### $C^{14}$ Dating

Increased atmospheric $CO_2$ would probably alter the amount of $C^{14}$ formed in the atmosphere and the change in metabolic pathways noted above may increase the assimilation of $C^{14}$ within plants. Both of these effects would distort the indicated age of pre-Flood biologic materials if the dating is based on present atmospheric conditions.

C. J. Yapp and H. Poths have arrived at a similar conclusion to that presented in this article based on an analysis of goethites from an ironstone in the Upper Ordovician Neda Formation. In their analysis the atmospheric $CO_2$ was determined to be approximately 16 times greater than the present (Yapp and Poths, 1992, p. 342). This value is in very close agreement with that derived under category 4.

### Conclusion

The minimum amount of atmospheric $CO_2$ required to sustain the antediluvian biosphere based on total in-place resources would have been at least 2628 ppm / 275 ppm or approximately 10 times greater than the amount in the preagricultural atmosphere. Furthermore, the minimum amount of $CO_2$ in the antediluvian atmosphere based on the report by Morton would require 4859 ppm / 275 ppm or in excess of 17 times that in the preagricultural biosphere.

This increase in atmospheric $CO_2$ could also create a need for an additional source of water vapor to sustain the antediluvian biosphere. Similarly, the increased $CO_2$ in the atmosphere is approaching the level that would interfere with breathing. However, this difficulty with breathing could be ameliorated through increased atmospheric pressure resulting from a water vapor canopy.

Additionally, increased $CO_2$ causes differences in the pathways through which carbon is assimilated within plants. This would produce different food values for plant material and could affect the diet of both people and animals. This phenomenon would result in differential plant growth rates that could be interpreted as part of the evolutionary process.

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# CHAOS: MAKING A NEW HERESY

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### Abstract

*New and exciting mathematical strategies in science have been rapidly developing over the lust two decades. A field of study has emerged, collectively called "Chaos" or nonlinear dynamics. A brief summary of the history and findings are given, and various features of chaos theory are discussed regarding creation and evolutionary world views.*


### Introduction

Are fractals, solitons, and bifurcations attracting us toward a paradigm shift in science? Can you say "deterministic chaos" without wincing? Is there really something new under the sun? Authors James Gleick (1988, p. 7) and Ian Stewart (1989, pp. 2-3) in their respective reviews of chaos theory say so, and they are note alone. Others suggest that this "new" science will contribute to everything from understanding evolutionary mechanisms to ushering in a new age (Briggs and Peat, 1989, p. 166). The AAAS (Anon., 1989) appears to be advancing a little chaos in the educational advancement of evolution, and deterministic chaos is

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rapidly becoming a standard part of the university curriculum. Chaos theory is even making its debut in popular fiction (Crichton, 1990, pp. 72-75), and at the cinema. However, are nonlinear dynamics, fractal geometry, or genetic algorithms really "chaos" theories by other names? Perhaps it is time to separate some of the facts from the fantasies and discover exactly what is new, if anything, under the "chaotic" sun.

### Historical Background

From a historical perspective the seeds of modern chaos began with the troubling realization that nonlinear systems of equations were not yielding the well packaged solutions that Newtonian investigators had come to know and love. Isaac Newton himself had investigated iterative techniques (Peitgen and Richter, 1988, p. 18), while he was dealing with differential calculus. Iteration involves a recycling of computed values in order to produce a string of successive computed values. Iteration appears to be key in chaos theory which will be discussed later. Perhaps Newton glimpsed aspects of chaos in his iteration method when his functions failed to have real roots. However, it is not clear how Newton may have understood variations in initial conditions in a "deterministic" solution process with respect to current perspectives within the modern science of chaos. After all, even Newton did not yet really live in a deterministic "Newtonian" world: he was helping to create it.

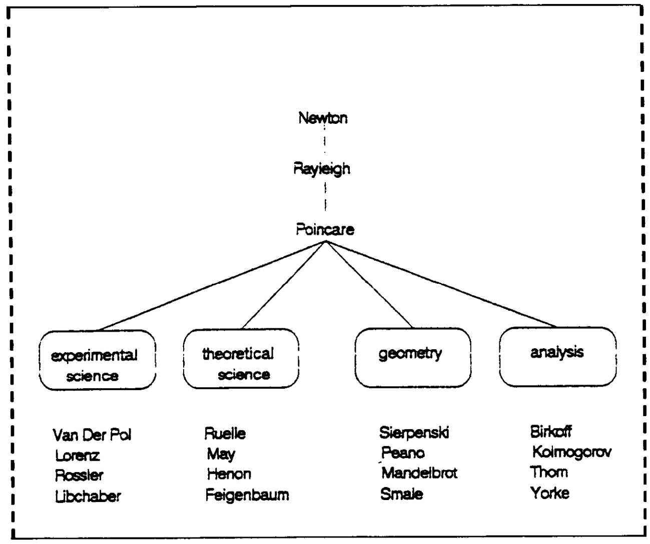
Newton operated from a geometrical perspective, as illustrated throughout his *Principia*, which led him in developing his analytical approach. He was untroubled by a strict analytical bias in opposition to geometry or intuition. He crossed intellectual boundaries and attacked everything to bring full disclosure. Furthermore, Newton is especially important in this regard, for it is unlikely that he would have been dissuaded in favor of modern fanciful interpretations in the mathematical sciences supporting evolutionary concepts developed from a Darwinian perspective.

Following Newton, Rayleigh apparently experienced the chaos of nonlinearity in his study of mechanical vibrations. Rayleigh took more of an experimental approach in analyzing nonlinear behavior by driving coupled mechanical systems in and out of resonance. However, all the modern investigators of chaos point to Henri Poincare as the first who clearly understood the implications of nonlinearity and the loss of analytically integrable solutions with respect to Newtonian determinism.

After this, investigators randomly appeared in different disciplines and remained isolated until scientists and mathematicians recently began to realize a general connection in their work over the last two decades (Gleick, 1988, pp. 3-4).

Little could be done to improve on Gleick's historical background of chaos, except a possible connection between chaos theory and the "catastrophe" theory of Rene Thorn and E. C. Zeeman. Table I is a brief list of some historic contributors in the area of nonlinear dynamics. Although highly abbreviated, this list is useful in investigating other notable scientists, mathematicians, and work in chaos. A comprehensive list of investigators in the field today would fill pages. Although difficult to strictly separate geometry from analysis or even physics, the work of some investigators may carry more weight under specific headings depending on the nature of their backgrounds or their publications.

**Table I. Representative scientists in non linear dynamics.**




A few of the individuals listed deserve special attention, as their names have been used to describe chaotic phenomena. Edward Lorenz, an M.I.T. research meteorologist, was one of the twentieth century scientists who showed the reality of chaos from his vacuum tube computer in the early 60's (Stewart, 1989, p. 138). In his numerical investigation of atmospheric fluid flow, he discovered a range of variables for a set of differential equations which produced his "Strange attractor," specifically the Lorenz attractor in honor of its discoverer. This so-called strange attractor is a finite manifold in phase space, possessing an infinite thread of values woven throughout its finite volume never repeating previous values within its orbit. At this stage, Lorenz discovered what is referred to as sensitive dependence, a situation where the slightest change in initial conditions alters the path or pattern of values generated from his set of equations. He further understood that it implied doom for long-range weather forecasting, since the slightest change in an initial value dramatically changed the pattern of the outcome.

Benoit Mandelbrot is a mathematician who came to chaos from the geometrical side of life. Mandelbrot's contribution helped to integrate the previous work of mathematicians such as Cantor, Julia, and Fatou, resulting in a richer understanding of what are called fractals (spacial forms of fractional dimension). His famous Mandelbrot set is a bizarre portrait in the complex plane which reproduces many Julia sets upon expansion of various regions of the master set. From a study of such expansions or magnifications, complete replicas of the entire Mandelbrot set are found nested in its microscopic fabric demonstrating the phenomenon known as self-similarity.

Mitchell Feigenbaum is a Los Alamos scientist who carefully studied the "logistic map" which will be examined later. Feigenbaum's contribution provided a basis for recognizing the underlying universality of nonlinear forms (Gleick, 1988, p. 175). He discovered what are apparently universal constants named in his honor, Feigenbaum numbers. The observed sequence of period doubling, called bifurcations, associated with transitions from stable states to chaos in certain phenomena were more mathematically accessible after Feigenbaum. This universal quality was a valuable leap forward in the ability for workers to really understand some of the nuts and bolts of nonlinear representations. Several investigators, before and after these men, have made significant contributions. However, the ones mentioned were foundational and significantly influenced the direction of development in modern chaos theory.

## Non-Fiction

*Basic Terms*

I begin by limiting the discussion to a brief examination of some specific features and observed consequences associated with chaos theory previously mentioned.

| *Features* | *Observations* |
|---|---|
| Nonlinearity | Sensitive dependence |
| Iteration | Self similarity |
| Driven systems | Bifurcations |

These lists represent major elements and discoveries in the study of chaos. Indeed, the first feature listed has been used to describe this field of study: nonlinear dynamics. Nonlinearity implies just that—functions containing terms which are something other than simple proportions or linear combinations. Transcendental functions or higher power terms introduce nonlinearity into a system. Alone, such functions may be appropriately understood and describe well-behaved phenomena. However, when these nonlinear functions are iterated, one obtains surprising results.

Iteration, or iterative feedback, constitutes a process in which parameter values are fed back through one or more equations producing new values to be repeatedly fed back through the same equation(s) to generate new values. From Newton to numerical techniques, iteration is not something really new (Peitgen and Richter, 1986, p. 5). However, the chaotic mindset about iteration is different. The mapping or processing itself has become a different order of solution. Prior to our modern computer, of course, it would have been difficult to think this way.

For example, consider a function, $y = f(x)$. Start with a "seed" value for x and determine y. Now let y become the next x and determine a new y, which becomes a new x, and so forth. In terms of x we may write the following sequence:

$$x$$
$$f(x)$$
$$f(f(x))$$
$$f(f(f(x)))\ldots$$

We may represent this continuous series more simply as,

$$x_{n+1} = f(x_n) \tag{1}$$

These values, or their map, represent the dynamics of a system. Equations are not "solved" so to speak, but are used as processing algorithms to generate values often used to produce a map, picture, or "portrait" giving an intuitive sense of the dynamics involved. Illustrations given in Figures 1-3, will be discussed.

The term "driven systems" is used to mean any dynamical system driven by some "engine" or energy source doing work on a system. Dynamical systems come as two types: conservative and dissipative. Conservative systems (those in which energy is presumed conserved) will not be discussed here, except to state that their energy conservation is demonstrated topologically in a phase portrait that preserves its area, or volume, under transformation (Schuster, 1988, pp. 105-108). A dissipative system is one in which the natural motion or activity of that system is depreciated due to some retarding influence, i.e. friction, etc. The area of such a system's phase portrait contracts under transformation and is not preserved. It is this dissipative type which needs a "driver" in order to sustain the activity of the system. This aspect will be important when entropy is discussed later.

A swinging pendulum which eventually comes to rest is a standard example of a dissipative system. Dissipative systems, therefore, must be "driven" in order to sustain the dynamics of the particular system. The interesting behavior occurs by driving elements of a system against the natural frequencies of those elements. If a pendulum is "driven," that is, in some way coupled to the shaft of a motor, the interaction due to the pendulum's natural period and the period of the motor's oscillation may make for very interesting and unusual motion as the rotational velocity of the motor increases. The motor's output could be adjusted systematically to generate an individual or global phase portrait to study the change in dynamical behavior. In many laboratory experiments, various "drivers" or energy sources for particular systems are controlled in systematic fashion, permitting a study of strange and complicated variations in periodic and chaotic motion.

Next, we consider observations or discoveries which are consequences resulting from the investigations of such nonlinear behavior. These have now been demonstrated in all sorts of systems in the areas of meteorology, economics, geometry, electronics, chemistry, ecology, and such everyday phenomena as dripping faucets.

During the chain of events which led to the modern synthesis of chaos theory, dynamical behavior was found to be profoundly sensitive to initial conditions. Lorenz saw this from his differential equations; geometers also saw it occurring from their topological transformations. In other words, the sequence of values generated from one or more nonlinear equations is extremely dependent on the initial value(s) used at the beginning of an iteration process. The meteorological study of Lorenz is the classic example of sensitive dependence and its consequences in weather forecasting (Stewart, 1989, 141).

Another consequence of nonlinear studies was the phenomena of self-similarity, sometimes referred to as scaling. This is conveniently visualized in the study of fractals, but it appears to be a universal feature of chaotic systems. Regardless of scale, similar patterns within a fractal or other kinds of chaotic maps are continually manifested within these pictures or the mathematical ratios representing respective regions in a map. This theoretically continues on an infinitely large or small scale.

Finally, bifurcation or period doubling is a system characteristic where the transition from a periodic condition to a chaotic regime experiences a pattern in the doubling of states or values. This feature illustrates one of the so-called "routes" to chaos and is evident in both theory and experiment.

The above items do not exhaust the field of study with respect to chaos, but they represent some very important fundamental features within this "new" science. Now we will take a look at a mathematical structure known as the logistic map, which demonstrates many of these characteristics just discussed.

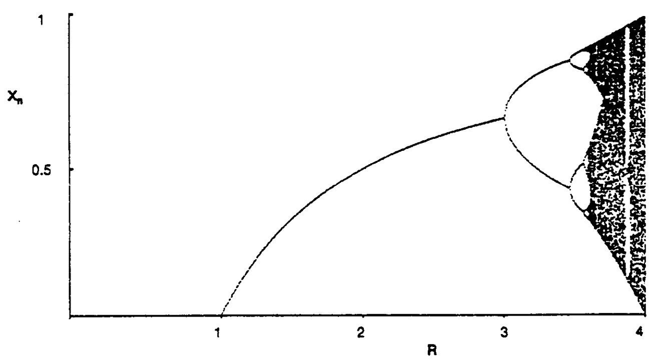



**Figure 1. Logistic map for 0 < R < 4.**

*The Logistic Map*

The logistic map is a picture developed from a simple one dimensional nonlinear equation, generally referred to as the logistic equation. This is written as,

$$x_{n+1} = Rx_n(1 - x_n) \quad (2)$$

This equation and its corresponding map has been extensively studied and documented and finds a fundamental place in college texts on chaos theory. The variable $x_n$ begins the process with an initial "seed" value $x_1$, as discussed previously. This equation contains $x_n^2$ and is therefore nonlinear. The term, $x_{n+1}$, represents subsequent values generated by the equation which in turn become the next $x_n$ to be fed back through the equation to generate new values. The R factor is the "driving" parameter and is varied from 0 to 4 in Figure 1. In Figure 2, R varies from 2.8 to 4 since much of what is of interest is where $3 < R < 4$. In Figure 3, an initial seed value was carefully selected for each R to demonstrate a feature of sensitive dependence in a rather odd way. These diagrams are the results of multiple iterations of this nonlinear equation while varying the driving parameter R.

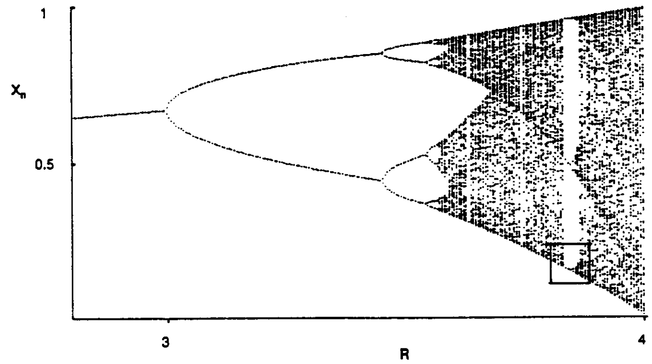



**Figure 2. Expansion for Logistic map for 2.8 < R < 4.**

Within these diagrams one can glimpse the observed discoveries which I have listed. The bifurcation phenomena is prominent in Figures 1-3. The doubling is clearly visible in the sequence 1,2,4,8, until the resolution of the computer printout fails us. Beyond about R = 3.6 is the reality of chaotic behavior and the pattern of any kind of periodicity or quasi-periodicity ceases, except in those strange areas where some would suggest that "chaos gives rise to order."

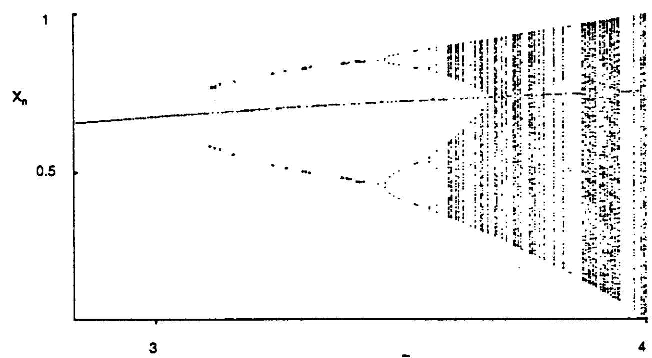



**Figure 3. Sensitive dependence of initial conditions illustrated by computer value approximation.**

The trail left by this iterative process can be studied with the help of the mapping in Figures 4-6. These show the path of generated values for a specific R leading to single and double-valued states in Figures 4 and 5, respectively. In Figure 6, the iterated values meander chaotically over the region. Such maps are useful in studying just how order presumably arises out of chaos.

To illustrate sensitive dependence in Figure 3, I allowed the truncation of computer values to tell the story. If you examine the logistic equation and set $x_{n+1} = x_n$, you will find that $x_n = (R - 1)/R$. In other words, if your initial condition for $x_n$ were exactly equal to this function of R then you should have a single valued solution for x for the entire range of R. Since $(R - 1)/R$ is rational this should be no problem. However, the computer in use must truncate any nonzero digit when the storage space terminates. In comparing diagrams 2 and 3 one can see the computer's effort at maintaining the single value through the variation of R. However, even when the effect of truncation is sensitive to less than even 1 in $10^{15}$ when using double precision, the value quickly zooms away after multiple iterations and resumes its place in the bifurcation zone or wanders around in the chaotic trash. Much of Figure 3 therefore resumes the shape of that in Figure 2, particularly in the chaotic region, when $x_n$ is not *exactly* equal to the ratio (R - 1)/R. This is a crude representation and different than how one might see sensitive dependence illustrated from other sources (i.e. Lorenz), but it serves to show that the slightest difference in value between two points will be magnified by an iterative process.

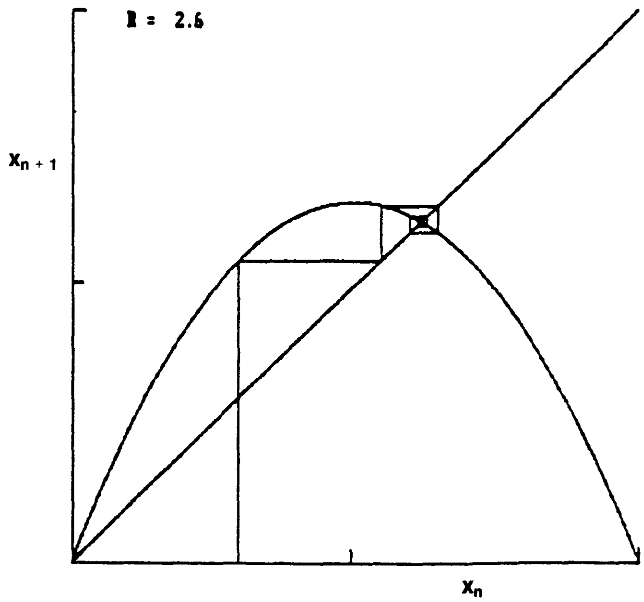



**Figure 4. A single-valued state.**

Finally, although not illustrated in this paper, an enhanced area of the block shown in Figure 2 would reveal a picture of the entire diagram. On the surface, this might remind one of something like a hologram where a small piece of the whole contains a perspective of the entire object in the picture. Successive enhancements of the logistic diagram would reveal the same pattern over and over again at increasingly smaller scales.

This concludes the discussion of some significant concepts in the field of deterministic chaos. As previously mentioned, many of these ideas are experimentally supported and therefore acceptable as part of the general body of scientific knowledge. However, spurious notions arising to attend this new theory about chaos sound very much like not-so-new heresies of the past.

## Fiction

As in every area of legitimate science, the pseudoscience of evolutionary speculation is close behind. Each of the above chaos principles has been used for every purpose from generating new evolutionary scenarios to virtual "proof" of evolutionary mechanisms. Like the attempt of evolutionary metaphysicists to boost support from quantum physics, evolution is being made to ride the coattails of legitimate scientific investigation in nonlinear dynamics.

Nonlinearity, like time, is becoming the new hero which opens unusual yet unlikely scenarios for evolutionary processes. Iteration represents biological feedback, and dissipative biochemical systems are driven in nonlinear fashion in a nonequilibrium state. Some might consider sensitive dependence to be an appropriate basis for an evolutionary "quick change" providing for a macromutation. Could bifurcations be used to represent branching of evolutionary forms bypassing any assumed missing links? Will observed outcomes of universal self-similarity replace outworn arguments from homology and embryology regarding similar features as proof of evolution? Are these just wild, crazy speculations of popular fiction or the mumbo-jumbo of new scientific buzz words? Let us look at what is really being said, written and promoted.

For some time Ilya Prigogine has been particularly important in this area. His work in nonlinear, far-from-equilibrium systems* has been interpreted as lending support for an abiogenetic mechanism. Chanu even suggests that Prigogine's use of mathematical operators leads to a new understanding of time from that previously understood in a typical thermodynamic sense (Chanu, 1991, pp. 212-213). Our previous sense of time must give way to a "proper" understanding of mathematical operators in dynamical systems. This begins to sound similar to the doubtful philosophies of physical reality vs. mathematical concepts illegitimately withdrawn from quantum theory. From such a philosophic viewpoint one need only modify de Sade's axiom of whatever is, is right. Today, whatever "mathematically" is, is right.

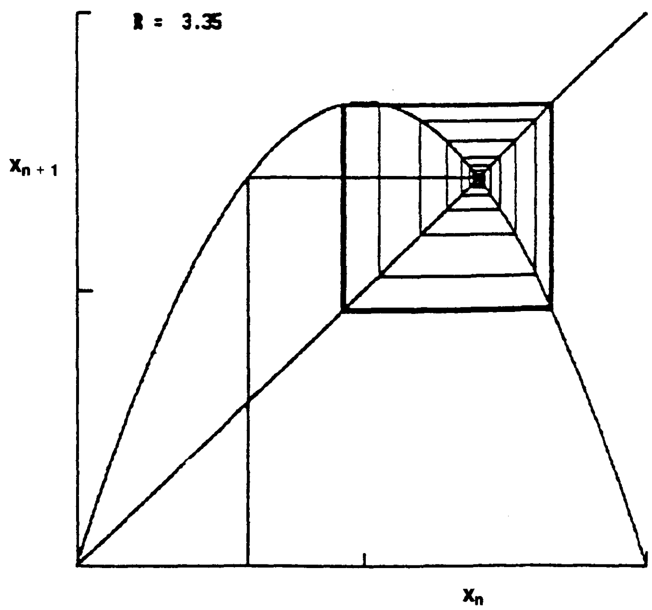



**Figure 5. A double-valued state.**

*Editor's Note: For a creationist review of this work see Williams, E. L. 1981. Fluctuations as a mechanism of ordering in Williams, E. L. (editor). Thermodynamics and the development of order. Creation Research Society Books. Kansas City, MO. pp. 55-66.

Nonlinear studies have led to a better understanding of so called chemical oscillators, such as the Belousov-Zhabotinsky reaction (Schuster, 1988, 11). However, can Prigogine, Eigen or others use these reactions as evidence for their philosophical extrapolations? Admittedly, an example of such a chemical oscillator personally witnessed at a lecture given by David Campbell of Los Alamos National Laboratories (Campbell, 1989) appeared to have a life of its own—but does it? Can chaos really explain and bridge the gap between nonlife and life? Can this be connected to Prigogine's view of biochemistry? Creationists have good reasons for doubt.

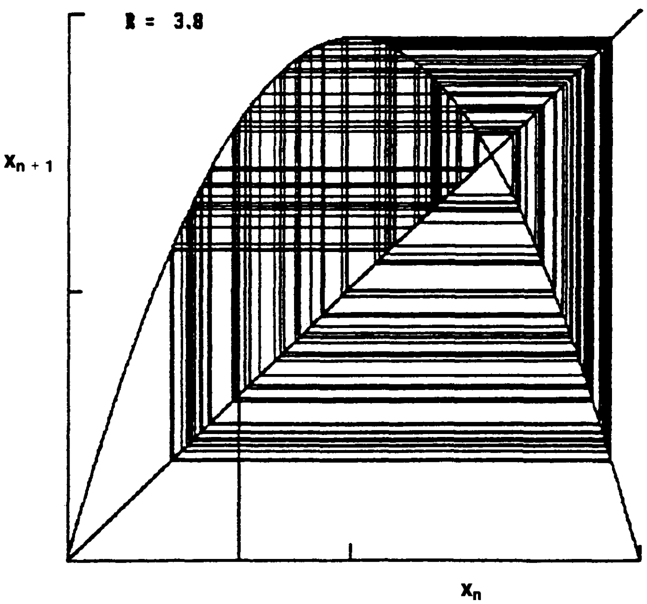



**Figure 6. A chaotic state.**

Next, Lynn Margulis has proposed a symbiotic evolutionary theory, which might be called "symbiotic feedback," where simple microbial cells ultimately interact and produce more complex nucleated cells (Margulis, 1982, p. 5). This procedure is no longer one of struggle and competition, but of cooperation. Presumed anaerobic ancestors had to come together to produce aerobic cells in response to the oxygen "waste" first generated by cyanobacteria. Margulis admits that the transition to an oxygen rich atmosphere is unpredicted by the "normal" laws in the physical sciences (Margulis, p. 6), but her solution lies in the biological realm. However, other advocates might be tempted to postulate that a "bifurcation point" in the development of earth's early atmosphere could be theoretically explained by some new "nonlinear" laws of chemistry and physics.

James Lovelock has noted the potential of chaos in his Gaian hypothesis. There is little doubt that Lovelock would be willing to accept chaos as the missing miracle which guarantees the generation of life. In his book, *The Ages of Gaia,* Lovelock (1988, p. 216) states:

> An ecologist colleague of mine, C. S. Holling, has observed that the stability of large-scale ecosystems depends on the existence of chaotic instabilities. These pockets of chaos in the larger, stable Gaian system serve to probe the boundaries set by the physical constraints to life. By this means the opportunism of life is insured, and no new niche remains undiscovered.

One of the more fanciful and speculative works in the area of chaos is *Turbulent Mirror* by Briggs and Peat. These authors integrate the diverse scientific work and findings of Prigogine, Lovelock, Margulis, McClintock, etc. to support a new picture of evolution. In a summary statement, the authors evaluate a viewpoint (with which they obviously share) expressed by Erich Jantsch (Briggs and Peat, 1989, p. 164):

> Jantsch's notion is unusual in that it runs directly counter to the old scientific belief that nature evolves from the small to the large, from the simple to complex. Coevolution of micro and macro scales is a fractal idea where both large and small scales emerge as aspects of one totally interconnected system.

This is a fairly good philosophic summary of what is happening in the evolutionary world. If the evolutionist imagines he is not constrained by a "linear" organization process from simple to complex, he will assume his difficulties with the previous thermodynamic arrow of time have been bypassed. If evolution is really fractal having self-similar characteristics at every scale, an evolutionist might be tempted to reorganize his phylogenetic concepts to support the notions of punctuated stability (order out of chaos) through variations in biological feedback. If this were the case, a uniformitarian framework for history might not be as relevant for the evolutionist as before. As creationists know, catastrophism has already received philosophic acceptance in much of the evolutionary camp.

Unlike the prior use of God to explain problem spots in evolution for the theistic evolutionists, a newer materialism might invoke "bifurcations" to punctuate geological history in order to achieve or circumvent previous problems which persuaded others to consider the supernatural. Magnetic field reversals could be the result of "chaos in the system" (Gleick, 1988, p. 29; Marek and Schreiber, 1991, pp. 151-152). A chaotic rupture in symmetry may kick-off gravitational collapse in stellar evolution (Doroshkevich, 1984, pp. 187-189). Nonlinear behavior could be used to suggest causes for presumed ice ages (Gilmore, 1981, pp. 429-433).

For another example, in a recent *Scientific American* article (Holland, 1992), John Holland discusses work in "genetic algorithms" referring to their applications in various areas of science. Most of the features I have listed (nonlinearity, iteration, etc.) are discussed in his article although no direct use of the term "chaos theory" as such is made. However, the purpose of his paper clearly sets forth mating and gene string recombinations as "driving" components in the evolutionary process. Genetic outcomes possess a sensitive dependence upon early random choices in Holland's classifier algorithm. Guided by such rules or conditions, stable states are achieved which become "successful organisms." Holland's references to successful uses of genetic algorithms in areas such as detection of pipeline leaks and turbine design, are of the same type as Gleick's and Stewart's discussion of chaos. Yet, do these scientific successes justify evolutionary pseudo-science?

Finally, this new science and, unfortunately, its alien philosophies are significantly enhanced by the marvelous and fantastic displays which come from modern computers. The images of Peitgen and Richter in *The Beauty of Fractals* are as beautifully electrifying as they are scientific. The picture-painting power of the modern computer sketches complex maps in a matter of moments disclosing extremely useful information for experiments and strategies in handling nonlinearity. However, do computer printouts always represent physical truth? Can chaotic behavior of dynamical systems become the new replacement for both mechanism and miracle? I doubt it, and so should everyone else. Mathematical theories are useful, but theories require empirical confirmation.

### A Creationist Response

Nonlinearity, iterative techniques, or driven periodic systems are not new. However, sensitive dependence, self-similarity, and bifurcation (along with intermittency and strange attractors) are new in the way that they are presently understood. Chaos theory does present an alternative analytical strategy in attacking problems. Furthermore, it virtually renders certain nonlinear problems "solvable" which were essentially incomprehensible in any generation prior to computers. If solvable is too strong a word for some, at least rich new insights have been gleaned which did not exist before 1950. However, alternative strategies, expansion of classical concepts, or new information does not necessarily demand overhauling the framework of science. A paradigm shift does not necessarily equal an epistemological shift.

Three fundamental areas merit discussion: entropy, morphology, and philosophy. Evolutionists of every stripe have found the concept of entropy a problem.* Some have sought a redefinition in hopes of giving ground to some evolutionary mechanism. The problem of morphology has always been finding the particular mechanism(s) which give rise to the various organic or cosmological forms. Is chaos really a new mechanism to solve the evolutionists' problem? Finally, is there even a valid hope that chaos theory provides substantial ground for explaining the unobserved evolutionary scenarios for the whole of reality? Should we accept the proposition that "there is chaos in the system" as the philosophic excuse in the absence of scientific evidence?

Entropy has been defined in several contexts in the developing body of chaos theory. Two of these might be called metric (informational) entropy and topological entropy. One of the major measurements for entropy in chaotic systems is referred to as the Kolmogorov or K entropy. This measure is closely associated with other important measurements such as Lyapunov exponents and fractal dimensions. However, entropy was essentially developed from Claude Shannon's information theory. Much of the problem arises from what is meant by the term information, particularly when we hear about chaos creating information. As mentioned earlier, individuals like Prigogine or Eigen extend the idea of information outside of what might be considered a legitimate interpretation. Furthermore, the general public may become confused by the use of what is conventionally understood by the term information. In a recent ICR impact article by A. E. Wilder-Smith (1992, p. ii), this very point was addressed:

> Conceptual information of the type necessary to 'finance' life's codes, languages and concepts must be carefully distinguished from Claude Shannon's type of information, which consists of mere surprise effects without any conceptual content . . . 'information' in the Shannon sense can certainly arise from concept-free inorganic matter, but it is nonconceptual in nature and has never been shown to be in a position to resolve any molecular forms. . . . Confusion in assessing the importance of information' in origins theories is due to the fact that the term 'information' has been reduced by Shannon to non-conceptual surprise effects, without most non-experts in the area of knowledge having noticed the fundamental change in meaning.

With respect to the work of Prigogine and others, Thaxton, Bradley, and Olsen have challenged their arguments. These authors have clearly distinguished between thermal and configurational entropy, indicating that a decrease in thermal entropy would not give rise to new information or higher configurational order. In *The Mystery of Life's Origin* (Thaxton, Bradley, and Olsen, 1984, p. 152) they state:

> There is no apparent connection between the kind of spontaneous ordering that occurs from energy flow through such systems and the work required to build aperiodic information-intensive macromolecules like DNA and protein. Prigogine et al. suggest that the energy flow through the system decreases the system entropy, leading potentially to the highly organized structure of DNA and protein. Yet they offer no suggestion as to how the decrease in thermal entropy from energy flow through the system could be coupled to do the configurational entropy work required.

In addition to this argument, their consideration of what is referred to as the "concerto effect" reinforces doubt regarding the possibility of sustained biochemical products in the natural environment. Interference from investigators directing processes in a laboratory environment effectively depreciates credibility that all such processes would be collectively directed by nature "in concert" (Thaxton, Bradley, and Olsen, p. 104).

Evolutionist Robert Shapiro seems to echo some of the same sentiment creationists share. In his discussions on abiogenesis experiments, Shapiro refers to investigations where chemical chaos is the hope for providing the necessary link from non-life to basic life (Shapiro, 1986, pp. 206-207). However, although some degree of self organization occurs, he concedes that no structure capable of self replication is being generated (Shapiro,

*Editor's Note: Refer to the technical monograph, *Thermodynamics and the Development of Order.* Creation Research Society Books to examine this problem.

p. 212). Sophisticated nonlinear reactions are still not enough to produce the most foundational requirement for life: a self-sustained replicator. Even prominent chaoiogist David Ruelle admits that Prigogine's dissension with the general view of irreversibility associated with entropy is a philosophic bias rather than one based on evidence (Ruelle, 1991).

In dissipative systems, phase diagrams representing real systems do not preserve the areas of their map. Although information, of the non-conceptual type of Wilder-Smith, within a system may be suggested to increase, the contraction of area is equivalent to an overall loss of information. Ultimately, despite a fascinating dynamic display, we see that entropy will increase and "dissipative" systems are therefore appropriately named.

The question of morphology centers around some new mechanism of iterative feedback, with mutation and natural selection, to ultimately produce phylogenetic diversity. We may in fact discover that conservative mechanisms within organisms do indeed proceed by processes which were previously unknown. However, processes, individually or in combination, have not been found to experimentally produce an organism which the majority would agree is different in kind, phylum or even order.

I believe this problem of experimental repeatability is most acute for the evolutionist in the area of biological transition of kinds. If the evolutionist places his faith in mechanisms which could generate abrupt changes in organisms to produce new kinds, the question as to why we do not see this new type of evolution occurring now is sharper than before. Appeals to more time were swept away due to lack of transitional forms. Yet now, any process that would make biological transitions more dramatic (and chaos is dramatic) yields a greater possibility that such a catastrophic event might be observed. If the new evolutionist becomes too chaotic, he may not be left with an excuse as to why he cannot theoretically develop some new species every week once he finds the critical control points in his biological chaos network.

The new improved chaos scenarios for evolution sound great in the telling, but unique organisms (meaning different, stable, reproducing orders or phyla) have not been observed to have arisen from another kind of organism. Even under the guidance of laboratory investigators who influence genetic or other biological processes, the origin of new phyla have not been achieved and confirmed.

Finally, various routes to chaos, bifurcations or strange attractors characterize the general context for universal events. Overall, I accept these consequences as higher ground for the entire scientific community. Both catastrophes and relatively uniform periods characterize cosmological history. Chaos theory could be helpful in understanding when conditions prevail to produce a steady state solution or chaotic catastrophe. This research field is "hot" because it has opened the possibility to predict new and previously unknown behavior. However, a philosophic shift in using an amalgamation of order and chaos to invoke the invisible, uncharted links in evolutionary schemes is unjustified. Such missing "philosophic" links are little different than their biological counterparts.

## Summary

Chaos theory has opened the door to valuable and useful insights in nonlinear dynamics. Evolution, like an illegitimate step-sister, grasps for an undeserved share of the inheritance due true science.

Theories for evolution are again seen to reside in the hearts and minds of advocates rather than empirical evidence. Evolutionary explanations may apparently move from simple to complex; still the universe, under a linear or nonlinear scheme, apparently does not. Biological feedback may explain or be used to demonstrate amazing genetic flexibility previously unknown; yet previously unknown classes of organisms have not yet been iterated into existence. Finally, though evolution remains strangely attractive to many, it is not yet demonstrated to be the result of a strange attractor.

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*Readers interested in this topic are urged to consult the various thermodynamic arguments offered concerning origin of life and living systems in *Thermodynamics and the Development of Order.*

## Quote

The evolution of our ancestral Forest Apes took place in widely separated areas.

Andrews, R. C. 1956. Meet your ancestors. Viking Press. New York. p. 17.