test the reality of color selection the butterflies were given a choice between shoots with no eggs and those with eggs dyed green, and shoots with green tinted eggs compared to ones with a normal yellow egg. It was found that the butterflies deposited eggs with equal frequency on unoccupied shoots and those with green tinted eggs, that is about 25% of the 80 inspections. The percentage of egg deposition on shoots with the rinsed yellow eggs was significantly the lowest being less than 5% compared to 30% for shoots with rinsed green tinted eggs. The authors explain that the reason these

percentages do not add up to 100% is that the remaining percentages are due to the fact that the butterflies did not lay any eggs after an inspection.

Another experiment indicated that the butterfly took twice as long to deposit eggs on a shoot already having eggs as it did for the deposition on egg-free ones. The extra time was spent in looking for a site as far as possible from an egg.

Finally Gilbert and his student tested the effectiveness of mimic eggs using *Passiflora cyanea*, which develops conspicuous yellow swellings on its stipules, or paired leaf-like appendages on the stem of the plant. When *H. cydno* females were given a choice between shoots bearing mimic eggs and ones with them removed, their preference for mimic free shoots was significant, that is 40% compared to 25%. Deposition time was also twice as long, just as was true for shoots bearing actual *Heliconius* eggs. The authors conclude that though mimic eggs do not totally deter egg deposition, their effect in forcing the butterfly to select places as far as possible from the tip of the shoot does reduce the number of eggs laid at that vulnerable spot.

As Gilbert points out, these relationships between butterflies and plants have also been found in the temperate zone. Thus there is one reported by Rausher which exists between the swallowtail butterflies and plants of the genus *Aristolochia* or birthwort family of which the Dutchman's pipe is a member. Also a similar relationship is found in the mustard family, as shown by Arthur M. Shapiro of the University of California, Davis.

In all of this there is a factor which suggests a caveat. Can we really be sure that the butterfly sees the structures as we see them and therefore would confuse them with eggs? It is possible that the butterfly has an entirely different visual field and so mimics which look like eggs to us would not have that appearance to a butterfly. Gilbert raises that question himself when he states that "this kind of discrimination may be rare in nature, and may in part be attributable to crowded greenhouse conditions." As he says "field studies will be necessary to determine whether the butterflies' capacity for egg-load assessment makes for significant differences in the survival rate and reproductive success of mimetic passion vines compared with nonmimetic ones in the same population."

Nevertheless, it seems to me that the experiments of Gilbert and his students strongly indicate that the butterflies are indeed confused by the mimetic eggs. If so, the question is how are we as creationists going to interpret this rather widely occurring phenomenon? First of all, it would seem that structures such as these were not part of God's original creation. For although undoubtedly butterfly caterpillars lived on plant tissues before man's sin caused a curse to be placed upon God's other creatures, their *reproductive rate* was far lower than now. One needs but to reflect on the havoc done by plagues of various locusts as recorded in the Old Testament to realize that the reproductive rate of these insects was greatly increased at various times as special punishment for gross national sins. Accordingly, it would seem that when the *average rate* of reproduction of the *Heliconius* caterpillar was increased in order to insure its continued existence, pro-

tective features such as the mimic eggs were also provided for the passion-flower vine. These remarkable features are then a part of God's remarkable power of preservation, that is protection from fatal injury, peril or other adversity. In this sense the word preservation is used as in the old mediaeval Latin sense of *praeservare* or "to guard beforehand." In other words it seems to me that God, foreseeing the ravages of the butterfly caterpillar in certain areas of some populations of the passion-flower vine, gave these populations their egg-mimicry ability as a protection against being completely destroyed. That is why within the *same species* some populations have these petioles that look like eggs and others do not! Verification of this concept could be made by comparing the number and behavior of the butterflies in areas where the mimic eggs exist on the passion-flower vine, with the number occurring in areas where the vines do not have them.

To those who may question the idea that God thus directly guides the destiny of His creatures, my reply is to simply quote our Lord who said: "Are not two sparrows sold for a farthing and one of them shall not fall on the ground without your Father." (Matthew 10:29) This saying is wisely interpreted by Matthew Henry to mean (1) They do not light on the ground for food, to pick up a grain of corn, but your heavenly Father, by His providence, laid it ready for them, and (2) they do not fall to the ground by death, either natural or violent, without the notice of God.

Thus if we are to counter the evolutionists' attempt to account for these interrelationships we must remember that God's preservation is detailed indeed, and also anticipatory. There is far too much of a feeling among creationists that God is *only* interested in mankind and his redemption from sin, rather than all of his creatures. For as St. Paul says: "For the invisible things of him from the creation of the world are clearly seen being understood by the things which are made, even his eternal power and Godhead, so that they are without excuse." (Romans 1:20) Also we are told that as a result of sin, "the whole creation groaneth and travaileth in pain until now." (Romans 8:22) That is, much that we see in nature is out of balance or deranged as a result of man's original sin. Thus one derangement is that we have greatly increased fertility of insects and other creatures and even man himself. But lest this result in the extermination of any plant species, God especially preserves them by endowing them also with greater fertility and various protective features. The mimic eggs and hair-like trichomes which pierce the butterfly caterpillars and often fatally immobilize them are two of such devices. Here indeed is a field of study which could profitably be undertaken at our proposed research laboratory by men who are interested in insects and their relationship to plants.

Contributed by Walter E. Lammerts

More Problems for Chemical Evolution

It often happens that scientists studying evolution in one field will come up with results that contradict the theory of evolution in another field. A recent example of this has been reported in which theoretical calculations from stellar evolution directly contra-

dicted results from chemical evolution.² A combined effort from three NASA research facilities on recent data from "young" stars concluded: "... we're coming out with a whole new scenario that's going to cause a re-examination of the chemical and biological processes that led to the origin of life on earth."³ This conclusion is based upon ultraviolet radiation measurements from a polar-orbiting telescope on a half-dozen "young" stars similar to the sun, which were less than 1 billion years old in evolutionary time. These new data suggest that "ultraviolet radiation on the earth from the young sun may have been up to 100,000 times greater than today"⁴ at the time life was supposed to be evolving. This would cause at least 1 million times the amount of oxygen in the early atmosphere due to breaking up the molecules of water vapor and carbon dioxide by the UV radiation. However, more oxygen means more protective ozone, but it would hardly be enough to shield the earth's surface from the much enhanced UV radiation. If those engaged in chemical evolution have problems with the present level of UV radiation, assumed the same in the past, what will they do with much greater amounts plus organically corrosive oxygen? The researchers point to the oxidized iron in "old" rocks as evidence for much more oxygen in the early atmosphere.

The article also states that methane and ammonia couldn't have existed in the early atmosphere because the molecules are too short-lived, and "that such an atmosphere was photochemically unstable if it existed at all."⁵ This has been pointed out by Gish⁶ and other creationist and evolutionary scientists. Therefore, "the overwhelming majority of chemical evolution experiments since the first in 1952 may have been conducted with the wrong atmospheric mixture."⁴ They suggest oxygen should be included in future experiments on the origin of life. These results are far-reaching: "The implications of all this are profound. . . . How could life have formed and evolved in such a hostile environment?"⁴ However, if probability theory and the extreme complexity of biological systems hasn't weakened their confidence in chemical evolution yet, then it is doubtful the conclusions of this article will either. The main reason is stated by Robert Jastrow: "... their materialism is so deeply imbued . . . and scientists like to think they have a unique handle on reality. And they're very arrogant about that . . ."⁷ The article does indicate the speculative nature of chemical evolution. It may also be one more example of the non-falsifiability of the theory of evolution, which some evolutionists are vehemently claiming is not true.

Contributed by Michael Oard

The Principle of Applied Creation in an Origins Curriculum

Once in a letter to Asa Gray, a Harvard professor of botany, Charles Darwin admitted, "I am quite conscious that my speculations run quite beyond the bounds of true science."⁸ In fact, *The Origin of Species* is not your typical scientific treatise, rather it is one long argument from the beginning to the end. He, of course, was arguing against creation, consequently, he was not inclined to consider any evidence for origins from a creation point of view. Darwin's prejudice has

been faithfully preserved in evolutionary theory and incorporated into introductory biology textbooks. The job of a conscientious educator is to eliminate this brazen bias in the curriculum. Applied creation is utilized as a curriculum tool with the express purpose of eliminating bias in evolutionary theory.

When reading the history of science, one may often read about absurd hypotheses, frequently related to spontaneous generation (life coming from nonliving matter), which were accepted as facts by the public. One reason for this is that experimentation was neglected:

During the reign of romantic natural philosophy, conditions were different; the representatives of that school, who imagined that they could solve all the riddles of existence by speculation, deeply scorned experiment, which they considered led to nothing but fruitless artifice. Gradually, however, reason came into its own even in this sphere; the immense success which the experimental method brought to contemporary physics and chemistry induced attempts to apply that method also to biology.⁹

Today experimentation, which can be nothing more than a critical observation, is recognized as the most important step in scientific methodology. On the other hand, theories or hypotheses do exist which are not humanly possible to test experimentally. What is the status of nontestable hypotheses? According to Sir Karl Popper, a noted authority on scientific methodology, "A theory which is not refutable by any conceivable event is nonscientific. Irrefutability is not a virtue but a vice."¹⁰ In reality, a nontestable hypothesis or theory is a statement of belief based upon a certain set of facts influenced by the investigator's personal philosophy, religion, or intuition. It is not in the realm of science. With this in mind, let us consider some of the evidence that Darwin used in the *Origin* and is commonly cited in introductory biology textbooks.

Comparative anatomy means to compare body parts and it may be illustrated in a textbook with a comparison of the skeletal legs of a dog, pig, sheep, and horse. There are obvious similarities among them.

THE EVOLUTION BELIEF FOR COMPARATIVE ANATOMY — Similarities among plants or among animals may mean they evolved from a common ancestor.

The fact of the matter is that one may make comparisons down to the molecular level but it will never ever tell us how anything originated. The impossible test for comparative anatomy would be to go back in time and witness evolution. The objection that many evolutionists have expressed is that creation is not in the realm of science. But, because comparative anatomy is itself not in the realm of science, it becomes permissible to consider the creation point of view.

THE CREATION BELIEF FOR COMPARATIVE ANATOMY — All life may have been created with a Divine plan involving similarities among species.

The point is that under the concept of creation one would not necessarily expect each species to be unequivocally different in every detail from every other species. The impossible test for the creation interpretation for comparative anatomy is the same as for

evolution — go back in time and witness creation. Obviously, we are not proving anything one way or another by considering both interpretations. What we are succeeding in doing is eliminating bias in evolutionary theory, which is of paramount importance to the education profession.

Comparative embryology may be illustrated in the textbooks with a series of pictures showing various stages of embryonic development of a shark, lizard, chicken, chimpanzee, and human. We need not discuss this evidence except to say that it is the same type and nontestable quality as comparative anatomy. The only difference is that it is a comparison of embryonic characteristics rather than adult characteristics.

Geographic distribution refers to the location of various plants and animals on earth. For example, kangaroos and koala bears are found only in Australia. **THE EVOLUTION BELIEF FOR GEOGRAPHIC DISTRIBUTION** — If we find plants or animals inhabiting isolated places on earth and nowhere else, the explanation may be that that is where they happened to evolve into existence.

THE CREATION BELIEF FOR GEOGRAPHIC DISTRIBUTION — All living things may have been created by miraculous power and were widely distributed on earth, but some species have become extinct except in isolated places. For example, fossil evidence indicates that camels and horses once inhabited North America. Horses are believed to have been reestablished in North America by settlers from Europe.

Again we see that the impossible test for both the creation and evolution interpretations for geographic distribution would be to go back in time and witness either creation or evolution.

Vestigial organs refers to organs or structures in plants and animals that have no use or for which no use has been discovered. In other words, these are organs which allegedly are left over from evolution or are in the process of evolving into something useful. The trend, though, has been to discover uses for organs and structures once thought to be vestigial. The human endocrine glands were once thought vestigial as was the coccyx or the so-called "tailbone." The coccyx has muscles attached to it and is necessary for proper movement. No definite use has been discovered for the human appendix, although some authors report that it may function as a defense against some diseases during infancy. Fifty or sixty years ago, for investigators to say an organ was vestigial was just another way of admitting their ignorance as to its purpose.

In order to expand one's thinking on a subject, it is sometimes useful to consider the source. Let us analyze Darwin's thinking on this evidence as presented in the *Origin*. He uses the word *rudimentary* to mean an organ or structure that has lost its function, and *nascent* to mean "a part is capable of further development." The wing of the penguin gives us an idea of the extremely speculative, nontestable quality of this evidence. Darwin raises the question as to how we can know if a part is rudimentary or nascent: "The wing of the penguin is of high service, acting as a

fin; it may, therefore, represent the nascent state of the wing; not that I believe this to be the case; it is more probably a reduced organ, modified for a new function."

This is an interesting statement. He begins by admitting that the wing of a penguin functions as a fin, which is to say that it is neither rudimentary nor nascent. He then goes on to speculate that the wing may be in a nascent condition — in other words, to eventually be used for flight — but then adds that it is more likely in a rudimentary condition, having lost its use for flight.

All of this is pure speculation based upon his belief that life evolved to the exclusion of creation. Why not consider creation? Why not consider the possibility that penguins are flightless birds specially created to exist in their present niche in the ecosystem. Why must everyone think that penguins have a need for flight or had a need to give it up?

He also points out in this chapter that "in the mammalia, for instance, the males possess rudimentary mammae."¹¹ If male mammary glands are rudimentary, then at one time they had the ability to secrete milk. On the other hand, the male mammary glands may be in a nascent condition, which would mean that males may some day have the incongruous ability to feed but not bear offspring. Or perhaps males will also develop the ability to bear offspring, thus eliminating the need for opposite sexes. Obviously, this is all nontestable speculation, so why exclude from consideration the possibility that males were created with rudimentary mammary glands? The concept of creation does not require every organ to have a function, have had a function, or eventually acquire a function. Evolution theorists cannot prove that what appears to be a rudimentary part ever had a use and often what appears to be rudimentary is later discovered to be useful. We are obligated to teach the theory this way because, much as one may wish it were not so, depending upon his or her bias, creation has not been disproved nor evolutionary theory proved.

As indicated in these analyses, creation is not actually being taught, instead applied creation has a secular function as a curriculum tool to eliminate bias in evolutionary theory. The utilization of applied creation brings the curriculum up to par for the education profession.

But why has applied creation become necessary?

Because scientists do not recognize any limitations regarding their ability to make truth statements about our environment. The fact of the matter is that the scientific method applies only to present-day, ongoing phenomena; historical events are outside the realm of experimentation. Yet far be it from me to suggest that scientists must not speculate about the past, as long as they do not insist that I must teach only their beliefs about it.

Because applied creation is a curriculum tool tied to Darwinian evolution, it could conceivably self-destruct without it. But, because it is also an educational principle based upon an educator's obligation not to deny students access to varying points of view, it would rise again, phoenix-like, whenever unscientific speculations or nontestable hypotheses about origins are incorporated into science textbooks and educational films, consequently, insuring objectivity in the future.¹²

Contributed by Randall Hedtke

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Mr. Hedtke is a public high school biology teacher who has included creation in the evolution curriculum since 1969. Applied creationism is based upon the National Education Association code of ethics, which states: "In fulfillment of the obligation to students, an educator shall not unreasonably deny students access to varying points of view."

BOOK REVIEWS

Gaia: A New Look at Life on Earth, by J. E. Lovelock. Oxford University Press. 1979. 157 pages. Price: \$18.25.

Reviewed by Douglas E. Cox.*

Lovelock advances a concept based on evolution, that he supports by drawing upon facts which Crea-

tionists may feel are more indicative of a Designer, and an earth especially planned by the Creator.

The book deals with the hypothesis that "the entire range of living matter on earth, from whales to viruses, and from oaks to algae, could be regarded as constituting a single living entity, capable of manipulating the earth's atmosphere to suit its needs and endowed with faculties and powers far beyond those of its constituent parts."

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Gaia is the name proposed by the author for both this hypothetical creature, and the hypothesis itself. The word is more familiar to us as "Ge" in "geology" and "geography." It is the ancient Greek name for Mother Earth.

In support of the existence of Gaia, the author presents an array of fascinating information. Topics covered include the definition of life, the origin of life, the history of the earth's climate, the chemical constitution of the atmosphere and oceans, the effects of pollution, and philosophical implications of the Gaia hypothesis.

As an evolutionist, the author supposes that life has been on the earth for a very long time, but recognizes a problem: the fossil record shows there has not been much variation in temperature throughout the period, and in fact climate has remained optimal for life. He asks, what was the thermostat and control mechanism? Life itself, or Gaia, is suggested as the regulator of climate.

Lovelock shows that the atmosphere consists of an improbable combination of gases. His investigations led him to conclude that the earth's atmosphere was "so curious and incompatible a mixture that it could not possibly have arisen by chance."

The gases nitrogen, methane, nitrous oxide, ammonia, and carbon dioxide are not in a state of equilibrium in our present atmosphere. It would be expected, for example, from the principles of chemistry, that nitrogen would combine with oxygen to form the nitrate ion, which would eventually become concentrated in the ocean. But the nitrogen of the atmosphere is vital for life, serving to dilute the oxygen and build pressure in the air. If the oxygen concentration increased by only a few percent, fires would soon destroy the earth's vegetation.

Lovelock identifies several control mechanisms that help to maintain the characteristics of the atmosphere at the optimum for life.

Besides photosynthesis, which removes CO_2 from the air and adds oxygen, the flux of gases such as nitrous oxide and methane, produced by bacterial fermentation in muds of marshes and sediments of estuaries, may regulate the oxygen level in the atmosphere. Similarly, the flux of ammonia controls the pH levels; that of methyl chloride regulates the ozone in the stratosphere; and that of methyl iodine distributes iodine from the sea to creatures inland.

Lovelock considers the problem why, if the earth is billions of years old, the ocean is not much more salty than it is. He suggests that some sort of biological control of the salinity of the oceans may exist.

Due to Gaia, some of the gloomy predictions about the effects of pollution may be unfounded. But caution is urged in any programs which may affect conditions in the earth's more sensitive zones, such as tropical rain forests and continental shelves.

The book highlights the special qualities of the earth for supporting life, in contrast to the other planets of the solar system. The author has woven his facts together in an attempt to reveal a living being, Gaia. Where did Gaia come from? Gaia evolved, by the process of natural selection.

Creationists perceive in the universe, the earth, and the atom the role of another living being—the Creator.

Bronze Age America, by Barry Fell, 1982. Little, Brown, and Co., Boston and Toronto. 304 pages.

Reviewed by H. L. Armstrong*

This book continues and extends the thesis set forth in the author's *America B.C.* and *Saga America*: that Europeans had crossed the Atlantic, and traded and settled in America, centuries before Columbus' time, and even before the Vikings of the tenth century or so. Much of the discussion here concerns evidence which, the author believes, shows that Norse people crossed the Atlantic and established a base near what is now Peterborough, Ontario, Canada, around 1700 B.C. The evidence consists especially of rock carvings; and the date is arrived at by astronomical information.

If these things can be corroborated, they will obviously call for a complete re-writing of parts of ancient history. They can also have a bearing on several points of Creationist studies.

First, the high level of technical skill and knowledge (including writing) in far-off Scandinavia at such a remote time may point to a rapid dispersion from Babel, only a few centuries earlier. It has been suggested that the same may be said of the level of knowledge which the builders of the megalithic monuments of Europe must have had.

In the second place, it is suggested that at the time the Arctic regions were relatively free from ice. One might suppose that if there was anything like an Arctic ice-cap before the Flood, the Flood would have removed it. Maybe, then, in 1700 B.C. no very appreciable amount of ice had yet been able to form. Such a state of affairs would fit in with the conclusions reached by Hapgood and others, from study of the maps of the ancient Sea Kings: that they refer to a time before large icecaps had formed. Such considerations may throw light onto the nature of the Flood, and of the Earth's recovery from the Flood.

The third point will interest especially those concerned with ancient history of a more conventional kind. It is suggested that the People of the Sea, who attacked Egypt in the time of Pharaoh Rameses III, were, or included, Norse or Nordic people. This interpretation is quite different from Velikovsky's, as set forth in his *Peoples of the Sea*. If Fell is right on this point, we have another example of the extent to which there was travel and communication all over Europe that long ago.

Abusing Science — The Case Against Creationism, by Philip Kitcher. MIT Press, Cambridge, Massachusetts, and London, 1982.

Reviewed by Christoph Bluth*

For some decades the scientific establishment completely ignored creationism. In recent years, creation-

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ism has become very popular particularly in the United States, where Creationists have embarked on a legal battle for "equal time" for the teaching of creationist and evolutionary theories in schools. Since then, Creationists have been frequently vilified and ridiculed in the scientific press, mostly by scientists who had never read any creationist literature and whose knowledge of creationism was at best second-hand. "Refutation" of creationism consisted largely of re-stating "orthodox" evolutionary theory — creationist critiques of "orthodox" theory were ignored.

Philip Kitcher's book therefore represents a welcome change of approach: for once, creationist arguments are taken seriously and discussed in depth. The result is certainly impressive: some creationist arguments are analyzed in the context of philosophy of science and the empirical data of science, and, it must be confessed, found to be wanting. The book has received high praise by well-known scientists such as Stephen Jay Gould, Richard C. Lewontin and Francisco J. Ayala.

However, while conceding that Kitcher has succeeded in refuting some spurious arguments and speculations, as a Creationist I have no hesitation in saying that he has failed to make his case. Let me briefly sketch my reasons for this assertion.

(1) Chemical Evolution

A. E. Wilder-Smith has presented two very penetrating critiques of current models of chemical evolution. A number of detailed critiques of chemical evolution have also been published by D. T. Gish. Although Kitcher mentions the publications by Wilder-Smith, he does not deal with his central arguments concerning chemical evolution. Creationist critique of chemical evolution hence stands unrefuted.

(2) The Second Law of Thermodynamics

Creationists have often argued that the 2nd law of thermodynamics is in contradiction to the concept of evolution. Kitcher's critique of some creationist formulations of this argument is, I believe, correct up to a point, but he has not refuted the argument as such. Like many biologists unfamiliar with thermodynamics, he attacks the argument on the basis that the law only applies to isolated systems. If one reads the technical literature on this subject (e.g. by Prigogine, Nicolis and Eigen) he realizes that it is not as simple as Kitcher would have us believe. Prigogine is very well aware of the problems the 2nd law causes for evolution; hence his valiant efforts over many decades to find a way to overcome them. Thermodynamics does not suddenly become invalid just because a system is open. The word "open system" is used as a magic wand to dispel the curse of entropy. Of course, if a system is open, this means that it is possible (in principle) that negative entropy will flow into the system. The question here is whether the energy influx from the sun could cause the earth in its pre-biotic stage systematically to deviate from equilibrium in such a way as to produce highly complex biological systems. While Ilya Prigogine, Manfred Eigen and others have obtained interesting results, it is clear that they have not solved the problem. It is difficult to believe that

random forces acting on a system like the prebiological earth-sun system can produce order, i.e. that the random interaction of the 'open system' earth with the universe involves the flow of negative entropy to the earth required for evolutionary processes. Quite to the contrary, the longer a system is subject to random forces, the more random the distribution of molecules is likely to become. Over time, the system is considerably more likely to approach equilibrium rather than consistently to depart from it.

(3) The Mechanism of Evolution

Again, Kitcher does a good demolition job on some of the more questionable statements by creationists on genetics, but fails when it comes to the crunch. Many creationists now find themselves in agreement with the methods and results of population genetics, but point out that it fails to address itself to the real question: Macroevolution. Kitcher obviously would have us believe that macro-evolution is nothing more than scaled-up micro-evolution. Population genetics is both necessary and sufficient to explain all known aspects of evolution. Indeed, "many evolutionary biologists . . . would argue that there is no basis for a distinction between the processes of microevolution and those of macroevolution." (p. 144). The burden of proof, of course, lies with those who would argue that microevolutionary processes are sufficient to explain macroevolution, and not the other way round. After telling us first that "many biologists" subscribe to his view, Kitcher then admits that there are others who disagree. However, he then side-steps the discussion by transferring it to the area of the fossil record, as if this were the only source of disagreement with his view of the evolutionary mechanism.

That all is not as simple as it might appear becomes clear in R. C. Lewontin's study *The Genetic Basis of Evolutionary Change*, where he freely admits, "It is an irony of evolutionary genetics that, although it is a fusion of Mendelism and Darwinism, it has made no direct contribution to what Darwin obviously saw as the fundamental problem: the origin of species . . . we know virtually nothing about the genetic changes that occur in species formation." (p. 159). The evolutionary concept postulates that all living beings on this planet have ultimately a common biological origin, and that complex organisms have over a long time span evolved from more primitive ones. This contention does not logically follow from microevolution as described by population genetics.

Wilder-Smith presents a very detailed argument on this issue, based on calculations done by M. P. Schützengerger, presented at a symposium on *Mathematical Challenges to the Neo-Darwinian Theory of Evolution*, which completely refutes the idea that the Neo-Darwinian mechanism can explain evolution, Schützengerger concluded his quantitative study of evolution models by saying: "Thus . . . we believe there is a considerable gap in the neo-Darwinian theory of evolution, and we believe this gap to be of such a nature that it cannot be bridged within the current conception of biology."

Kitcher deals with all sorts of peripheral aspects of Wilder-Smith's books (*The Creation of Life*, 1970;

'*The Natural Sciences Know Nothing Of Evolution*,' 1981), but ignores entirely his central arguments, such as the one referred to above. Hence the creationist critique of the mechanism of evolutionary change stands unrefuted.

(4) The Fossil Record

Although strong disagreements exist among scientists about many aspects of evolutionary theory, the most obvious and best-known discussion is that between those who believe evolution proceeded gradually, and those who believe that long periods of evolutionary "stasis" were interrupted by sudden bursts of evolution — "punctuated equilibria." Proponents of the theory of 'punctuated equilibria' are not very keen that Creationists should exploit their results. Creationists would argue that the new theory is not adequate to account for the phenomena of the fossil record. The gradualists cite the improbability of fossilization and the resultant incompleteness of the fossil record as an explanation for the absence of transitional forms. In my view, this argument is easily refuted by a thorough study of the results published by Steven Stanley, Niles Eldredge, Stephen Jay Gould *et al.* Creationists argue that the gaps in the fossil record are such that even a theory of 'punctuated equilibria' cannot explain them. Kitcher discusses some of the arguments put forward by D. T. Gish, but ignores the really difficult issues (e.g. the 'Cambrian explosion') and doesn't discuss many other creationist studies on the issue. Again his discussions do not, in my view add up to a refutation of the Creationist position. (I have argued this view in more detail in a more extensive paper.*)

Evolutionists will no doubt wish to read *Abusing Science*; and creationists, too, might well do so, if only to learn what the other side is saying. I must say, though, that it seems to be based on only a very few creationist sources; and even they are discussed very selectively. In my view, the author has failed to deal with the central issue; and he has left me as firmly as ever convinced that the self-organization of matter, which is what the various theories of evolution come down to, is against all the facts of science.

**Creationism Defended*, elsewhere in this issue of the *Quarterly*.

The Neck of the Giraffe: Where Darwin went Wrong, by Francis Hitching. Ticknor and Fields, New York, 1982. 288 pages, \$13.95.

Reviewed by L. John Van Til.*

Very likely in the months and years ahead *The Neck of the Giraffe* will become a minor classic in the ongoing debate between science and religion. It would be an exercise in understatement to say that this book is a very important one. *The Neck of the Giraffe* is one of those rare books that summarizes and evaluates a complex and exceedingly important problem in an interesting and even humorous manner. The sub-title of the book, "Where Darwin Went Wrong," accurately states the thrust of the book, that is, that Charles Darwin was wrong in his theory of evolution.

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A chance reading of the title and sub-title would likely evoke disbelief among some, laughter and incredulity among others, and dismissal of it by still others as yet another in the long line of crabby attacks on Darwin by religious fanatics. Disbelief and surprise might be proper responses by those who are unaware of the decade-long row that has been bubbling up in the academic journals and in the annual conventions of the various scientific associations. Hitching summarizes this debate and concludes that the great weight of evidence supports the conclusion that Darwin's theory of evolution cannot be sustained. Darwin, of course, argued that man descended from other forms of life over a long period of time through the process of natural selection.

In the first chapter Hitching outlines the central role that fossil records play in a Darwinian view of evolution. While textbooks at all levels suggest continuity in the various layers of fossil deposits, Hitching shows that leading scientists today recognize that this claim is false and non-provable. Gaps in the fossil record exist and undermine the validity of this crucial element in the Darwinian theory. States Hitching, "Puzzling though this is to those of us brought up to believe in the gradual ascent of man from the amoeba, the fossil record contradicts this."

Darwin was aware that he could not explain the mechanism of change, a subject examined in the second chapter by Hitching. By the time of Darwin's death in 1882 it seemed that the Mendelian laws of genetics supplied the answer to the question as to how changes between generations took place. Mendel was correct in certain respects, but a century of genetic studies has revealed an incredibly complex genetic pattern, one with limits that preclude its application to the problem of the origin of species. There are, Hitching observes, natural limits to genetic change, a fact that is most frustrating to Darwinian evolutionists.

Even micro-changes, as in viruses, have been advanced by modern biologists as evidence of evolution. But, concludes Hitching, it is a long step from minor alteration to "macro-changes" implied in the Darwinian theory.

Turning to the question of meaningful information encoded in genes, Hitching examines the evidence associated with the discovery of DNA. While it seems clear that all life forms include DNA and DNA-related properties, suggesting that all life had a common origin, little more can be said, according to Hitching. A central mystery, obviously, is the question of how life-sustaining elements came into being in the first place — "How did life begin?" Modern biologists speculate on this question to be sure. But, says Hitching, they will never know how life began in a scientific sense because it was by definition a unique event and "unique events cannot be investigated satisfactorily by science."

Hitching devotes substantial space to discussion of the various theories of the origin of life at the DNA level. It is a thoughtful and lengthy summary, but too long to note in detail here. One point is clear, as the title to the third chapter suggests; the odds are greatly against a chance formation of life (DNA-related fac-

tors) from non-life chemicals and conditions. The odds are of a magnitude that is beyond the comprehension and imagination of the human mind — 10^{138} and the like.

In the fourth chapter Hitching reviews biological oddities. He does this after quoting Darwin himself to the effect that if complex organs (the eye) exist, which could not have been the result of slight modifications over a long period of time, his theory "would absolutely break down." Biologists recognize that the human eye is amazingly complex in structure and in operation. It is also admitted by most that for such an organ to arrive at its present complex state by chance in a natural selection process is against all odds.

The same can be said about bombardier beetles, the whale's tail, feathers on birds, hair on mammals, blood circulation, poison in snakes, and much more. "Fanciful," says Hitching, is the correct way to label the notion that these marvelous features of nature's creatures matured by chance. It is, as Hitching states, "against all odds."

Having suggested that the Darwinian theory of evolution requires too much speculation to be accepted as valid, Hitching turns to alternative theories in a fifth chapter. In it he first examines creationism as a theory. The result is a thoughtful summary of its main features. In fact, the chapter is a very good short summary of all current creationist thinking. In the end, Hitching rejects creationism as an explanation because it cannot be proved or disproved. Nevertheless, Hitching gives the impression that it is a formidable school of thought, one that he basically respects for its honesty and competence.

One weakness of Hitching's study should be mentioned at this point. In a subsequent chapter he discusses the development of a new evolutionary theory that he believes will, at some point, replace Darwin's now discredited theory. Unfortunately, he does not note clearly that this new view is based on unprovable assumptions, just as the creationist view is. In other words, he could be more conscious of the "presuppositional nature of knowledge," including his own.

Chapter six is an excellent summary of the problem of time as it affects the question of evolution. Central to Darwin's view, of course, is a very long time period for the existence of the world — the earth had to be very, very old for the supposed evolutionary changes to take place gradually. This is a familiar idea in all textbooks dealing with Darwin's views — millions and billions of years are mentioned and thrown about in a cavalier way. But recently, scientific thinking has gone in the opposite direction, arguing for dramatic changes in a relatively short time period. This is a further blow to the Darwinian view. The problem of dating anything beyond the reaches of human experience involves grand assumptions that even Hitching seems not to appreciate. It should be added that Hitching's summary of current theories of catastrophic change in the earth's surface is exceptional — worth reading aside from its place in the development of the book.

A seventh chapter evaluates the tendency for contemporary biologists to focus too much on genes, molecules, and cells. This has caused them, says Hitching,

to lose sight of "nature's creations as a whole." There are patterns to life, he notes, that are unexplained by the myopic focus on micro-elements. There seems to be, he says, an underlying "law of forms" which all of life obeys.

It is also in this chapter that he explains a view of evolution that he hopes will one day come to replace Darwin's theory, one attributed largely to the Belgian physicist Ilya Prigogine. While very complex and extremely difficult to comprehend, in essence this theory postulates the existence of a single underlying principle to all matter. This is a mathematical principle, or series of related principles, that is so complex that Hitching turned to a friend for help in understanding it. Said his friend, in the end, intriguing though his work is, "In many ways Prigogine is as much a mystic as a physicist or chemist. He has a view of life which may well be right, but does not altogether lend itself to our existing scientific methods — in other words, to be blunt, it is not science as we know it."

This conclusion, as indicated earlier, is much like Hitching's attitude toward creationism. In other words, the "new" theory of evolution seems not to be any more provable than creationism.

Having discussed the failure of Darwin's theory and having discussed the "new" evolution, Hitching has made his main arguments. He does, however, have an additional chapter on "monkey business" in which he shows clearly how evolutionists over the years have doctored the evidence to support the theory — Pilt-down Man, Peking Man, and the like. This is valuable material for people who have not been aware of the hoaxes associated with the attempts to substantiate Darwin's theory over the years. These "reconstructions" of "missing links" are part and parcel of the history of Darwinian evolution.

A final chapter is a useful history of Darwin's life. It points out, for example, that Darwin's grandfather, Erasmus Darwin, had written on evolution in his *Zoonomia* (1794, 1797). Most of the ideas in Charles' *Origin of Species* (1859) can also be found in his grandfather's work, a copy of which Charles owned and thumbed well. Nevertheless, Hitching concludes that Charles Darwin was a great student of nature and would be famous for this even though he was wrong in his theory of evolution.

After reading *The Neck of the Giraffe*, the inescapable conclusion is that biologists must now go back to the drawing boards and look again for an explanation of the riddle of life. It can only be hoped that teachers of science, at all levels, will take to heart the message Hitching has summarized so well for us all and stop teaching the Darwinian theory of evolution as though it were correct. In fact, any teacher who continues to teach in the Darwinian fashion after reading Hitching's book can only be regarded as insufficiently advanced on the evolutionary ladder.

If Mark Twain could read *The Neck of the Giraffe*, his reaction would be predictable. He would smile agreeably. When he visited the museums in his day that housed the "reconstructed" creatures of the evolutionary past, he said of the dinosaur that it was "three bones and twelve barrels of plaster."

LETTERS TO THE EDITOR

Allopatry Defended

In reply to Mr. Mehler¹ there is growing evidence that some form of allopatry has indeed occurred, and that species can suddenly change morphologically after long periods of stability. Perhaps the most publicized recent example is by Williamson,² who studied a very detailed sequence of fossil molluscs from the eastern Turkana basin in East Africa. All of the 13 lineages studied by him showed a pattern of evolution conforming to the "punctuated equilibrium model." That paper generated considerable debate (see *Nature* 269: 608-612), but it is by no means the only example. From the New Zealand Cenozoic molluscs *Bassina*, *Lima*, *Phialopecten*, and *Poirieria* all appear to conform to such a pattern.³

If change is occurring on this scale (5000-50,000 'years') then it should be visible in the present fauna. A possible example is provided by the New Zealand freshwater fish *Retropinna retropinna* which exists as both lake and diadromous populations. The lacustrine populations were treated as different species until it was documented that in many cases the lake populations had been established by man. This is illustrated by the differences between the Rotorua lakes population, liberated into the lakes in the 1900's, and the Waikato R. population from which they were derived. The lake populations are dwarfed, and the taxonomic differences include a reduction in the number of vertebrae from about 60.5 in the Waikato river to only 51-53 in the lakes.⁴ Lake Waahi has a lacustrine population sympatric with a diadromous stock derived from the Waikato R. system⁴ and it is probable that the two stocks represent different gene pools. If a sample of these fish were found as fossils above strata containing the original diadromous fish, and the discoverer had no knowledge of their history, then they would probably be cited as evidence for allopatric speciation.

Where does this lead the creationist?

(1) Species *do* change rapidly in behavior and morphology in response to changed environment and that change can be permanent if genes are lost (illustrated by the Pacific sardine off California which were originally schooling fish but after heavy fishing pressure have now become dispersed into shallower water).⁵

(2) One could hypothesize that sufficiently regular changes could modify a species quite dramatically, eventually leading to new genera. Such effects would be most marked in animals with a short lifespan, bacteria, fungi, or viruses, since these have the greatest turnover of generations.

(3) We accept as an axiom that Biblical 'kinds' do not change; but we should be careful not to equate a 'kind' with some level of the artificial and changing taxonomic system.

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- ¹Mehler, A. W., 1982. Flaws in allopatric theory (In Panorama of Science.) *Creation Research Society Quarterly* 18(4): 233-234.
- ²Williamson, P. G., 1981. Palaeontological documentation of speciation in Cenozoic molluscs from Turkana Basin. *Nature* 293(5832):437-443.

³Maxwell, Phillip A., 1982. New Zealand Cenozoic mollusca—how useful are they for evolutionary studies? (Read before the Systematics Association of New Zealand.)

⁴McDowall, R. M., 1979. *Journal of the Royal Society of New Zealand* 9(1):85-121.

⁵Murphy, G., 1980. Schooling and the ecology and management of marine fish. (In) Bardach, J. E., J. J. Magnuson, R. C. May, and J. M. Reinhard, eds., Fish behaviour and its use in the capture and culture of fishes. ICLARM Conference Proceedings 5. International Centre for Living Aquatic Resources Management, Manila, Philippines. Pp. 400-414.

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Received 17 November, 1982.

Reply to Jones

1. No one (including Creationists) would doubt that species can and do change rapidly in behavior and morphology under the influence of sudden changes in environment such as an alteration to the pH Factor. This is well documented especially in marine organisms. However, that these sudden changes would occur over long periods such as the 5000-50,000 years mentioned by Dr. Jones is questionable. Creationists would insist that sudden changes are just that — *complete* in one or two generations.

2. As admitted by Dr. Jones, any peripheral species cut off from the mainstream population would suffer from a *loss* of genes — i.e., a *loss* of information in the D.N.A. of the isolated gene-pool and this must result in reduction, that is, devolution not evolution. (Note the *reduction* in vertebrae from 60.5 to 51-53 in the lakes population). No known biological mechanism exists which could cause an isolated fringe species which suffered from *reduced* gene-pool information, to evolve upwards through *increased* D.N.A. complexity.

3. Dr. Jones does not state whether the Waikato River Freshwater *Retrapinna* population is reproductively isolated from the lakes population (i.e. can they interbreed with fertile offspring) so as to be classified as two genuine species. No change in "kind" has occurred.

4. My text and illustrations as given in the C.R.S. *Quarterly* show clearly that the type of allopatry claimed as the mechanism to explain away the missing links does not square up to the known geologic facts, and is therefore untenable.

5. Williamson's mollusks from Turkana in East Africa show long periods of stasis followed by sudden changes at the *same* complexity level or sudden changes in size. No upward movement in evolutionary complexity levels has been demonstrated. Halaam of England found the same thing with mollusks from the Jurassic.

6. Dr. Jones' assertion that we must be careful not necessarily to equate Biblical "kinds" with various levels of human taxonomic systems is quite correct. Nobody knows for sure how these Biblical "kinds" correlated (if at all) with current scientific taxa.

Yours faithfully,
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Received 16 December 1982

Comments on Fossil Succession

I would like to make a couple of comments on Glenn Morton's article "Fossil Succession"¹

Firstly, Mr. Morton has by no means demolished the Flood Geology Model of Drs. Whitcomb and Morris. Mr. Morton has made the error of accepting the standard geologic column of uniformitarian geologists in abiding by the unproven named time scales of evolutionary science, i.e. the "Cambrian," "Silurian," etc. It is my firm opinion that Creationists should abandon the standard column and treat each fossil deposit on its own merits. Co-relation with other fossil deposits is unwise and unnecessary.

I also dispute Mr. Morton's claim of fossil succession being a support for evolutionists — (a) Any fossil can be found at any depth (i.e., "Silurian" crinoids at surface level in the Jenolan Caves, Australia, and various finds of human remains at considerable depths in many places), (b) If uniformitarian geology was correct, we should expect to find countless cases of uplifted "early" deposits of say "Cambrian" trilobites or "Devonian" mollusks which have become eroded elsewhere, being re-deposited on top of "younger" fossils of say the "Permian." Thus we could expect to find countless columns as follows:—

Cretaceous
Devonian — (re-deposited after uplifting and erosion)

Permian
Cambrian — (re-deposited after uplifting and erosion)

Pennsylvanian
Devonian
Cambrian

This sort of thing should be very common in view of the standard claims of numerous upliftings and erosions in the past alleged 600 million years, yet such cases are virtually unknown.

We should drop altogether the terms of the geologic column (except as references), and avoid terms such as "earlier," "later," "first to appear," and so on.

We should also request uniformitarians to explain the complaint by Howorth in *Ice or Water?*² that no one could come up with reasons as to why there are "countless" cases of paraconformities where two deposits separated by up to a hundred million years have not the slightest evidence of erosion between them, and the bottom and top surfaces of these deposits lie so smoothly together that it is plain that there was no erosion for that length of time. One may accept that a deposit was not eroded for 1000 or even 10,000 years, but not for millions of years.

Undoubtedly Noah's Flood deposited the majority of fossils but let us not forget the many catastrophes which would have led to other fossil deposits in the centuries following the Flood as the Earth returned

to some sort of equilibrium. Only the Flood can also explain so many extinctions.

References

¹Morton, Glen, 1982. Fossil succession. *Creation Research Society Quarterly* 19(2):103-111, & 90.

²Howorth, Sir Henry H., 1905. *Ice or water?* Longmans, Green, and Company, London.

Yours faithfully,
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Received 24 December 1982.

Reply to Mehler

I wish it were as easy as Mehler believes to abandon the idea of the geologic column. We often claim that it doesn't exist; and yet in spite of his conclusion, Woodmorappe's recent article shows that the entire geologic column exists in Iran, by the Caspian, the Himalayas, Indonesia, Australia, North Africa, Canada, South America, Japan, Mexico and the Philippines.¹ Figure 1 shows what the rocks around the Dallas area look like. The beds had to be deposited in the order numbered. It is impossible for it to have been otherwise. Let us assume that bed 7 was deposited before bed 6. In order for this to occur, bed 7 had to have been deposited on top of bed 5 and then lifted up while bed 6 was deposited or shoved underneath it. Then bed 7 would have to be replaced on top of bed 6. This being impossible, bed 6 had to have been

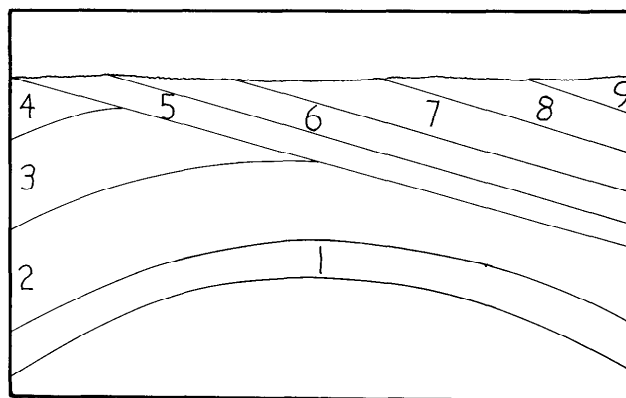


Figure 1. The strata in the vicinity of Dallas, Texas.

deposited *earlier* than bed 7. In order to reject this, one must reject logic itself. Thus we can not "avoid terms such as 'earlier,' 'later,' 'first to appear,' and so on."

Which bed is above or lying on top of another is determinable regardless of one's philosophical position. Simple up and down is not a matter of philosophical opinion but one of fact. Neither I nor the people working under me can successfully explore for oil without concepts of earlier and later. If an oil trap forms in the rocks later than the oil formed, there will be no oil in that perfectly suitable trap. The oil will have migrated elsewhere.

Even Whitcomb and Morris implicitly assume that there is an order in time for the appearance of various

groups of fossils. Their entire ecological-hydrodynamic model is an attempt to explain that order.

As for using unproven evolutionary names, it would not help to talk about the Mortonian or Mehlertian period of the flood since no one would have the slightest idea what I was talking about. We must use those terms, just as Whitcomb and Morris do throughout their book if we wish to communicate.

I must disagree with Mehlert's contention that depth of burial is important for geologic age determination within the evolutionary scenario. Assume that bed 5 is a Silurian deposit. The fact that the Silurian fossils are found at both the surface and at depth in an oil well core is irrelevant to the age of that bed.

Nor can I agree that reworked fossils should be more common if the evolutionary views are true. Within their system it takes thousands of years for a fossil to weather out of its host rock and before the soil above it eroded away the fossil itself is most likely to be weathered into soil. Under this slow erosion it is to be expected that reworked fossils are the rarity that they are. The bedrock underneath my house is full of fossil mollusks. The mollusks weather out of the bedrock and are held in the clay soil. Only rarely can one find these fossils on top of the soil and when found, they are so weathered as to be almost unrecognizable. However, when my children dug a hole in the backyard, they found many, very fine specimens. Thus under normal conditions it would be unlikely for these fossils to be redeposited.

On the other hand the Whitcomb-Morris model predicts that we should find more reworking than we do. Whitcomb and Morris state,

"An undetermined amount of strata, particularly in the upper levels, may have been re-worked and redeposited during the later stages of the Deluge, as a result of the great epeirogenic (continental uplift) processes which ended the universal inundation."²

Thus the order shown in Mehlert's letter is more to be expected from the flood than from the uniformitarian position.

I would agree that disconformities (paraconformities) present a problem for standard geological science, however, I never mentioned them in my article and do not fully understand how they apply to a criticism of my views. What I showed was an angular unconformity (unfortunately printed upside down) not a disconformity. There is a large difference between the two.

As for the comments about postflood catastrophism, that is precisely what I am proposing. I simply refer to the entire period of catastrophism as the flood.

Sincerely,

Glenn R. Morton
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Received 21 January 1983.

References

- ¹Woodmorappe, John, 1981. The essential nonexistence of the evolutionary uniformitarian geologic column: a quantitative assessment. *Creation Research Society Quarterly* 18(1):46-71. See especially p. 62.
- ²Whitcomb, John C., and Henry M. Morris, 1961. *The Genesis Flood*. Baker Book House, Grand Rapids. P. 327.

Concerning Several Matters

Several recent items in the *Quarterly* have put forward views which seem diametrically opposed to some which I have published. Thus, I wish to defend my position. Also, I believe that these rival views may make needless difficulties for Creationists.

First, there is the matter of dating by radioactivity. In his article: "Electromagnetics and Appearance of Age,"¹ Morton cites my work² on radiometric dating and points out that the list of radiometric results were only those at least 20% discrepant. The purpose of the 20% limit is to ensure that dates are not included which some authors may not regard as discrepant: the point being that even accepted results contradict themselves well outside the limits of measurement error!

As for the analogy about train timetables not being discrepant if some trains are off schedule, a *few* errant trains don't disrupt train schedules, but *routine* failures do! As a matter of fact, I know from personal experience in a certain Eastern European nation that the socialist-run trains are so inefficient that train schedules are the butt of many popular jokes! Likewise, a few discrepant dates wouldn't mean anything, but the considerable number of discrepant results cast great doubt upon radiometric dating.

It is well known that often, when a result is contrary to a theory, proponents of the theory say that the result was expected, apparently thinking that somehow excuses everything. An analogous situation exists for radiometric dates and discrepant results.

As a matter of fact, discrepant results are not, strictly speaking, "expected." There is no way of *independently* knowing how many rocks would ostensibly remain closed systems over the alleged eons of time. In fact, radiometric results were once treated with much greater confidence than they are now. I documented in my paper (the statement of Goldich at the beginning of the work) that the once-used term "absolute age" has fallen nearly into disuse because dating results have to be selectively accepted.

Discrepant results are also not "expected" because many rocks showing no evidence of reheating, leaching, cleavage, etc., produce discrepant results. The rejection of dating results by uniformitarians is thus quite arbitrary. It is a mistake to accept uncritically selective use of data and all the rationalizations that go with it. Radiometric dating involves questionable initial assumptions mixed with hypotheses piled upon hypotheses. Every scientist knows that a position that endlessly multiplies assumptions, hypotheses, and rationalizations for non-fitting data is not a good position. I had cited at the end of my work (and also know other) uniformitarians who think little of radiometric dating. A thorough reading of my work would reveal numerous other geologic evidences which thoroughly deprive radiometric dating of credibility.

Nor is radiometric dating accredited just because even discrepant results show a crude trend towards greater results going stratigraphically downward. Results do not have to be random or chaotic in order for a dating system to fall into disrepute. It is uniformitarians themselves who have largely rejected the Lead-Alpha and Th²³²-Pb²⁰⁸ methods because of their

inconsistencies, yet the inconsistencies were not chaotic nor trendless.

The trend for radiometric results to be older going stratigraphically downward (Morton's Fig. 1) is exaggerated even if "fitting" results were included. It was documented in my paper that many (if not most) discrepant results go unpublished. The author has been informed by a uniformitarian familiar with radiometric dating (and not knowing that the author is a Creationist) that not only are discrepant results often not published, but that more severely deviant results (for which it is more difficult to ascribe some sort of alleged geologic meaning) *preferentially* go unpublished. A second factor exaggerating the trend of radiometric results is the nature of the biostratigraphic control. Biostratigraphic control in my work on radiometric dating was treated as if it were definitive. Biostratigraphic dating, like radiometric dating, involves selective acceptance of data (where certain fossils are elevated to index fossil status and others of long stratigraphic range are conveniently disregarded). Even the best biostratigraphic control is therefore not a single value but a spread of values over at least several tens of millions of years. Taking all these factors into consideration, one can see that the radiometric-stratigraphic correlation exists but is really quite crude.

Such a trend is no proof for radiometric dating because other geochemical-stratigraphic trends exist. The K-Ar/biostratigraphic trend can be explained by rates of formation of magma with controlled entrapment of argon. The igneous bodies formed during Creation week formed in hours or days and so most argon remained trapped in the magma: hence high Ar/K ratios and "ages" up to billions of years. Flood-related mobilizations of magmas took longer (their beginning stages over months) and so more of their argon escaped: hence lower Ar/K ratios and "ages" only hundreds of millions of years to tens of millions of years (Intraflood progressive slow-down in magma generation explains decline in K-Ar results going stratigraphically upward in the Phanerozoic.) Finally, contemporary magmas are exuded so slowly that nearly all Argon can escape the magma and so modern lavas usually (but not always!) yield zero ages. The stratigraphic trends of the Rb-Sr and U-Pb isochron methods can be explained by progressive isotopic differentiation. The stratigraphically lowest rocks are the least geochemically differentiated so there is a large spread of concentrations of the isotopes in question: hence steep isochrons and large apparent ages. Stratigraphically higher rocks have a smaller range of isotopic concentrations because they are more differentiated than lower ones and hence isochrons are more horizontal and define lower apparent ages. Modern lavas are such a differentiated "cream" that they usually (but not always!) yield horizontal isochrons and hence essentially zero ages.

Morton cites the absence of unsupported radioactive isotopes of half-life shorter than 80-100 million years as evidence of a 4.5 billion year earth; again approaching the topic in a very uncritical manner. Much of the research on such isotopes and discovery of 100 m.y. half-life isotopes in nature is relatively recent and published in journals such as *Nature* and *Geo-*

chimica et Cosmochimica Acta; reflecting the pioneering nature of these discoveries. Consequently, it is yet possible that unsupported isotopes of half-life much under 80-100 m.y. may yet be discovered; especially in light of the fact that discoveries of 100 m.y. ones are recent and generally singular discoveries. I would, in any case, have to be convinced that as much effort has been expended to find isotopes which are no longer believed to naturally exist due to the alleged 4.5 b.y. earth age as has been expended to find those of 80-100 m.y. and older.

There is a perfectly logical reason why God may not have created any isotopes of half-life much under 80 m.y. The shorter the half-life of an isotope, the more intense its radiation and the greater the biological hazard it presents (as witness the fear of nuclear fallout and even "minor" leaks from nuclear reactors: the clear danger of injecting short-lived and intermediate-lived isotopes into the environment). Moreover, most of the intermediate-lived isotopes form compounds more water-soluble than those of U-Pb and hence would be easily leached out from rock by groundwater and easily become geochemically concentrated into "hot spots" of great biological danger.

Was the Antediluvian Earth Warm?

Another article, also by Morton, cautions against deductions from fossils that have no living representatives.³ There is some merit to this, but on the other hand organisms within a taxon tend to have similarities. His claim that recognition of climatic tendencies almost forces one to accept evolution and/or uniformitarianism is a complete *non sequitur*. Recognizing climatic tolerances of organisms follows from a study of their morphology and has nothing to do about how they got that way (whether through evolution or through special creation). Recognizing and using evolutionists' studies in paleoclimatology (provided that it is based on morphology of the organisms in question) no more pushes one to accept evolution than recognition and use of medical advances (made often by evolutionistic doctors) pushes one to do so.

The essence of Morton's article is the claim that the Flood transported everything around so as to make paleoclimatic judgments almost useless. Such a view is untenable because many organisms could not be transported great distances. For instance, the Permian-Carboniferous floras of Antarctica cover vast regions; and it totally strains the imagination to consider that such vast amounts and concentrations of vegetation could be transported intercontinental distances from the nearest subtropical locality. Oceanic currents should tend to be chaotic and to disseminate, not concentrate, transported debris. Moreover, many excellently-preserved leaves from the Permian of Antarctica attest to the fact that the leaves must have been buried close to where they lived.

Morton notes that Creationists accept paleoclimatic deductions from coal plants and also believe that plants were washed into their present positions. He claims that this is based upon mutually exclusive ideas of coal formation." But belief in the allochthony of coal plants certainly doesn't oblige one to believe that they were transported across transoceanic distances

and thereby have lost their paleoclimatic signature! Local transport sufficed.

Events During and After the Flood

Finally, I wish to comment on two items, again by Morton, about the deposition of sediment during the Flood, and about the connection between the Flood and fossils.^{4,5} First let us consider the sediment.

Sediment is transported in a way based upon the velocity of the water carrying it. The water loses velocity as it travels into the ocean. The waters of the Mississippi lose velocity as they enter the Gulf of Mexico, so sediment is most certainly not homogeneously delivered over the entire Atlantic Ocean or even the Gulf of Mexico. Because of loss of velocity, sediment carried by the river is deposited close to the continent in the form of the Mississippi delta and of continental shelves.

Sediment coming off the continents thus gets deposited within a few hundred miles of the continent and never makes it to deep oceanic regions. Even the much greater possible velocity of Floodwater draining off continents does not radically change this picture, because distance of sediment transport is at least a second power function. Thus, to double the distance that the Mississippi debouches a certain clastic particle size into the Gulf, the velocity of the Mississippi River would have to increase severalfold.

Another major factor leading to trends in accumulation of sediments is found in local tectonosedimentary factors on continents. Stratigraphic evidence shows that sediment is very heavily controlled by local factors and is not free to move around over large portions of the earth. Evidence from petrography shows that most sediment was laid down within a few hundred miles from where it was eroded, making it untenable that large volumes of continental sediment would be available to enter the oceans. The existence of platforms, geosynclines, basins, etc., show that local tectonosedimentary factors cause sediment to be trapped far inland on continents and never have the liberty of entering oceans.

Morton's claim that the Cambrian is free of shales is certainly not true on a global scale.

As for the fossil succession, it has not been "difficult for Creationists" but simply has not been examined at sufficient depth. The modern Creationist-Diluvialist paradigm is a young one; so there are naturally many areas of thought not yet studied in great depth. My paper⁸ (in press) will intensively cover this topic. At the same time, evolutionary explanation is *not* "perfectly logical" but requires numerous special pleadings for such factors as "missing" transitions, non-superposed fossils, "missing" strata; and all this revolving around completely unsubstantiated premises (such as the premise that fossils have time significance).

Flood-deposited strata, according to Morton, belong to Precambrian. He greatly exaggerates the Precambrian-Cambrian unconformity and conveniently assumes that the Flood pulverized nearly all organisms living then and so resulted in almost no fossils. As a matter of fact, there are many regions where the Precambrian-Cambrian beds are sedimentary, conformable, and distinguished only by fossils (see a recent special journal issue⁶ on just this topic). If the Flood

is represented by Precambrian strata there certainly should be Flood-caused fossils in these strata as much Precambrian strata is sedimentary and not greatly different from the richly-fossiliferous Phanerozoic strata. Yet there are not, so Morton's hypothesis should receive its quietus right there. There are, after all, no fish, reptiles, mammals, man, etc., in any Late Precambrian strata.

Morton's criticisms of both the ecological and hydrodynamic models of fossil separation seem to contain misunderstandings. He claims that all invertebrates, fish, mammals, etc., (his Fig. 1) should be totally separated with little or no overlap. This criticism ignores the suggestion of the originator Clark that there are *several* habitats of fish, reptiles, etc., that not only explains the persistence of groups long after their first appearance in the rock record but also explains why there are different types of reptiles, mammals, invertebrates, etc., appearing and disappearing in different parts of the geologic column.

I recall Clark also suggesting that habitats occurred at different elevations, facilitating complex separations and overcoming Morton's objections such as marine invertebrates on top of forests and the absence of dolphins in the Devonian where agnathans dominate.

The hydrodynamic model of Whitcomb and Morris does not depend primarily on passive action of Floodwater on organisms. The common (but not universal) tendency for organisms of similar type to increase in size going stratigraphically upward (while mere passive sinking, as pointed out by Morton, would indeed have larger representatives buried first) may simply reflect the fact that in many cases superior ability to escape is more important than density. (Larger organisms can escape further and longer than smaller ones.)

The explanations for fossil separation are not illogical and *ad hoc* as Morton asserts, but represent a blending of diverse and sometimes opposing tendencies. Differential escape, for example, favors the sluggish agnathans buried at low stratigraphic levels while the (in this case opposite) tendency of differentially-elevated benthic habitats enables entirely sessile marine invertebrates to occur at the highest stratigraphic levels. Differential escape of land vertebrates is artificially made more difficult by Morton's criticisms. Animals need not migrate great distances, but just uphill wherever they are. They need not, as Morton imagines, know where to escape, but merely flee uphill as Floodwaters steadily rise, slower animals failing first.

Many Flood models (for example Nevins') allow Cenozoic to be post-Flood in the light of volcanosedimentary evidence. This could explain progressive extinction of mammals. But fossil species and genera should not be recognized. All of the factors involved in the stratigraphic separation of fossils (including the near absence of man until the highest levels) is extensively covered in the author's treatise⁸ in print.

Morton cites some evidences which he believes require for the fossil record more than one year of burial. Not all the fossil record need have been deposited in the Flood year even according to traditional Diluvialist models; but on the other hand Morton's evidences are largely or totally erroneous, or at best questionable.

It is not Creationists who have "ignored those items which need time" but Morton who has ignored alternatives to alleged evidences for protracted time intervals. He cites mudcracks in the geologic record, ignoring work of uniformitarians who note that chemical changes in clays can result in cracks and who consequently do not rely on cracks alone as evidence for subaerial exposure.

The argument from upright plants and trees is also equivocal, both uniformitarians and Diluvialists having showed that upright biotas can easily result from transport. Nor does it take long at all for fungus to grow on plants or for burrows to be built (minutes to hours) and then truncated (his Fig. 4). Erosion of older fossiliferous sediments and incorporation into younger sediments is also inconclusive. Penecontemporaneous cementation can occur over weeks, but intraclasts need not even be lithified! There are numerous instances of large (indurated but not lithified) intraclasts preserved in modern beach environments. Rapid erosion generates intraclasts.

Morton's statement that sandstones are "nearly always void of fossils" is not true. Most sandstones are fossiliferous, and so this argument can (if anything) be turned around against the uniformitarian. The greater richness of fossils in shale over sandstone is explained by uniformitarians through their paleo-environmental interpretations. Sands accumulate in biotal-poor areas such as rivers, beaches, and nearshore environments; while shales result primarily from marine muds accumulating in biotal-rich offshore environments. A similar line of reasoning can be adapted to a Diluvian interpretation.

Morton contradicts himself in citing unconformities. He claims that unconformities cannot occur in one year but then cites the Precambrian-Cambrian unconformity as evidence for the Flood!* The Paluxy tracks and the dinosaur eggs of Mongolia (which are also near the surface) can be post-Flood phenomena, as can many or most footprint regions.

Attention is now focused on Morton's model itself. It has already been pointed out that the Precambrian-Cambrian contact is gently depositional in many areas, so his claim that all human remains and most other organisms would be obliterated by the "tremendous erosive forces" of the Flood seems fallacious.

The heart of Morton's model is this: the Phanerozoic record is entirely post-Flood and deposited in about 3 centuries. It would not be local catastrophes; but large regional catastrophes would be required to deposit all the strata. Such a situation would almost make a mockery of God's promise to Noah that the Flood was forever over. Furthermore, a situation of such widespread, persistent, and enormous regional catastrophes would hardly be conducive to the repopulation of the earth to any significant extent.

Morton's claim that the Phanerozoic record could in itself be "snapshots" of the repopulation of the world follows from a view of repopulation that is, at very best, oversimplified. Every biogeographer knows that the repopulation of a region stripped of life is heavily dependent upon local conditions such as migrational

barriers. There would therefore not be any great consistency of repopulation sequence on a global scale.

Repopulation is not primarily dependent upon reproductive rates nor predator-prey ratios but on forms (such as pioneering plants) especially suitable for inhospitable conditions. Nor does the fossil record, as a whole, support Morton's reproductive-repopulation model. The predators within a group of animals appear in the fossil record at about the same position in the column as non-predators, and in approximately the same abundance. Numerous organisms of clearly high-reproductive rates (such as Tertiary foraminifers and certain plankton) appear late in the geologic record, and vice versa. Paleobotany especially contradicts Morton's model. The small and slow-reproducing Devonian plants appear before faster-reproducing arborescent lycopods of the Permocarboneferous. Angiosperms, including the cottonwood with its pioneering propensities and enormous reproductive rates, appears last in the geologic column.

A consultation of my maps⁷ on the distribution of rocks ascribed to alleged geologic periods shows that the Middle East and adjacent regions have extensive (and thick) fossiliferous Phanerozoic rock. Is this fact, taken along with Morton's suggestions (see his Table 1) to imply that all the individuals between Noah and Isaac lived in a state of levitation in midair while the Phanerozoic was being deposited in the Mideast?

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- ¹Morton, Glenn R., 1982. Electromagnetics and the appearance of age. *Creation Research Society Quarterly* 18(4):227-232.
- ²Woodmorappe, John, 1979. Radiometric geochronology reappraised. *Creation Research Society Quarterly* 16(2):102-109 and 147-148 (inside and outside back covers.)
- ³Morton, Glenn R., 1980. The warm Earth fallacy. *Creation Research Society Quarterly* 17(1):40 & 41.
- ⁴Morton, Robert, 1980. Prolegomena to the study of the sediments. *Creation Research Society Quarterly* 17(3):162-167.
- ⁵Morton, Glenn R., 1982. Fossil succession. *Creation Research Society Quarterly* 19(2):103-111 & 90.
- ⁶1981. *Precambrian Research*, vol. 15. (Entire volume.)
- ⁷Woodmorappe, John, 1981. The essential nonexistence of the evolutionary-uniformitarian geologic column: a quantitative assessment. *Creation Research Society Quarterly* 18(1):46-71. See Maps 1-10, pp. 48-57. Note that the Middle East is thoroughly blanketed with Phanerozoic rock. Were Abraham and others suspended in midair while this was going on?
- ⁸Woodmorappe, John. A diluviological treatise on the stratigraphic separation of fossils. To be published, *CRSQ*, probably September, 1983.

John Woodmorappe
Received 2 December 1982.

Reply to Woodmorappe

Let us begin by considering the radiometric dates. First, a look at the plot of Woodmorappe's data reveals that if a date is wrong, it is far more likely that the radioactive age is younger than the expected age.¹ In other word, when radioactivity yields a discrepant result, it is more often than not younger than what it should be. This tendency can also be seen in the carbon-14 dates presented by Lee.² Thus a uniformitarianist could rightfully claim that radioactivity is actually yielding a minimum age. To fit our preconceptions it would seem that we need things to generally date older than expected and yet these cases are not as frequent. If the contention that radioactivity just does not work is correct, then there should be

*The Precambrian-Cambrian contact in Wisconsin, I observed, is an angular unconformity.

just as many erroneous dates which are too old as are too young. Woodmorappe quotes Mauger completely out of context. Woodmorappe says,

Most sobering of all is the following recent statement by Mauger, 'In general, dates in the correct ball park are assumed to be correct and are published, but those in disagreement with other data are seldom published nor are discrepancies fully explained.'³

When I first read that, I thought Mauger was talking about radioactivity in general. However, looking at the original, he was referring to one type of deposit (an air fall tuff) from one area.

Woodmorappe quotes Forman as saying that it is untidy to report a particular discrepant age. This quote hardly proves that geochronologists are deceitful since Forman reported the bad date in spite of the untidiness. The final quote could not be located due, I believe, to a faulty reference.

In the Warm Earth Fallacy, I was questioning whether we diluvialists can really tell what the pre-flood climate was. Assuming that plants could float at the time of the flood (a reasonable assumption) a plant could float from the equator to the pole in about three month's time, assuming the same velocity as the Gulf Stream. Plants thus transported would be meaningless for climatic interpretation. That plants can and are carried that far is attested to by numerous authorities. Henry N. Andrews says,

It is known from the works of H. B. Guppy and others that seeds and fruits may be carried great distances, for example from the West Indies to the shores of Britain and Scandinavia by the Gulf Stream.⁴

Wilfred Francis reports,

Driftwood from the tropics of the West Indies and the Caribbean Islands is deposited wherever the Gulf Stream changes direction and loses momentum, for example on the South Coast of Iceland, where many cottages contain mahogany beams from driftwood originating in Cuba; to the north of Scandinavia, where accumulations from *tropical trees, animals and insects are deposited on the shores of the Kola Peninsula; on the West Coast of Greenland, as mixed ice and driftwood, and on the islands of the Barents Sea and the North Coast of Siberia.*⁵ (my emphasis)

Thus the authorities would disagree with Woodmorappe's contention that animals and plants are not transported large distances. How much more likely this would be during the flood. Lull reports that natural rafts of vegetation have been reported over 1,000 miles from the point of origin and sometimes these rafts carry with them monkeys, large cats, squirrels, arboreal mammals, reptiles and molluscs.⁶ Thus the finding of tropical animals and plants even on the north shores of Siberia does not mean that Siberia is currently warm any more than the finding of flood deposited tropical plants at the poles proves a formerly warm climate.

Woodmorappe criticizes my assumption of uniform sediment distribution and claims that not much sedimentary material gets into the deep ocean. First I would agree that the sediments were probably not

homogeneously distributed in the flood waters, however; in *any* problems of physics, one must make assumptions and homogeneity is the simplest mathematically and conceptually. In order to handle the problem under the assumption of non-homogeneity one must make *additional* assumptions concerning how various sedimentary particles were distributed volumetrically, where the sediments came from (which seems difficult to determine) and what the currents were like.

Secondly I would like to point out that very thick sedimentary sequences *are* found in the deep ocean basin. Submarine geology is basically what I do for a living. Seaward of the continental shelf-edge along the east coast of the United States, seismic data reveals more than 15,000 feet of sedimentary rocks in water depths as great as 5-10,000 feet and the shelf edge is more than 100 miles from the present coast line. The USGS IPOD seismic line shows 20,000 feet of sediment under 10,000 feet of water.⁷ The sedimentary thickness in the abyssal North Atlantic have been mapped and show 6,000 feet of sediments 3-400 miles from shore.⁸ This is not an insignificant amount of sediments. Woodmorappe overlooks the Mississippi cone of sediments which have been deposited in 10,000 feet of water. The sediments came from the Mississippi River. This cone extends nearly to the Yucatan Peninsula.⁹ The Amazon Cone extends 2/3 of the way to the mid-Atlantic Ridge and the Ganges cone off India extends over 1,000 miles into the abyssal Indian Ocean.¹⁰

Woodmorappe must have misunderstood my article on "Fossil Succession." Nowhere did I equate Precambrian strata with flood-deposited sediments. On the top of page 110 and the bottom of page 109 I specifically said that Precambrian strata are pre-diluvial. Phanerozoic strata are flood strata deposited over several centuries after Noah left the ark.

Within the classical ecological model, I find it difficult to explain the fossil sequence found in the Triassic Newark Basin.¹¹ The Stockton formation is the lowest and contains insects, arthropods, and burrows. Above this is 4 meters of the Lockatong Formation which contain, going up: dinosaur footprints then articulated reptiles, plants and clamshrimp, above this are fish and clamshrimp and at the top of the Lockatong are more dinosaur prints. Covering the Lockatong is the 15 meter thick Passaic formation. At the bottom of it and just above the Lockatong are roots, above that are dinosaur footprints covered by strata containing more roots. Above this is the Orange Mountain Basalt flow which in turn is covered by the 20 meter thick Feltville formation which contains (from bottom up) footprints, fish, plants and roots. This is covered by the Preakness Basalt Flow which is in turn covered by the Towaco Formation. This formation contains from bottom up, roots, fish, plants and stromatolites around tree stumps, footprints, roots, fish and plants, then more footprints, roots, fish and plants, and at the top of the Towaco are more dinosaur footprints. This is covered by the Hook Mountain Basalt which is covered by 80 meters of the Boonton formation which contains from bottom up: footprints, plants, footprints, plants, footprints, roots, footprints,

clam, shrimp and on top of it all are fossil fish, leaves and pollen. This seems difficult to explain with current flood models.

Do animals only need to go uphill wherever they are? In Louisiana, much of Texas and along nearly all coastlines, the local difference in elevation is only of the order of 5-10 feet. In the Dallas area the maximum elevation difference is only around 50 feet. I doubt that that would make a large difference in the time of burial in the flood.

Woodmorappe supposes that I ignored the fact that mudcracks can form under water. I am perfectly aware of the phenomenon of synaeresis. However, there are morphological differences between synaeresis and dessication cracks. Plummer and Gostin note,

Dessication mudcracks are generally continuous, polygonal, and of several generations with V- or U-shaped cross-sections that are infilled from above. Synaeresis cracks, on the other hand, are generally discontinuous, spindle, or sinuous in shape and of one generation only, with V- or U-shaped cross-sections that are infilled from either above or below.¹²

Dessication cracks are also associated with footprints and rain-drop impressions and synaeresis cracks aren't. Thus just because synaeresis cracks can form it does not at all imply that all cracks are therefore synaeresis cracks.

I will admit that I did a poor job explaining myself concerning the lack of fossils in sandstones. Pure sandstones were what I was referring to. Pirsson and Schuchert note,

It is a well-known fact that pure sandstones are poor in fossils, but when mixed with clay and more especially when limy, do contain them sometimes in considerable abundance. This is because clean sands are laid down well within the zone of wave agitation, which not only washes out the mud and carries it farther oceanward, but also shifts the sand.¹³

If the flood dumped everything into place in one year, then we are talking of sedimentation rates of 10 to 50 feet per day in order to account for the observed sedimentary thickness. In such rapid deposition, there would not be enough time to separate the sands from the clay; and it would be difficult to explain how we can have pure sands in the first place. Any fossils deposited along with the pure sands (however we get them in a flood) should have been preserved and yet there are none (or very few). Thus my argument about the sandstones still stands.

I do not see a contradiction in my treatment of unconformities. The angular unconformity observed by Woodmorappe in Wisconsin, I believe, indicates the shape the pre-flood sediments had acquired immediately prior to the flood. The erosion at the onset of the flood eroded the strata so when flood deposits were subsequently laid down on top of this erosional surface the observed angular unconformity was produced. The problem I see is the lithification, folding and erosion within the Phanerozoic strata. It just needs more time.

I agree with Mr. Woodmorappe that what I am proposing is large scale regional post-flood catastrophism.

I know I am not the only creationist to have proposed that. I do not see a mockery being made of God's promise not to flood the world again. Noah lived 300 years after he disembarked from the ark, and we have no clear indication as to the exact time God made that promise.

I also agree that migrational barriers would hinder migration and need to be studied. However we see much evidence of migrational barriers in the fossil record.¹⁴ A given species appears first in one locality and then later in other areas. However, migrational barriers must not be overrated. Lull reports,

The bears are splendid swimmers, for one was observed by Captain Perry in Barrows Strait 20 miles from shore, with no ice in sight. Even such natatorial powers would not, however, take them to Iceland, and yet living bears are stranded on the Icelandic shores every year, no fewer than twelve having arrived in one season.¹⁵

Iceland is 500 miles from Scotland, the nearest land.

I would also agree that I have some difficulty with plant reproduction (mainly because I cannot find seed production rates for various orders of plants) but I must object to Woodmorappe's contention that we know the reproductive rates of extinct Devonian plants. Who observed their reproductive rates? It is rather difficult to get fossil plants to reproduce in the laboratory. Besides, the early plants reproduced by spores.¹⁶ If my botany doesn't fail me (and I'm sure some botanist will be kind enough to correct me if it does) plants that reproduce by means of spores are capable theoretically of producing more offspring than seed-bearing plants.

I also agree that fusulinids present a problem for my views. I would feel better if they did appear earlier in the record. However, it is not just my suggestion that has trouble with this because if fusulinids were in the oceans when the flood began, why were they not deposited in abundance in the Cambrian strata? They are not mobile but simply float in the water.

References

- ¹Woodmorappe, John, 1979. Radiometric geochronology reappraised. *Creation Research Society Quarterly* 16(2):102-129 & 147-148. See especially p. 114.
- ²Lee, Robert E., 1982. Radiocarbon: ages in error. *Creation Research Society Quarterly* 19(2):117-127. See especially p. 118.
- ³Reference 1, p. 114.
- ⁴Andrews, Henry N., Jr., 1961. *Studies in Paleobotany*. Wiley, P. 192.
- ⁵Francis, Wilfred, 1961. *Coal: its formation and composition*. Edward Arnold Ltd., London. P. 627.
- ⁶Lull, Richard Swann, 1925. *Organic evolution*. Macmillan, p. 60.
- ⁷Schlee, John S., et al., 1979. Structure of the continental slope off the Eastern United States. *SEPM Special Publication No. 27*, p. 105. The interval velocities in the lower part of the figure indicate where the sediments end and basement begins. Velocities less than 6 km/sec are sedimentary velocities.
- ⁸Tucholke, Brian E., et al., 1982. Sediment thickness and depth to basement in Western North Atlantic Ocean basin. *Bulletin of the American Association of Petroleum Geologists*. September. Pp. 1384-1395.
- ⁹This can be seen in the *National Geographic* map of the Atlantic Ocean basin published in June, 1968. For seismic data see Worzel, J. Lamar, and C. A. Burke, 1979. The margins of the Gulf of Mexico. (In) *Geological and geophysical investigations of continental margins*. Ed. Walkins et al., AAPG *Memoir* 29. Pp. 403-418. See especially pp. 409 & 410.

- ¹⁰See the map of the floor of the Indian Ocean, published by the *National Geographic* in 1967.
- ¹¹Olson, Paul E., 1980. Triassic and Jurassic formations of the Newark basin. New York State Geological Association Guidebook, Warren Manspeizer Ed. Pp. 18-20.
- ¹²Plummer, P. S., and V. A. Gostin. 1981. Shrinkage cracks: dessication or synaeresis? *Journal of Sedimentary Petrology* 51(4):1153.
- ¹³Pirson, Louis V., and Charles Schuchert, 1920. Text-book of geology. Wiley. P. 491.
- ¹⁴Laporte, Leo F., 1979. Ancient environments. Prentice-Hall. P. 81.
- ¹⁵Reference 6, p. 59.
- ¹⁶Stokes, William Lee, and Sheldon Judson, 1968. Introduction to geology. Prentice-Hall. P. 339.

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Comments on the Electric Theory of Gravity

The theory, proposed by Barnes *et al.*, that gravity is nothing more than a second-order effect of the electromagnetic force, is a fascinating one.¹ It should be pointed out, however, that it was largely anticipated in a paper by Lorentz, written in 1900. (See the list below.) It seems to me in either case to be incomplete; at least I was unable to find answers to the following points.

(1) Quantum mechanics shows the lowest bound state of the proton and electron to be the ground state of the hydrogen atom — which is what prevents all atoms from collapsing into neutrons. If quantum theory is rejected, there must be a continuous, universally available supply of energy, to prevent all matter from turning into neutrons. But such a state of affairs would seem to be contrary to the first and second laws of thermodynamics.

(2) The observed mass of the neutron equals (roughly) the mass of the proton plus $2\frac{1}{2}$ electrons. Without quantum and relativistic mass corrections this would be too much mass; with them, too little. (According to the uncertainty principle, an electron bound within the volume of a neutron would need to have an energy corresponding to 40 times its rest mass.)

(3) The observed spin of the neutron is $\frac{1}{2}$. If it were a composite of an electron and a proton, both of which also have spin $\frac{1}{2}$, its spin should be either 0 or 1.

(4) If the neutron decays to just an electron and a proton the decay violates the law of conservation of energy. If, on the other hand, it is composed of its observed decay products: a proton, an electron, and an antineutrino, other problems arise:

(a) The neutrino is a neutral particle. Now the theory of Barnes *et al.* depends critically on the notion that all neutral particles are composites of charged particles. But how could the neutrino be so? It is less massive than any charged particle. A similar problem would arise concerning the neutral pion, which is less massive than either charged pion.

(b) The neutrino is extremely non-reactive; it can pass through several light-years of lead as if it were going through empty space. How would the neutron bind such an elusive particle?

(5) Experiments show that the radius, R , of a nucleus of mass number A is given by $R = 1.2 \times$

$10^{-13} A^{1/3}$ cm. The observed sizes of nuclei, then, are far too small to fit in with the theory. For instance, the nucleus of aluminum-26 has a radius of 3.6×10^{-13} cm and a volume just over twice that of an electron, if the electron be considered a sphere, of the radius given in the theory. But the nucleus is composed of 27 protons and 14 electrons; so it should be at least six times as large as it is actually observed to be.

This subject attracted considerable interest around the turn of the century and somewhat earlier. References include the following:

- H. A. Lorentz, Collected Works, v. 5, pp. 198-215, Nyhoff, The Hague, 1934.
- J. C. Maxwell, Collected Papers, v. 1, pp. 570-571, Dover, New York, 1952.
- M. Abraham, *Arch. Math. Phys.*, v. 20, p. 193, 1912.
- O. Heaviside, *Electromagnetic Theory*, third ed., v. 1, P. 455, Chelsea, New York, 1971.
- R. Gans, *Phys. Zeitschr.*, v. 6, p. 803, 1905.
- F. Wacker, *Phys. Zeitschr.*, v. 7, p. 300, 1906.
- A. Einstein, *Viertelj. Schrift Ger. Medizin*, v. 44, p. 37, 1912.

The paper by Maxwell (written in 1864) and that by Abraham seem to show that there are fatal flaws in this type of gravitational theory.

Reference

- ¹Barnes, Thomas G., Harold S. Slusher, G. Russell Akridge, and Francisco S. Ramirez IV, 1982. Electric theory of gravitation. *Creation Research Society Quarterly* 19(2):113-116.

Sincerely,

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Received 16 December 1982.

Reply to Becker

Mr. Becker's concern over our Electric Theory of Gravitation is expressed in five points which he wishes to have answered. One should first note that all of those points relate to his rejection of our assumption that all matter is made up of electric charges and in particular that a neutron consists of an electron and a proton. Our assumption that a neutron consists of an electron and a proton is based on the observed fact that a neutron decays into an electron and a proton. This is the type of logic employed in classical physics. Unfortunately that type of simple logic does not set well with many who are unalterably committed to quantum mechanics.

Be that as it may let us look at those five points: *Answer to point 1:* Becker takes the conventional quantum theory position found in most elementary physics textbooks. It does not provide any real physical explanation as to why the electron does not fall on into the proton.

My paper, *New proton and neutron models* (reference 1 in the article under consideration) provides a classical reason why the electron will not fall into the proton. There is nothing mystical about it. There is a magnetic force that is strong enough to balance the electrostatic attraction, preventing the unlike charges from coming in contact with each other, but naturally forming the hydrogen atom. It does not tend to form a neutron. That paper shows that it would take the

addition of external energy to force the electron and proton into the formation of a neutron. That is a higher state of energy. Becker's concern over a violation of the laws of thermodynamics is due to a failure to consider the possibilities of classical alternatives. This classical model is governed by those laws. Incidentally those laws themselves are classical laws.

Answer to points 2 and 5: Points 2 and 5 relate to the mass and size of the electron, proton, neutron, and atomic nuclei. These are interesting points because of the physical absurdities in the modern physics relationship between the size and mass of the electron and the proton. As background for a consistent classical relationship between the sizes and masses of the electron and proton see my paper *Electric explanation of inertial mass*, in the March 1983 issue of the *CRS Quarterly*. In that article it is shown that the inertial masses of an electron and proton can be accounted for by a magnetically induced electric field that provides the Newtonian third law reaction force on the charge during acceleration. That theory provides a logical relationship between the size and mass of those particles. Those sizes are quite different from the presumed sizes in modern physics. That makes it possible for an alternate physical explanation of the neutron and eventually of the atomic nuclei. For example, the deformable nature of the electron makes it plausible for altered size and mass within the nuclei.

One physical absurdity associated with the modern physics concept of the electron will be noted here. Modern physics regards the electron as a *point* charge, as can be seen from the following quote, "*If the electron has any extension, it has not yet been detected, and for now the electron can be regarded as a mathematical point.*"¹

No amount of mathematical manipulation can remove that concept from the realm of physical nonsense. A point charge would have an infinite electric field strength and an infinite amount of energy. According to relativity that would mean an infinite mass, hardly consistent with the observed inertial mass of the electron.

There is still another problem with the modern physics notion that the electron is a *point* particle. It is this assumed smallness that is counted on to achieve high resolution in the evaluation of the size of other particles. The method employed is a scattering experiment similar to the Rutherford scattering experiment employing alpha particles. One must assign a high degree of uncertainty to the size-evaluations of other particles because the electron size itself is certainly not the extremely small size it has been assumed to be.

Answer to point 3: Becker cites quantum spin postulates as a barrier to any classical concept of the electron and proton as constituents of the neutron. According to quantum theory the spin of each of these particles (electron, proton, and neutron) has a constant value that can never change. Such a quantum constraint, if true, would mean that the electric charge in an elementary particle, such as the electron or proton, is unaffected by a rate of change of the magnetic flux linking the charge. In other words, Faraday's induction law is arbitrarily declared null and void in

so far as rate of change of magnetic flux is concerned in the domain of the electron or proton or neutron.

There is experimental evidence that the spin of a proton is not constant. If that be true, quantum mechanics is in real trouble. There is credible experimental evidence that the spin of a proton *increases* to a much higher value in a high energy proton beam that impinges upon other protons. Presumably in the acceleration process there is an associated magnetic flux change that induces in the proton a higher spin (a greater circulating current) as would be expected from Faraday's induction law.

Because of the importance of this experimental evidence the following quote is given from a paper by Alan D. Krish regarding the influence of spin in violent collisions between protons. The experiments were performed at the Argonne National Laboratory. "*It has long been thought, however, that the influence of spin should decline as the energy of collision increases. The reasoning behind this assumption is simple, the energy associated with a proton's spin is constant, and so it becomes an ever smaller fraction of the total energy as the collision becomes more violent. — Only in the past few years have experimental techniques been devised for testing this assumption. It has turned out to be quite wrong. The influence of spin does not diminish as the energy of a collision increases; on the contrary, spin seems to become more important as the collision becomes more violent.*"

A reasonable explanation of this experiment is that the spin increases as the energy of the proton in the beam increases. That directly contradicts the quantum postulate of no allowed change in the value of the proton's spin. It favors the classical concept of induced spin (circulating current) in accordance with Faraday's induction law, a fundamental classical law of physics.

Answer to point 4: Becker has supposed that any classical theory of the neutron violates the law of conservation of energy. He cites quantum concepts as disproof of any classical theory of the neutron and hydrogen atom. But one should consider the classical alternative closely. The *Electric theory of gravitation* paper was not a paper on atomic and nuclear physics. However, in the previous paper on the proton and neutron models, classical theory was employed and did include energy associated with the proton and electron in the neutron. As previously noted it would require the addition of external energy to form a neutron from an electron and proton. The classical concept does conform to the law of conservation of energy. However, the author reserves the right to re-examine the so-called equivalence of mass and energy. The usefulness of the energy expression mc^2 notwithstanding, mass and energy are not the same thing. It was the spin magnetic energy contradiction of the equivalence of mass and energy that led H. A. Lorentz to *reject* the concept of quantum spin. He pointed out to Goudsmit and Uhlenbeck that if one considered the spin of an electron to indicate a rotating electron the "*magnetic energy would be so large that by the equivalence of mass and energy the electron would have a larger mass than the proton, or if one sticks*

to the known mass, the electron would be bigger than the whole atom!"³

I had published that same result, much greater magnetic energy in the spinning electron than one could account for by the equivalence of mass and energy.⁴ It was with real satisfaction that I later learned that Lorentz had previously considered that problem and called it to the attention of Goudsmit and Uhlenbeck. It is to the credit of Uhlenbeck and Goudsmit that they acknowledged Lorentz's challenge to the spin concept. "We could not fully understand it, but it was quite clear that the picture of the rotating electron, if taken seriously, would give rise to serious difficulties."⁵

Becker raised the question as to how one can account for the mass of a neutral particle that is less massive than any charge, if all mass contains charges. The answer relates to the presumed dual nature of light. This author rejects the particle nature of light, the photon, the quantum of light. Support for this rejection of the particle concept can be found in the excellent source book by Dean Turner and Richard Hazelett, *The Einstein myth and the Ives papers*, The Devin-Adair Co., 1979.

This book was reviewed in the *CRS Quarterly*, Vol. 17, June 1980, pp. 77-79. The noted Bell Telephone Laboratories scientist Herbert Ives' experimental and theoretical papers are all contained in that book. The section "Ives on the Demise of the Photon" is sufficient, in the author's opinion, to justify the rejection of the particle concept of light, the photon. Hence from that point of view none of the so-called "zero rest mass particles" are particles.

The second part of that answer is a rejection of the presumed mass in light, whether or not one calls it a photon. The astronomer Charles Lane Poor in his 1922 book, *Gravity vs Relativity* has a devastating refutation of the presumed 1919 solar eclipse "confirmation" of general theory of relativity. He shows very objectively that there is no justification for Einstein's claim that these observations confirm his theory of gravitational attraction of light, a presumed proof of the mass of a photon. The following quote is from that book: "When the deflections of light, as actually observed are considered both in direction and in amount, the discordances with the predicted effect become marked, and the plates present little or no evidence to support the relativity theory. Furthermore, if these deflections are real, and not due to instrumental errors (so readily called upon by the relativist to explain everything that the relativity theory cannot account for), then it has not yet been shown that the relativity theory is the only possible explanation. As a matter of fact there are other perfectly possible explanations of a deflection of a ray of light, explanations based upon every-day, common-place grounds. Abnormal refraction in the earth's atmosphere is one; refraction in the solar envelope is another. The atmospheric conditions under which the eclipse plates were taken were necessarily abnormal, and the plates, themselves, clearly show that the rays of light passed through a mass of matter in the vicinity of the sun; a mass of density sufficient to clearly imprint its picture upon the photographic plates.

*Such is the evidence, such are the observations, which, according to Einstein, 'confirm the theory in a thoroughly satisfactory manner'."*⁶

Conclusion

One of the long-sought goals of physics has been to unify the foundations of physics into a minimum of basic principles. It now appears that the philosophy on which modern physics is founded, that of relativity and quantum mechanics, is a deterrent to the accomplishment of that unification into a minimum of basic principles. One has but to look at the "colorful" and "strange" expansion of technical terminology in modern physics to have evidence that it employs an almost unending process of *adding on*, rather than unifying into a minimum of principles. There is no denying that the methods of modern physics have accomplished a great deal. Nevertheless there remain many logical inconsistencies, some of which have been referred to in this letter.

I have for years been attempting to show the plausibility of developing a unification of physics from the classical point of view. A series of papers, including among others the aforementioned *Electric theory of gravitation*, *Electric explanation of inertial mass*, and the *New proton and neutron models*, plus a book in progress are all a part of that effort. Two of the earlier papers, in which an ingenious graduate student collaborated, developed an electrodynamic alternative to special theory of relativity. That provided a real breakthrough. It opened the way for a whole new classical approach. The rim speed of a spinning proton or electron can exceed the speed of light. There can be a greater ratio of magnetic to electrostatic force within the atom than ever before considered possible. It provides a classical alternative to the mystical nuclear force. The wave concept of light is removed from the nebulous notion of a dual nature. The concept of mass of a particle is clarified. The classical laws of electromagnetism can be applied in a domain of physics from which they had been forbidden.

There is still much to be done, but it now appears that the key to the progress of physics in the future lies in the classical type of logic upon which so much physics was developed. After all, how can one have much confidence in progress unless he rejects the quantum theory emphasis on uncertainty?

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A Tomato with Three Cotyledons

The work of Dr. William J. Tinkle with mutant plants having three cotyledons (the first leaves) rather than two has been reported in the *Quarterly*.^{1, 2, 3} The larger leaf area at the beginning of plant growth might be expected to be an advantage, but Dr. Tinkle's work and also that of Dr. Lammerts⁴ showed these plants to be less vigorous and less productive.

When my daughter found a three-cotyledon plant among tomatoes she was growing from seed I recalled Dr. Tinkle's work and his request for seeds from any plant with an unusual number of cotyledons.⁵ I selected the two plants most nearly matching the mutant in size for controls and planted one on each side of the mutant in a longer row of tomatoes.

The first tomatoes of the mutant plant ripened on the same date and were slightly larger than those of the most productive control plant. However, later tomatoes were smaller, the average tomato from the mutant plant weighing 5.6 ounces compared with 6.8 and 7.4 ounces for the control plants. The total production of the mutant was 206 ounces while the two controls produced 228 and 292 ounces each.

More of the tomatoes produced by the mutant were of poor quality. About 25% (by weight) of the mutant tomatoes had some rot developing as they ripened compared with 7% and 11% for the two control plants.

The first true leaves after the cotyledons also appeared as a set of three but thereafter the foliage appeared normal. This plant did not grow as tall as the controls.

I have carried this experiment as far as my ability and time permit, my obligations in the field of astronomy having priority.

Is anyone in the Creation Research Society able to continue the work begun by Dr. Tinkle, raising several generations of plants with supposedly beneficial mutations and studying their characteristics? I have seeds from this three-cotyledon tomato and the controls, which I will give to anyone able to do this work.

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A Finding in Flint

May I report something which I have found? Upon moving out of town, to a house on a hill overlooking the valley, I noticed some unusual-looking stones around a flower bed.

One, in particular, seemed to have something inside, surrounded by a transparent rock, which I believe is flint, and which is extremely hard. I cut it open with a chisel, and found, inside what looked like evidence of an ancient type of shoe, with a small foot inside that. The foot was attached to what could have been a portion of leg, extending to just below the knee, where it was cut off. The foot and leg were covered with a material, in four layers of different colors, in an open weave. The material disintegrated in the presence of air. After a while the leg, too, began to disintegrate, seeming to fall away in grains of sand. It appears as if there was a type of petrification, the flesh and body of the leg having been replaced by granite sand.

I am trying to get someone, more familiar than I with anatomy, to examine this; but I have not anything to report along those lines yet.

My belief is that this was part of a body which was buried deep in the ocean, had sand forced into the vacancies of the leg and foot, and became petrified. As for raising it above the surface again, there seems to be much evidence of uplifting in the landscape of this part of Texas. However, I cannot be sure that the stone had remained in the place where I found it from time of uplifting.

Two questions, in particular, seem to arise here:

- (a) Is this indeed a relic of Noah's Flood?
- (b) How long does it take for flint to form around an object?

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Further Remark on the Fourth Law

I would like to make a correction to my paper 'Variation and the Fourth Law of Creation'.¹

The final section of the paper got in by mistake; the fact is that I take the view that there is only the fourth law of creation at work in nature and not natural selection working in conjunction with it.

The standards and requirements of the fourth law of creation cause those possessing them to survive and those without them to become extinct. The function of the fourth law of creation involves not only keeping organisms within their kinds, but at the same time allowing for adaptation within the kind.

The fourth law of creation, then, is both keeper of kinds and selector of kinds.

Further support for the views set out in my paper are as follows: —

There are up to 300 breaks in a complete genome and from one to five breaks are to be found in each chromosome. These take place during cell division which leads to cell differentiation. The fragmentation and rejoining of these sections, along with the activity of the enzyme A.D.P., involves ribosyl transferase ADPRT. This is involved in gene expression, cell differentiation, fragmentation, repair of D.N.A. and regulating the activities of other D.N.A.-cutting and repairing enzymes. If a specific inhibitor of A.D.P.R.T. activity is used, then cell differentiation does not occur.

This has been observed in three types of somatic cells and one microorganism.

Further, I would like to add my views on homology, genes and the fourth law of creation. The main pattern of an organism's biological structures is to be found in the nucleus. As stated in my paper,¹ each organism has a genetic permutation and that permutation consists of all the variations within each allele and also that the permutation extends further than this; each gene can code for a number of functions within an organism, some homologous, some non-homologous. Although this is the case, genes, nevertheless, are not unlimited. Rather, their arrangement, reading and interaction with others all serve to produce the various structures of the organism. This would help to explain why, within related species, the same structures can often be found being coded for by various gene permutations. The organism has repair, renewing and standbys among the permutations. All of this makes things more difficult for evolution to occur. As regards hybrids, let me give an example: — if a nucleus is removed from, say, a sea urchin's or amphibian's egg or somatic cell respectively and is replaced with that of a related species, the characteristics which develop are those of the species that contributed the nucleus. If, however, a related species with different genetic combinations is chosen as donor of the nucleus, development only goes so far and then stops.

When a nucleus in its 'home' cell changes, say, various gene permutations for the same homologous structures (or non-homologous structures), because it holds the pattern of that organism, it dictates to the cytoplasm to change. When the nucleus is introduced into a related egg not having undergone such changes in the cytoplasm, it can only produce those stages of the structures that are coded alike; those that are not coded alike, even though they are part of the same kind they will not produce anything beyond a given stage.

This demonstrates that the main body is contained within the nucleus.

For evolution to occur, all, or nearly all, of the cells of the organism would have to change. The whole mechanism of the fourth law of creation prevents this from taking place.

So, the pattern of biological structures can indeed be coded for by a variation of genes of an organism; the genes, their arrangement, interactions and how they are read can result in a gene or a set of genes coding for a number of functions. This is a standby mechanism and part of the larger permutation of the genetic set of an organism; this would explain the homologous and non-homologous structures in which genes of various permutations can get involved without ever leaving the organism's Genesis kind.

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Comments on the Velocity of Light

Mr. Paul Steidl¹ has given a very favorable review of some work published by Barry Setterfield in *Ex Nihilo*, the Australian creationist journal. Steidl believes that Setterfield's logic is unassailable and that his theory is appealing and convincing. We cannot agree. In our opinion there are faults in the logic, the data do *not* support the view of how the velocity of light changed, and the implications of the theory are contradicted by fact and raise more problems than the theory solves.

Setterfield's logic² is questionable when he determines the constancy of reaction energies, since the reasoning seems circular. He starts with the famous equation $E = mc^2$ and shows that $m \propto 1/c^2$. This is a perfectly valid start. However, when he then substitutes this proportionality into $E = mc^2$ yielding $E = \text{constant}$, he has used one equation to determine two variables. This is logically fallacious. Since this step is rather important in the development of the theory, this point alone can make the theory suspect. Secondly, the data presented by Setterfield³ (some of which are shown by Steidl) do not support the curve he advances. If the rest mass of the electron is proportional to $1/c^2$, then this means that as c decreases, m must increase according to this relation. Thus if m_n is the most recent value of the rest mass, it must be proportional to $1/c_n^2$, where c_n is the value of c in the year of the most recent rest mass measurement. Similarly for any given year, $m_o \propto 1/c_o^2$ where m_o and c_o are older values. Dividing these two proportionalities we have, $c_o^2 = (m_n/m_o) c_n^2$. By letting c_n have Setterfield's 1963 value and m_n have the 1963 value of the rest mass and m_o have the 1929 value, we find that in order for the change in the rest mass to be due to a change in c , the velocity of light in 1929 must have been 301,701 km/sec. This is far higher than the measured values of c in 1929. Setterfield's predicted value would be around 299,811 km/sec.

A similar analysis can be made for other constants. Listed in Table 1 are the values of c needed to account for the observed changes in the constants. The italic values of c represents the value of c used for c_n . The measured value of the constant under consideration for that year was used for m_n . As can be seen, nearly all of the constants have changed by far more than the theory expects or predicts. This is evidenced by the speed of light listed in the table which would be necessary to account for the observed change in the constants. In none of the cases is the retrodicted velocity of light as expected. This conclusion remains true even if one minimizes the change in the constants by assuming a systematic experimental error. If both measured values (m_o , m_n , etc.) were assumed to be wrong by one standard deviation in a manner favorable to the theory (e.g., the difference between m_o and m_n or any other constant under consideration were smaller), *the derived velocity of light in the past still does not fit the predicted velocity.*

Setterfield also claims that the product of Planck's constant and c is constant and yet his own data shows that in 1951 that product was (exponents dropped) 198604. In 1953 it was 198583; 1955 it was 198623;

Table 1. The various columns show the values in km./sec. which the speed of light would have needed to have, in the year concerned, to make the constant at the top of that column come out as measured. The extreme right column shows the speed according to the theory. There are many disagreements. The figures in italics are those used for c_n , as explained.

Year	Electron Mass	h	q/m	h/q	gamma	Ionium	Proto- actinium	Carbon-14	Predicted velocity
1904						330,000			299,853
1912		303,363							
1913						304,788			299,838
1914		309,653							
1926				300,651					299,814
1927			299,886						
1928									299,812
1929	301,702	303,409	300,652	300,574					
1930		303,270					822,629		
1932	301,019								299,808
1934				300,677					
1936						299,792	856,905		
1937			299,860	300,477					
1938			299,826	300,482					
1939	299,826	300,518	299,809	300,286					299,801
1940									299,800
1941	299,836	299,882	299,818	299,981					
1942				299,982					
1943				299,959					
1946		302,808							
1947	299,843		299,801					311,135	299,795
1949	299,826				299,814			310,130	299,794
1950	299,830				299,814	299,792	321,339	309,463	299,794
1951		299,973	299,792	299,833					299,794
1953	299,833	299,882	299,818	299,866					299,793
1955	299,809	299,837	299,792	299,803					299,793
1957	299,802	299,833			299,814				299,793
1958	299,802	299,833			299,805	299,792	299,792	301,888	
1960	299,803	299,815	299,792						299,792
1962					299,806				
1963	299,792			299,792	299,796			303,747	
1966									
1970									
1972					299,792			299,792	299,792
1980		299,792							

1963 it was 198630 and in 1980 it was 198648. This product is gradually getting larger and is not constant as Setterfield claimed.⁴

The list of velocity determinations shown by Steidl⁵ and used by Setterfield actually omits many determinations of c that disagree with Setterfield's curve. Some of these are: Fizeau, 1849, 313,300 km/sec.; two 1855 measurements of 305,650 km/sec. and 298,000 km/sec.; Foucault, 1862, 298,000; Rosa and Dorsey, 1906, 299,781; Mercier, 1923, 299,782; Anderson, 1941, 299,776; Bol and Hanson, 1950, 299,789; and Rank, Ruth and Van der Sluis, 1952, 299,776 km/sec. Since these velocities disagree with Setterfield's curve, were

they edited from his analysis because he felt they were wrong? If he had used them his curve would certainly have been different.

Also, the theory leads to conclusions which are incompatible with the existence of life and known facts about the earth. It is proposed that radioactive decay began on the third day of creation and the decay rate was constant until the end of the sixth day.⁶ At that point, the speed of light and radioactive decay rates began changing according to his log sine curve. During the last 3 days of the creation week the half-life of uranium 235 would have been 12.49 hours, meaning that uranium 235 would have gone through 5.76 half-

lives before the decay rate began to change. During the first week after the creation week, uranium 235 would have gone through a minimum of another 2.0 half lives giving a total of 7.76 half-lives of decay on the U-235 clock. By the end of the sixth week there would be a minimum total of 8.18 half-lives on this clock. The problem with this arrangement is that Eicher⁷ showed that the maximum number of half-lives that U-235 could have gone through since creation is only 7.8 assuming that all lead 207 was derived from the decay of U-235. Thus if Setterfield is correct, there should be far less U-235 than is observed. This fact contradicts his viewpoint.

Another problem that any radical change in the decay rate presents is the problem of heat. Currently granite produces 235 ergs per gram per year of heat due to radioactive decay.⁸ At the origin of the earth the amount of radioactive material would have been greater implying that there would have been more than 235 ergs produced each year and that this would be a minimum value for granitic heat production. However, even using this minimum value, heat production during the first 3 days of radioactivity would be enough to vaporize the earth. Since the half-life is proportional to $1/c$ and heat production is inversely proportional to the half-life, the heat generated would have been $5 \times 10^{11} \times 235 \text{ erg/gm/yr} = 7684 \text{ cal/gm/day}$. The amounts to 23,052 calories per gram over the three days. Within Setterfield's theory the specific heat should remain constant (using Debye's theory) so assuming a specific heat of granite of $0.2 \text{ cal/gm}^\circ\text{C}$ the temperature rise during the creation week would be $115,000^\circ\text{C}$. Thus on the sixth day of creation when God created Adam He would have had no cool place to put him. The final point which must be raised in connection with this theory is one of the implications it has for the earth's rotation if the kinetic energy is to be conserved, as it should be since there is no corresponding potential energy. For it to have been conserved, the earth's rotation would have been such that there would be 417 days per year at the time of Christ when, according to the theory, the velocity of light was 391,966 km/sec. This figure is not in accord with fact. At the time of creation, conservation of energy would require that the earth be rotating 5.7 million times per second (non-relativistically). Obviously, the earth would break apart long before it rotated that fast. The reason for this rapid rotation is to maintain the same kinetic energy if the mass was formerly smaller.⁹

No claim can be made that the values of the electronic mass listed by Setterfield are really measuring "rest-mass" or gravitational mass instead of inertial mass.¹⁰ The mass of the electron is measured by observing how much deflection an electron beam in a cathode ray tube undergoes after it has experienced a known force. This observation allows one to calculate the ratio of the charge to the electron's mass (inertial mass). The fundamental unit of charge is then determined by other means such as Millikan's oil drop experiment. By dividing the charge by the charge to mass ratio, the mass is determined. Since this is charge to inertial mass, the mass derived by this technique is inertial mass. If inertial mass was less

in the past, the earth had to rotate faster, as mentioned. In view of these considerations, we find it impossible to believe that matters could have developed as envisaged in Setterfield's theory.

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- ⁹Reference 2, p. 57.
- ¹⁰Reference 8.

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Difficulties with a Changing Speed of Light

A recent item, "The Velocity of Light and the Age of the Universe,"¹ by Paul M. Steidl reported an explanation, by Setterfield, of how we can see the light from the distant stars, if the universe is not old enough for their light to have traveled to us since a recent creation at its present speed. The explanation was that the speed of light has decreased very much since the recent creation. That way, the light from the distant stars could travel most of the way from them to us during the first few years after the creation. According to an extrapolation, light would have traveled initially about one thousand billion times faster than it does today.

Setterfield is not the first one to propose such a solution to this perplexing problem. Other creationists have written along similar lines. The idea of a rapidly changing speed of light seems to be attaining some degree of acceptance among creationists.

The notion of a speed of light that changes rapidly enough so that the light from the distant stars can be seen today, although thousands of years old, does not agree with the principle of conservation of energy. Granted, the permittivity of free space was taken to remain constant so that electric energy is conserved. However, the permeability of free space would also need to remain constant so that magnetic energy is likewise conserved. This is essential to an electromagnetic wave, in which the energy is shared between its transverse electric and magnetic fields.

Since both the permittivity and permeability of free space must remain constant, one cannot have a variable speed of light within the framework of classical electrodynamics; for the speed of light is the reciprocal of the square root of the product of these two quanti-

ties. If one is to have the speed of light changing rapidly in free space, he must have one or both of these quantities change rapidly; but neither can.

Let me present an example of the kind of contradictions that arise in the event one choses to allow, theoretically, the speed of light to be huge at the time of creation and to decrease between then and now. This seems better than an involved display of mathematics.

Let us suppose, for the sake of argument, that the light from a distant star traveled half the distance between it and us on the first day of creation. The energy density of the starlight within that enormous volume of starlight is practically zero, because the light energy from only one day's worth of star-burn is spread out over such a huge volume.

As the years pass, that wave front slows down, and it is part of the light an observer on the earth sees as he looks at that star now. The star would appear to be incredibly dim to him, as that starlight would be a part of the star's first starlight that was "stretched out" over a huge region of space on the star's first day. The distant stars appear dim anyhow, just because of their distance; but this is an additional factor. The distant stars would appear billions of times fainter than they actually do; indeed, they would likely not appear at all. The reason is conservation of energy. A day's worth of star-burn had to be stretched out over a huge volume of space initially, then slowed down and viewed a little at a time later on the earth.

The conservation of energy objection deals with orders of magnitude. Therefore, we need not be concerned about non-essential factors such as whether the light we are viewing from the distant stars traveled half the distance between us and them on the first day, or one tenth the distance. It won't make enough difference to matter.

It seems that the only recourse left open to the rapidly varying speed of light theory is to say that the changed permittivity and/or permeability of free space somehow caused the distant star to emit energy on the first day of its burn at a rate that was just as much higher as the speed of light was faster. Actually, the factor of increased energy production in the star must be the cube of the speed of light factor, because the volume that light filled would be proportional to the cube of the radius of the expanding sphere it is occupying. That way the billions of times as much energy would be spread out over billions of times as much volume and, the energy density would be the same as today. However, it is difficult to see how the change in either or both of these two quantities could have much to do with the rate with which a star liberates energy. If thermonuclear fusion actually is the source of stellar energy, then it is difficult to see how a change in the permeability of free space (i.e., the strength of the magnetic force) could have much effect on the rate of energy output from the stars. A change in permittivity would have a big effect upon the fusion rate, as that would change the electrostatic force hindering the nuclei in their attempt to fuse, but a change in permittivity was not considered. It is just as well, because if the strength of the electrostatic force changed too much, a normal sized star would either not fuse at all, if the electrostatic force were

much stronger than it is today, or it would fuse so rapidly it would explode, if the electrostatic force were much weaker than it is today.

If stars generate their energy from gravitational collapse, not from fusion, as Steidl² suggested (also others), a change in the constants of electromagnetism is even less help. The electromagnetic force and the gravitational force are not related to one another as far as we know. Some day someone may achieve a grand unified field theory, but that day is not here yet.

A rapidly decreasing speed of light is not the answer to the perplexing question of how an observer can see light from stars so distant that their light, traveling a constant speed, could not travel from them to us in the short time allowed by a recent creation.

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Reply to Comments

Morton *et al.* seem to have misunderstood the approach used throughout the Part 2 article in which the same results have been derived by two different methods.¹ In the case of the rest-mass of the electron, the formula² $m = q^2 / (6\pi\epsilon_0 rc^2)$ is derivable independently of $E = mc^2$, and it is thus apparent that m is proportional to $1/c^2$ with no circular reasoning involved at all.

They suggest that because the measured values of the other "constants" give retrodicted values of c usually higher than the predicted value, then the whole theory is in error. In fact, this proves that c WAS higher in the past. However, it must be remembered that all these other measurements were of a lower order of accuracy than the measured value of c . For c we have 5 & 6 figure accuracy; for these other variable "constants" we have only 3rd and 4th figure accuracy in the critical region. Accordingly, though *the correct trend is plainly in evidence*, these figures cannot be relied upon to give accurate retrodicted values of c .

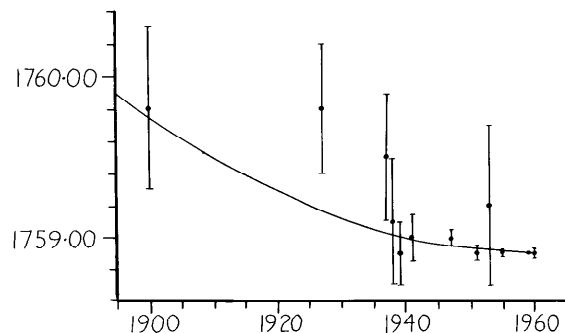


Figure 1. The ratio of charge to mass reported ($\times 10^{-8}$) vs. the year. It can be seen that the smooth curve, giving the figure as predicted on the basis of the variation of the velocity of light gives quite good agreement.

Morton's approach in this instance is therefore procedurally in error. Instead of getting retrodicted values of c from these "constants," one should predict the values of these "constants" from the more accurate computer curve and see whether or not their error margins cover the predictions obtained. This is well illustrated by Fig. 1 for the q/m ratio, corrected for the Faraday effect, and their error-bars. The smooth curve is the predicted values of q/m based on the more accurately measured values of c . As can be seen, the error bars of the actual measurements cover the curve in all but 3 cases out of 13. It should be emphasized that c decay theory predicts that 13 other "constants" should be varying in given directions. They all do as predicted. An Australian physicist has written³ "The chances of Setterfield's predictions matching 13 other physical constants purely by a 'fluke' is only . . . 0.6 of a chance in a million. That suggests very strongly that he is right . . ."

Morton *et al.* should be well aware of the problems involved in the measurement of Planck's constant, h . However, the crowning proof of the constancy of the hc product, which they quoted, comes from astronomical observations. For the most distant astronomical objects Bahcall & Salpeter⁴ have shown that the value of the hc product was (1.001 ± 0.002) times the present value. There have been a number of other measurements of this ratio for these very distant objects that have been firmly based on established physics without uniformitarian assumptions resulting in the conclusion that the hc product is constant throughout all time.^{5,6} These methods have completely overcome problems with the local measurement of h and confirm the hc product as constant virtually since Creation. This fact, incidentally, demolishes Morton's own theory of permittivity change recently published in the *C.R.S. Quarterly*.⁷ In the face of overwhelming observational trends for decreasing c and increasing h , and an hc product proven constant, the logical conclusion is that h MUST VARY PRECISELY AS $1/c$, even though accuracy limitations on the local measurement of h make it inappropriate to use to get retrodicted values for c or to demonstrate the constancy of the hc product.

In their statement that many determinations of c have been omitted, Morton *et al.* have not caught up with the results of the complete Part 1 in the International version of *Ex Nihilo* Vol. 1:1, or with the most recent computer work reported in *Ex Nihilo* Vol. 5:3 (Aust) or Vol. 1:3 (International) pp. 41-46, Jan. '83. Values were edited out when they had been rejected BY THE EXPERIMENTERS THEMSELVES as being "unreliable,"⁸ or "but rough approximations,"⁹ or "an inaccurate preliminary value."¹⁰ In any refined analysis it is customary to exclude such data. Nevertheless, when an analysis was done using *all* such values, including those listed by Morton, the statistics showed that there was EVEN LESS POSSIBILITY OF CONSTANT c from 1675-1960 than before. In addition, the best r^2 fit to *all* these data IS THE SAME COMPUTER CURVE by a factor of 2 or more on all other curves.

Morton *et al.* misunderstand me in supposing that I proposed that radioactive decay began on the 3rd day. My statement relates to what was created on

that day in Creation Week and then immediately began decaying. Their hypothetical problem with the heat at the earth's surface due to radioactive decay will be resolved in future articles. A complete model is currently being worked on for the earth and its internal structure, etc., from the time of Creation to the Flood; and associated radiometric dates. This is obviously not the place to go into details, except to say that the model envisages the whole planet starting off in a cold state at the beginning of the 1st day, with radioactive elements distributed more or less uniformly throughout, and coming to be concentrated in what is now the crust in the period of 1656 years from Creation to the Flood through the action of known geological processes. This would give rise to the present layering and temperatures inside the earth without vaporizing it as alleged. The supposed problem with the U^{235} half-life is dealt with at the same time, and two doctors of geology with whom I have discussed the model find it very attractive.

In the final question concerning mass and the earth's behavior, there is again some misunderstanding, probably because of differences between Einsteinian and Newtonian concepts. It is customary to measure masses in other than gravitational units.¹¹ We measure in terms of rest-mass, which is the same as inertial mass, and active or passive gravitational mass — all measure the same thing. However, the gravitational units are those employing MASS-ENERGY, *not rest-mass*, as "the Principle of Equivalence states that it is the TOTAL ENERGY THAT REACTS GRAVITATIONALLY and not just the bare rest-mass."¹² Indeed Professor R. C. Tolman has pointed out that "it is the total energy of an isolated object that determines the gravitational field of that object"¹³ and this energy is constant for all c . The Newtonian concept deals only with the rest-mass; the General Theory deals with the broader principle of the total energy. A detailed treatment of the General Theory equations shows that planetary orbits thus have a constant radius and period on this model of c decay. This results since m is proportional to $1/c^2$ from above, and the Newtonian gravitational constant G ("which is essentially a conversion factor"¹⁴ because of the use of rest-mass) is proportional to c^4 (shown in a forthcoming article). The Einsteinian gravitational potential that occurs in the Schwarzschild solution, Gm/c^2r , is therefore a constant quantity as the powers of c mutually cancel. Accordingly, since the centripetal acceleration for a circular orbit is w^2r , and the gravitational acceleration with which this is balanced in the General Theory is Gm_1/c^2r^2 , then we have in Neo-Newtonian terms $Gm_1/c^2r^2 = w^2r$ and so:

$$Gm_1/c^2r = w^2r^2 = v^2 = \text{CONSTANT} \quad (1)$$

where v is the tangential velocity, r is the orbit radius and w the angular velocity. In (1) the left hand side represents the Einsteinian potential. However, if this is converted to the Newtonian potential, it becomes obvious what is giving rise to the kinetic energy under these General Theory conditions. By including the rest-mass m of the planet on both sides of (1) and eliminating c on the left, there results the Neo-Newtonian formulation applicable to the changing c scenario:

$$Gm_1m/r = \text{CONSTANT} = (mc^2)v^2 = Mv^2 \quad (2)$$

where M is the Einsteinian mass that is doing the reacting gravitationally. What is expressed in (2) is the Newtonian gravitational potential energy balanced by the kinetic energy term of the planet in motion. Here it is apparent that it is not the rest-mass that is the consideration in this gravitational situation, but rather the mass-energy, which is constant. This is the natural consequence of the General Theory. The extension of this result to the rotation of a planet on its axis means that it is not the rest-mass that is reacting for the kinetic energy in that gravitational sense, but rather the Einsteinian mass or the rest-mass energy which is constant, just as in the case of (2), and so the velocity v of rotation will also be constant. This answers completely the objection raised about the constancy of the earth's rotation and the various forms of mass.

As for Akridge's comments, I have not yet had much opportunity to study them at any length. However, I believe that considerations such as those suggested about the early history of the earth, extended to wider regions, may go far toward meeting the difficulty. Also, if it is admitted that things which have been supposed to be constant, such as the velocity of light, actually have varied, it may be that it is necessary to look a little more carefully at the various principles of conservation. Presumably conservation of energy did not apply right at the beginning of creation; maybe

some thought is in order as to when it did begin to apply.

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Yours in the Creator,
Barry Setterfield
Box 318, Blackwood, South
Australia.
Received 14 February 1983.

REPORT ON THE SEARCH FOR A SITE FOR OUR RESEARCH LABORATORY

On Sunday, December 26, 1982, George Howe, Emmett Williams and I met at the Phoenix Airport, rented a car, and drove as far as Camp Verde where we spent the first night. Figure 1 shows our route of land hunting. Camp Verde is a very small outpost-type village in a desert type of environment. There is access to water, but land is very expensive. Also, it was very cold. On December 27th we left for Flagstaff quite early in the morning and got into Flagstaff about 10:00 A.M. We met with a realty lady who showed us a parcel of 2½ acres for \$10,000.00. It was a fine level piece but no water was immediately available; and it was very far from town on a rather poor graveled road. We were also shown a parcel down in the juniper tree area about 1500 feet lower than Flagstaff, and costing \$7,500.00. However, no water was immediately available to this property either; and a rather complicated piping arrangement would have to be made to get water to this parcel. Other parcels were even more expensive; and water available only by drilling wells, an expensive sort of proposition. Also, the ecological movement appears to have affected the area so that development is looked on with suspicion.

It was very cold in Flagstaff and a stiff wind was blowing making the 8 degrees above zero seem more like 20 degrees below!

On December 28th we drove on to the Grand Canyon and found 2.5 acres of land for \$8500.00, about

28 miles from the canyon. However water has to be hauled in, well drilling costs are prohibitive, and zoning is questionable. Driving south toward Williams we found that we could buy 40 acres in Ash Fork for \$10,000.00; but again there was no water, a 4-wheel drive vehicle was needed to reach most plots, and of course a permit needed for a septic tank.

At this juncture we were rather discouraged. The isolation of most of the sites, the rugged winter weather, and lack of water would force only a limited use of any site; and certainly the cost of fuel would dictate a winter shut-down. As we approached Prescott, decreasing in altitude from 8000 to 5000 feet on U.S. Highway 89, the change was remarkable.

We began seeing irrigated alfalfa fields in refreshingly beautiful green color north of the Chino Valley. So we stopped and talked with some realty agents. The climate is mild compared with the Flagstaff-Grand Canyon area. The towns of Chino Valley and Prescott are livable — schools and churches are there. Even supermarket shopping is possible. Water can be obtained, as wells are on the average only 200 feet deep. Also, some of the acreages have irrigation rights. The area is close to the Grand Canyon (100 miles) and a University library in Flagstaff (75 miles). There is a junior college in Prescott with a library. Telephone and electric service are readily available, and the land has good resale value.

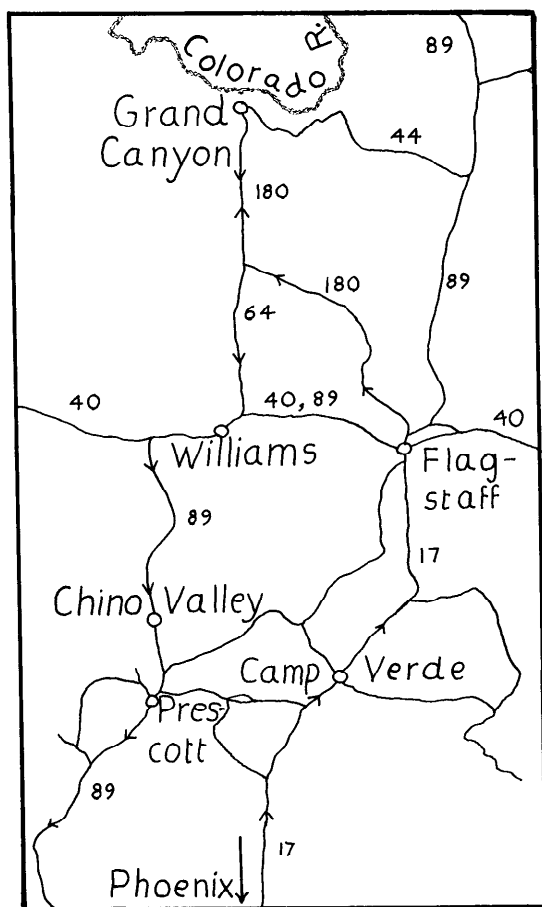


Figure 1. Map showing the places visited in Arizona. The arrowheads on roads show our route; and the numbers of highways are shown beside them.

Land in the area varies from \$5000-10,000.00 per acre with a well already dug in some cases. Drs. Howe and Williams plan to return to the Chino Valley area in March and select a site where botanical studies are possible as well as geological investigations of strata from the Grand Canyon. Two problems are of primary importance: that is evidence for the catastrophic nature of the Grand Canyon formation as well as its remarkable layers of stratified rocks; and secondly reinvestigation of the reported occurrence of pollen grains in the Cambrian and Precambrian shales. We will develop our philosophy of research at the Board meeting. This base is to be named the CRS Grand Canyon Experiment Station.

At this time I decided to return home as I was suffering from cold exposure in Flagstaff and at the Grand Canyon. Drs. Howe and Williams went on to Weatherford, Oklahoma, to see Dr. Norbert Smith and look at his land. Norbert showed them three acres of *original* prairie land which had never been plowed. George Howe was most enthusiastic about this. Dr. Norbert Smith will lease this 3.4 acres of original grassland for \$1.00 per year forever. This land will be used for plant succession studies to disprove certain aspects of so-called megaevolution. Telephone

and electrical services are available on one corner of the acreage. A well can be dug for \$100.00. No zoning problems exist. The site will be designated the CRS Grassland Experiment Station.

Norbert, who is a member of the Research Committee, will oversee this site for us until a permanent staff is available. Since he has published about 150 research papers our committee is desirous of using his proven ability. He has submitted some excellent research proposals to our committee and they have been approved, except that no salary would be paid to him. He agreed to direct a man we hope to hire on a summer stipend (1983) to do studies on the survival of living organisms in mixed salt and fresh water (of interest as related to the Flood). George Howe will contact the young scientist with known ability to do the work. He will also begin taxonomic studies of the various plants on the experiment station site under direction of Dr. Howe, whose profession is botany. This would consist mainly of collecting specimens, making preliminary identification, and sending them to Howe for confirmation.

We are very pleased with the progress of our research efforts. The future appears to be very exciting. We are spending only the interest on the capital fund and we can assure you that CRS will receive a maximum work return for a minimum outlay of money. Two field experiment stations after a year of fundraising is remarkable. To those who have contributed we wish again to thank you. And to those of our members, both voting and sustaining, who have not as yet contributed we earnestly ask you to give this program your prayerful attention. Then please contribute what you feel able to. Even though it may not be possible to contribute \$150.00 per year for five years as we originally asked, even a small donation will be gratefully accepted.

Sincerely,
Walter E. Lammerts
Member of the
Research Committee.

Grand Canyon Experiment Station Land

It is a pleasure to announce that the C. R. S. Research Committee, under the able leadership of Emmett Williams, has purchased a 2.5 acre tract of tillable land along a major highway near Chino Valley, Arizona. This parcel was purchased after Williams, Lammerts, and Howe carried out an extensive investigation of properties throughout northern Arizona. As interest monies from the Laboratory Project Fund will permit, this land is slated to become the site of field experiments and other research projects. Its proximity to the Grand Canyon, Grand Canyon Caverns, Painted Desert, Petrified Forest, national forests, mountains, juniper woodlands, and Sonoran desert make it an ideal location.

George F. Howe

A Word from France

The following consists of excerpts from an open letter to President Mitterand of France, by M. Pierre P. Grassé, published in *Figaro*, 19 September, 1981. We came across this item in the *C.H.A.C. Review*, volume 10, no. 2, page 10, March and April 1982. The *C.H.A.C. Review* is published by the Catholic Health Association of Canada, 312 Daly Ave., Ottawa, Ontario, Canada.

Readers of the *Quarterly* may have heard of M. Grassé before; for he has been a persistent critic of Darwinism. See, for instance, the review of his book *Evolution of Living Organisms* on pages 171 and 172 of the *Quarterly* for December, 1978. The following excerpts reveal Grassé's thoughts on another matter which will be of interest to many readers.

On your request, Parliament will vote for the abolition of capital punishment and in so doing, will make concrete your respect for human life, even when it concerns the lives of the worst criminals. . . .

Yet, Mr. President, in our country, when you desire to be liberal and fraternal, the death sentence will continue to be passed on a daily basis.

Let me explain . . .

During these days of clemency, it would be wise to weigh the value of arguments which legitimize the condemning to death of an infant in the womb.

These arguments (the foetus is not a human being; the foetus is the exclusive property of the mother) are false and contradicted by embryology, genetics and molecular biology.

There is no pre-human period in our life cycle. In the light of recent discoveries, the embryo is revealed as a genuine human in miniature.

The embryo is an individual totally distinct from the maternal organism on which it lives parasitically. In all justice, the father possesses the same rights over the child as the mother: both begetters bequeath exactly the same number of genes.

Justice and logic do not allow as flagrant and crass a contradiction as that which may become French law tomorrow: the granting of life to the murderer and the sentencing to death of the innocent. The death penalty in our country will not be abolished until the day when abortion is strictly forbidden.

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History The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creationism, with a current membership of over 600 voting members (with graduate degrees in science) and over 1800 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

Activities The Society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$13.00 (\$15.00 U.S. for overseas) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$13.00 (\$15.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$16.00 (\$18.00 U.S. for overseas).

Statement of Belief Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms.

We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. Subsequently a Revised Edition (1974), a Teachers' Guide and both Teachers' and Students' Laboratory Manuals have been published by Zondervan Publishing House. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was an historic event worldwide in its extent and effect.

4. We are an organization of Christian men of science who accept Jesus Christ as our Lord and Saviour. The account of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Saviour for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Saviour.

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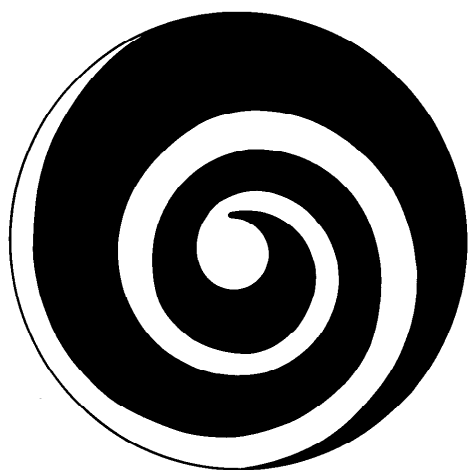
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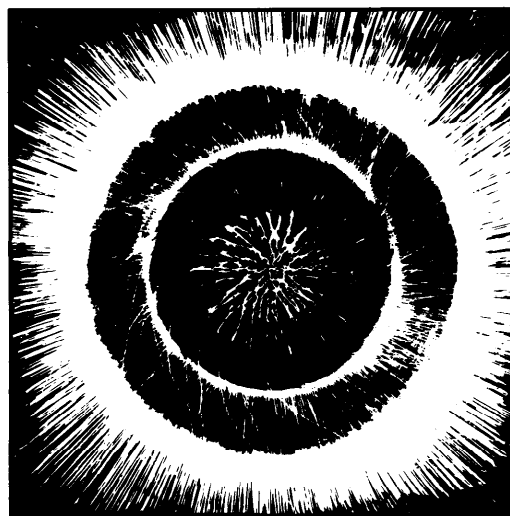
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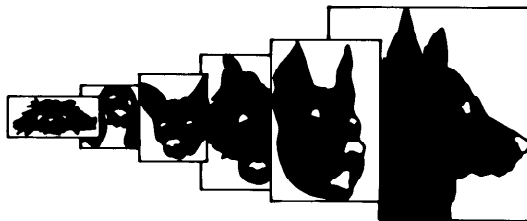
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