Conclusions

Although there are fluctuations in natural systems such as shock waves and other catastrophic events, it is unreasonable to assume that they can be used as a driving force for molecules-to-man evolution. Nonuniform conditions can exist briefly as illustrated by the Zhabotinski reaction.[31] However, like all real systems, it is driven toward equilibrium and does not proceed to higher states of order.

Dissipative structures offer considerable promise as good models for living systems and certain temporary nonequilibrium states found in nature. However they cannot be used as models for the origin of such systems.

The major problem that must be faced by evolutionists is how their imagined universe moved out of the preferred natural state of equilibrium. Natural means seem fruitless. This writer prefers to believe

> In the beginning God created the heaven and the earth

as the origin of natural order.

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[26]Crawford, F. H. 1963. Heat, thermodynamics and statistical physics. Harcourt, Brace, and World, Inc. New York. 518-520.
[27]Williams, 1966. *Op cit.*, p. 20.
[28]Crawford, *Op cit.*, p. 519.
[29]*Ibid.*, p. 520.
[30]Williams, 1973. *Op cit.*, p. 42.
[31]Glansdorff and Prigogine, 1971. *Op cit.*, pp. 261-263.
The Zhabotinski reaction goes as follows. A solution of $Ce_2(SO_4)_3$, $KBrO_3$, $CH_2(COOH)_2$, H_2SO_4 and a few drops of Ferroline (redox indicator) are mixed and stirred by magnetic agitation. The solution changes color periodically from red (excess of Ce^{+3}) to blue (excess of Ce^{+4}) and back, etc. Depending upon concentration, temperature, and mixing conditions the entire solution will change at once or in "bands". The system reaches equilibrium, staying a single color, usually in less than thirty minutes.

THE SPECIES CONCEPT IN LYELL'S *PRINCIPLES OF GEOLOGY*

G. H. HARPER*

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Lyell's book had also something to say about biology; and his views on that subject are investigated here. It turns out that he was not so much of a Darwinian as is often supposed; in fact, his doctrine was more like the one now commonly called Progressive Creation. Creationists who have not read the work may be surprised to find that some of his arguments and illustrations may still be useful to them.

This article will summarize the concept of biological species in Sir Charles Lyell's *Principles of Geology*. The book was first issued in 1830 (vol. I), 1832 (vol. II), and 1833 (vol. III), and its original full title was *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, By Reference to Causes now in Operation.* After the 5th edition (1837), the contents were split into the *Principles* (6th and later editions), dealing mainly with processes now seen in operation on the earth's surface, and *The Elements of Geology* and *Manual of Elementary Geology* which dealt with "geology proper". This article is based on the 9th edition (1853) of the *Principles*, whose full title is *Principles of Geology; or, the Modern Changes of the Earth and its Inhabitants Considered as Illustrative of Geology*, and which was published by John Murray of

*Mr. G. H. Harper has taught Biology in school, and is now a historian, studying the propagation of opinions on law, order, design, progress, and species, through British nineteenth century educational textbooks. He is neither a Special Creationist nor an evolutionist, but a steady state theorist. He is now with the Centre for Science Education, Chelsea College, London, England. His address is 7 Epsom Court, Berry Lane, Rickmansworth, Herts, England.

London. It is illustrated with some charming wood engravings.

Books I and II deal respectively with the history of geology and modern geological processes. Of present concern is book III (pp. 566-799), which is largely on biology. Chapters XXXIII-XXXVI are on the species concept; XXXVII-XXXIX, on geographical distribution of species; XL-XLIII, on the origin and extinction of species; and XLIV-L, on the influence of organisms in geography (coral reefs, for instance) and the formation of fossils. Also on fossils was the much earlier chapter IX, in which Lyell was still arguing, at this late date, that the fossil record did not show progression. Henceforth, we shall be concentrating on the material in chapters XXXIII-XXXVI and XL-XLIII, as well as "Concluding Remarks" on pp. 798-9. Page numbers refer to the 1853 printing, and readers who have access to earlier editions, or the facsimile reprint (New York, 1970) of the first edition, may be interested to compare the treatments.

Early in chapter XXXIII, Lyell introduces four problems to which he addresses himself in the book. First, do species have a "real and permanent existence in nature"?—or are they "capable, as some naturalists pretend, of being indefinitely modified in the course of a long series of generations?" Second, if species have a real existence, is each derived from a single stock or from several? Third, how far is the duration of each species limited by changing conditions in the animate or inanimate world? Finally, are there proofs of the successive extinction of species and the creation of others to take their place? (pp. 566-7) The rest of the chapter is occupied with the first problem, and consists of ten pages of an apparently fair presentation of "Lamarck's arguments in favour of the transmutation of species" (pp. 567-77). It is largely based on Larmarck's *Philosophie Zoologique*, and need not be summarized here. One remark is worth making, however; it is curious how transmutation theories achieved wide circulation before 1859 through the works of antitransmutationists. William Paley introduced Erasmus Darwin's theory of appetencies to many who would not otherwise have learnt about it, Lyell broadcast Lamarckian theory effectively, and Hugh Miller did the same for de Maillet, Lamarck, and the *Vestiges*.

In the next three chapters, Lyell opposes Lamarck's theory with a presentation of his own concept of species. The last page of chapter XXXVI gives a summary of his answer to the first problem stated above. It contains six points. (1) ". . . there is a capacity in all species to accommodate themselves, to a certain extent, to a change of external circumstances, this extent varying greatly, according to the species". (2) A large change in situation is usually followed by modifications, "but the mutations thus superinduced are governed by constant laws, and the capability of so varying, forms part of the permanent specific character". (3) "Some acquired peculiarities, of form, structure, and instinct, are transmissible to the offspring . . . ." (4) "The entire variation from the original type . . . may usually be effected in a brief period of time . . . ; indefinite divergence, either in the way of improvement or deterioration, being prevented, and the least possible excess beyond the defined limits being fatal to the existence of the individual". (5) "The intermixture of distinct species is guarded against by the aversion of the individuals composing them to sexual union, or by the sterility of the mule offspring". (6) "From the above considerations, it appears that species have a real existence in nature; and that each was endowed, at the time of its creation, with the attributes and organization by which it is now distinguished". (p. 611)

It is worth presenting Lyell's views somewhat more fully on several of these conclusions. On variation, for instance, he readily admits that some species "may be found to differ less widely from one another than do the mere varieties or races of certain species". But this "would by no means overthrow our confidence in the reality of species" (p. 581). In explaining this, final causes are introduced. "We must suppose that when the Author of Nature creates an animal or plant, all the possible circumstances in which its descendants are destined to live are foreseen, and that an organization is conferred upon it which will enable the species to perpetuate itself and survive under all the varying circumstances to which it must be inevitably exposed" (p. 582). Species destined to survive under a wide range of environments, such as horses or dogs, may therefore be able to produce varieties, the differences between which exceed the interspecific variation in other genera.

The remainder of chapter XXXIV gives illustrations of the variability of species, to support the principle that variability is merely one of the fixed characters of a species. Dogs are instanced as showing extreme variability (pp. 584-5), but to show that this variability is limited or "definite", the French researches on mummies acquired during the occupation of Egypt are mentioned. "Instead of wasting their whole time exclusively in collecting human mummies, M. Geoffroy and his associates examined diligently, and sent home great numbers of embalmed bodies of consecrated animals, such as the bull, the dog, the cat, the ape, the ichneumon, the crocodile, and the ibis" (p. 585). The authors of the report on these specimens were MM. Cuvier, Lacépede, and Lamarck, and they agreed that they could find no differences between the mummified specimens and their modern equivalents to suggest transmutation (pp. 585-7). Lyell continues by considering seeds from Egyptian tombs, modern cabbages, primroses, and changes induced by soil and horticulture. But in cases where considerable changes can be induced, "we soon reach certain limits, beyond which we are unable to cause the individuals descending from the same stock to vary . . . ." (p. 588).

Chapter XXXV re-emphasizes that any change which a variable species can undergo will generally be effected within a few generations; "the quantity of divergence diminishes after a few generations in a very rapid ratio" (p. 592). Some examples are then given of the inherited peculiarities of some varieties of a species —usually the dog. Not all characters of this type are inherited, however. "A pig has been trained to hunt and point game with great activity and steadiness; and other learned individuals, of the same species, have been taught to spell; but such fortuitous acquirements never become hereditary, for they have no relation whatever

to the exigencies of the animal in a wild state, and cannot, therefore, be developments of any instinctive propensities" (p. 595).

The rest of the chapter is concerned with domestic races, once more, and the point Lyell particularly makes is that the use to man of domestic animals was forseen by God, who provided them with the requisite variability and other specific characters; ". . . the power bestowed on the horse, the dog, the ox, the sheep, the cat, and many species of domestic fowls, of supporting almost every climate, was given expressly to enable them to follow man throughout all parts of the globe, in order that we might obtain their services, and they our protection". And in case the elephant appears to be an exception, its restriction to the warmest latitudes is still a providential arrangement because "the quantity of vegetable food required by this quadruped would render its maintenance in the temperate zones too costly, and in the arctic impossible" (p. 597). A piece of evidence in favor of this general interpretation of domestic animals is seen in the horse; the obedience of an individual horse to a succession of human owners is a propensity of no obvious use to horses in the wild state (p. 596).

The problem of hybrids dominates chapter XXXVI, and it is a problem because some naturalists consider hybrids "as affording the strongest of all proofs in favour of the reality of species; others, on the contrary, appealing to them as countenancing the opposite doctrine . . . ." (p. 600) Lyell regards hybrids as supplying evidence for fixity of species on various counts: hybrids generally cannot sustain themselves in the wild state; very closely related species are often found to have non-overlapping geographical ranges; a hybrid of two well adapted species would itself be unlikely to be well adapted to that environment; and if most species arose as hybrids from original types, where are the original types? It is in the context of the low chance of survival of hybrids in the wild state that Lyell introduces natural selection theory; "even of the seeds which are well ripened, a great part are either eaten by insects, birds, and other animals, or decay for want of room and opportunity to germinate. Unhealthy plants are the first which are cut off by causes prejudicial to the species, being usually stifled by more vigorous individuals of their own kind . . . . In the universal struggle for existence, the right of the strongest eventually prevails; and the strength and durability of a race depends mainly on its prolificness, in which hybrids are acknowledged to be deficient" (pp. 604-5). At times, the history of natural selection theory has run a course independent of the history of evolutionism, and there are a considerable number of variants of the theory. In this case, Lyell is adhering to a common form in the period before 1859, one in which natural selection is seen as weeding out defective individuals and hence stabilizing a variety or species—not changing it.

The question of origin and extinction of species is turned to in chapters XL to XLIII. In contrast with Linnaeus' theory that all original species were created in the same restricted locality—namely, the first habitable part of the world to emerge, on the subsidence of the primeval oceans (p. 665)—Lyell proposes that "Each species may have had its origin in a single pair, or individual, where an individual was sufficient, and species may have been created in succession at such times and in such places as to enable them to multiply and endure for an appointed period, and occupy an appointed space on the globe" (p. 666). Admitting the existence of barriers to the spread of species, such as seas, mountain chains and climatic belts in the case of land organisms, land, shoals, abysses and currents in the case of marine organisms, and winds in the case of species dispersing in the air, then we have an explanation of the restriction of many species to particular regions of the world.

Lyell's views are somewhat more original when he comes to time and duration. He does not adhere to a literal reading of Genesis, but first quotes the theory of the Italian, Brocchi, to the effect that "The death . . . of a species might depend, like that of individuals, on certain peculiarities of constitution conferred upon them at their birth; and as the longevity of the one depends on a certain force of vitality, which, after a period, grows weaker and weaker, so the duration of the other may be governed by the quantity of prolific power bestowed upon the species . . . ." (pp. 668-9)

Brocchi's theory is not entirely acceptable to Lyell, though they agree on the "gradual extinction of species one after another" (p. 669), and the limited duration of species. Lyell believes, against Brocchi however, that the "prolific powers" of species are unimpaired at their extinction, and that they die out for other reasons—these being the main substance of chapters XL to XLII. There are many interesting ecological observations in this part of the book, which suggests that Lyell was no mean naturalist. In particular he emphasizes the concept of the "station" of each species, which is "all the circumstances, whether relating to the animate or inanimate world, which determine whether a given plant or animal can exist in a given place" (p. 669). He instances the restriction of some species to particular soils, such as *Carex arenaria* and *Elymus arenarius* (p. 670). Competition between species is mentioned, and also co-operation, as in the case of young oaks protected by holly from deer and swine in the New Forest of Hampshire, England (p. 671). Insects give some striking examples. "Entomologists enumerate many . . . cases where insects, appropriated to certain plants, are kept down by other insects, and these again by parasites expressly appointed to prey on them" (p. 672). The use of final causes is again evident. Lyell compares the efficiency of insects with the steam engine, which has the advantage over many hundreds of horses, of equivalent power, in that it does not require to be fed when not in use. Similarly, among insects, "A scanty number of minute individuals, to be detected only by careful research, are ready in a few days, weeks, or months, to give birth to myriads, which may repress any degree of monopoly in another species, or remove nuisances, such as dead carcasses, which might taint the air. But no sooner has the destroying commission been executed than the gigantic power becomes dormant" (p. 673) and the population drops to its usual level. This idea is used to explain Linnaeus' assertion that three flies, of the

species *Musca vomitoria*, "could devour a dead horse as quickly as a lion" (p. 673).

The intention in discussing all this ecology is to establish that species "depend on a great complication of circumstances" (p. 677), and that "if it be shown that stations can become essentially modified by the influence of known causes, it will follow that species, as well as individuals, are mortal" (pp. 669-70). As to be expected, chapters XLI and XLII proceed to demonstrate how familiar causes can so alter the stations of species that "the successive destruction of species must now be part of the regular and constant order of nature" (p. 678). Considerable evidence is presented for the drastic effects on species when a different species is introduced into the environment, and this includes an interesting account of the effects of "the Greenland bears, when they are drifted to the shores of Iceland in considerable numbers on the ice" (p. 679). In general, Lyell wishes to demonstrate "that when any region is stocked with so great a variety of animals and plants as the productive powers of that region will enable it to support, the addition of any new species, or the *permanent* numerical increase of one previously established, must always be attended either by the local extermination or the numerical decrease of some other species" (p. 678). Inorganic changes may also have the same effect, either by altering the barriers limiting dispersal of species, or by affecting conditions of the environment such as climate. As an example, Lyell considers the multiplicity of changes in climate, and barriers to migration of land and marine species, if the isthmus of Panama were to subside below sea level (pp. 691-2). Altogether, "amidst the vicissitudes of the earth's surface, species cannot be immortal, but must perish, one after the other . . . . There is no possibility of escaping from this conclusion, without resorting to some hypothesis as violent as that of Lamarck. . . ." (p. 696).

Lyell finally comes to a four-page section on the "Introduction of New Species". He allows that some naturalists, such as Humboldt, regarded the topic "as among the mysteries which natural science cannot reach"; but Lyell thinks that "To geology . . . these topics do strictly appertain . . . ." (p. 704), and he proceeds to consider "what kind of evidence we ought to expect . . . of the first appearance of new animals or plants, if we could imagine the successive creation of species to constitute, like their gradual extinction, a regular part of the economy of nature" (p. 704). The problem is that, with knowledge of species still at an elementary stage, the sudden appearance of a new species, in a locality already well investigated, legitimately prompts the inference "that the beings in question had previously eluded our research; or had at least existed elsewhere, and only migrated at a recent period into the territories where we now find them" (p. 704).

Attention is then directed to the probable rate of extinction and creation of species. After reviewing estimates of the number of species, and arriving at a very approximate number of "between one and two millions of species now inhabiting the terraqueous globe", excluding microscopic species, Lyell thinks it reasonable to assume "that if only one of these were to become extinct annually, and one new one were to be every year called into being, much more than a million of years might be required to bring about a complete revolution in organic life" (p. 706). If, for the sake of the argument, this be accepted, then it would seem that an area the size of Europe (about a twentieth of the world's surface) would experience an extinction and a creation once in twenty years on average—and much less frequently if we think only of terrestrial and well known groups of species in which the events in question might be detected for what they were. Since the chances of gaining useful knowledge on the replacement of species among the extant fauna and flora are so small, Lyell considers that the study of the first appearance of living species in the fossil record gives a much better opportunity of establishing or disproving his theory of the continual replacement of species.

At the very end of the *Principles*, there are two pages of "Concluding Remarks". They are concerned with the age of the earth—or, rather, whether it had an origin. Two opinions are contrasted. One school of thought wishes "to discover in the ancient rocks the signs of an epoch when the planet was uninhabited, and when its surface was in a chaotic condition and uninhabitable". But "The opposite opinion, . . . that the oldest of the rocks now visible may be the last monuments of an antecedent era in which living beings may already have peopled the land and water, has been declared to be equivalent to the assumption that there never was a beginning to the present order of things" (p. 798). Lyell seems to be saying, in the succeeding paragraphs, that geological evidence is indeed quite compatible with a steady state theory, postulating no origin. However "if, in tracing back the earth's history, we arrive at the monuments of events which may have happened millions of ages before our times, and if we still find no decided evidence of a commencement, yet the arguments from analogy in support of the probability of a beginning remain unshaken . . . ." (p. 798). "To assume that the evidence of the beginning or end of so vast a scheme lies within the reach of our philosophical inquiries, or even of our speculations, appears to be inconsistent with a just estimate of the relations which subsist between the finite powers of man and the attributes of an Infinite and Eternal Being". ". . . in whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power" (p. 799). Thus, we have good evidence for the existence and attributes of God in geology, but no evidence for an origin of the earth. Belief in that must rest on other evidence.

In summary, we have in Lyell's *Principles of Geology* a fairly conventional view of the nature of species—conventional for the period, that is. Species were created with fixed attributes, but nevertheless able to undergo limited modification to the extent that distinct races may be produced. Final causes are admissible in explaining some characteristics of species, such as unusual variability. Just as the organs are carefully adjusted to each other so that no "indefinite" modification is compatible with viability in the animal or plant, so each

(Continued on page 141)

2. that this year we publish two one-third-page advertisements in *Nature* and one one-third-page advertisement in *Moody Monthly*;
3. that one questionnaire be sent to voting members and another to sustaining members who do not renew membership;
4. that we ask Mott Media to handle the reprinting of the whole O'Toole book;
5. that the C.R.S. pay all expenses of board members incurred in attending the annual meeting including the meals;
6. that the theme of the June 1980 *Annual* be "Domestication of Plants and Animals" (including the origin of these forms);
7. that we proceed to develop a clearing house for employment;
8. that five of the incumbents of the Board of Directors whose terms would expire be renominated (Tinkle had written indicating that he did not wish to be renominated). Other nominations were made. (Elsewhere in this issue the complete slate is listed.);
9. that the present officers of the board be re-elected;
10. that the C.R.S. establish facilities to act as distributor for our books, reprints and monographs, which would be sold from a central location;
11. that consideration be given to reprinting *Scientific Studies in Creationism*;
12. that Williams be empowered to spend up to $2000. for C.R.S. books from Craig Press (in partial carrying out of 10);
13. that C.R.S., while not wishing to contribute financially toward a convention booth for the Missouri Association for Creation commend the organization for its activities;
14. that ex-board members who are Fellows be permitted to attend meetings, but not to vote;
15. that the 1980 meeting of the Board of Directors be held 18, 19 April at Ann Arbor, Michigan, the business session to start at 1800 hours (members should be encouraged to come earlier). (See the announcement, elsewhere in this issue, about an open meeting).

Wayne Frair, Secretary

SPECIAL NOTICE

The following candidates have been nominated to the Board of Directors to serve for a three-year term beginning in 1980.

Harold L. Armstrong
Thomas G. Barnes
D. R. Boylan
Duane T. Gish
Erich von Fange
Emmett L. Williams
Paul A. Zimmerman

Six members are to be elected to the board. It should be remembered that elections are staggered, one third of the members of the Board being elected annually. Thus, if a certain member of the Board is not listed here, it does not necessarily mean that he is leaving the Board.

The date of the annual election is 1 March 1980. Biographical information on each nominee will be distributed with the ballots.

EXCERPTS FROM THE BYLAWS

Article III - Election of Directors

Section 1. The date for the annual election of directors shall be set by the secretary, but in no case shall it be later than March 1.

Section 2. The Board of Directors shall annually nominate at least one candidate for each vacancy on the Board of Directors, said candidate to have agreed to serve on the Board of Directors. The secretary shall report the names of those nominated by the Board of Directors together with the date of the election to all voting members not less than 120 days prior to the election.

Section 3. Any voting member may nominate one candidate for election to the Board of Directors by presenting a petition signed by not less than 25 voting members of the Society, said petition to list the name and address of the candidate, indicate the qualifications of the candidate in not more than 50 words, list the name of the individual nominating him, bear the certification of the nominator as to the authenticity of the signatures on the petition, and contain a statement by the nominator that the individual nominated is willing to serve on the Board of Directors. This petition must be mailed to the secretary and must be postmarked not less than 60 days prior to the election. On receipt of the petition, the secretary shall ascertain that at least 25 of the signers of the petition are voting members in good standing.

The Species Concept in Lyell's Principles

(Continued from page 139)

species is carefully adjusted to other species and its environment in a complex, harmoniously balanced ecosystem. The rather more unusual features in Lyell's concept of species are his denial of general progression and his theory of the regular creation of new species (in opposition to the mass creation of new species following geological catastrophes).

This article has been written with a view to encouraging special creationists to read widely in the biological and geological literature of the first half of the 19th century and earlier. There is a surprising amount of sound theory to be encountered, more of which could well be taken seriously today.