

Creation Matters

Volume 14, Number 5

September / October 2009

— A publication of the Creation Research Society —

Creation Classic

What Is Science?

by Wilbert H. Rusch, Sr., M.S., LL.D.

*Note: This article is taken from Dr. Rusch's informative book entitled *Origins: What Is at Stake?* published by CRS Books in 1991. He has provided a concise treatment of the usual "textbook" description of science and the scientific method. Today, many commentators claim that this is not how science actually operates. In any event, it is useful to look again at this classical treatment of the subject.*

It is believed that the first public use of the word **science** was perhaps as the title of an organization: The British Association for the Advancement of Science. This group was founded in 1831. The term is derived from the Latin *scire*, meaning 'to know.' The word implies the collective human knowledge in any field of study. However, it is ordinarily applied to any organized field of study investigated by what is known as the scientific method. It also may include any synthesis of the body

of facts obtained by such investigation.

Since in this day, we have been forced into an increasing specialization of endeavor, science is divided into a number of fields, each of which is known as 'a science.' There seems to be general agreement today that what are known as the natural sciences would include aspects of psychology, and among the social sciences, physical anthropology, sociology, and economics. These may be considered to make up the true sciences.

The sciences

The established criteria for true sciences are that they deal with empirical events or objects. The conclusions lead to connecting knowledge concerning separately known events. They enable us to make more or

... continued on p. 2

Friedrich Küchenmeister – Parasitologist

by Arthur Manning, M.S.

Many parasitic worms have amazingly complex life cycles. In the 1800's scientists were attempting to explain their observations of what we now understand to be different stages of these worms' development. The interesting history of this area of science is recounted by John Farley in his book, *The Spontaneous Generation Controversy from Descartes to Oparin*.

Friedrich Küchenmeister (1821–1890) was a prominent German researcher in this area. It was believed by the experts of the time that some worm cysts which developed in some animals were degenerate forms, "strays," not an intermediate stage of development. Küchenmeister vigorously opposed this notion because it ran counter to his

world view. Farley (1974, p. 61) quotes him: "Such a theory of error contradicts the wisdom of the Creator and the laws of harmony and simplicity put into nature."

According to Farley (1974, p.62),

Küchenmeister was, of course, correct; the cysticerci are a necessary part of the tapeworm life cycle. Most of the evidence at that time, however, pointed in the opposite direction. He was not only taking issue with some of the great names of that period — such as von Siebold and Dujardin — but also with the empirical evidence at their disposal. To do this obviously required a deep commitment, the type of commitment that

... continued on p. 4

Dinosaurs Are Not Big Lizards

by David Woetzel

It is a fact that many reptiles may continue to grow throughout their lives, so some creationists have simplistically postulated that a dinosaur ("terrible lizard") is merely the result of having a lizard live much longer than today in the favorable environment of the early earth. We know from scripture that antediluvian men often lived for hundreds of years, so it is reasonable to conclude that animals also enjoyed longer lives. What would a lizard that lived for centuries look like? The answer is that it would still be a lizard, not a dinosaur.

The differences between lizards and dinosaurs are greater than might appear at first glance. There are more fundamental, skeletal differences that can be seen between all lepidosaurs (e.g., living lizards, snakes and tuatara, plus many more fossil forms) and all archosaurs (e.g., extinct thecodonts, pterosaurs, and dinosaurs, plus living crocodiles). In Table 1 is a simplified classification of reptiles (adapted from Anonymous, n.d.) Note that lizards and dinosaurs are classified differently.

Morphology differences

Having understood that lizards and dinosaurs belong to different subclasses within the class Reptilia, we can move on to discuss some of the important distinctions that prompted zoologists to classify them separately. An organism is classified by observing the entirety of its morphological traits in character space. Even though dinosaurs (and other archosaurs) clearly appear to fit the bill as reptiles, there are significant structural differences.

... continued on p. 7

What Is Science? ...continued from page 1

less reliable predictions of events as yet unknown. This establishment of general conclusions is a feature common to the natural sciences. The natural sciences deal with that body of knowledge concerned with matter in the very small, as in the basic particles making up atoms, ranging up to matter in the very large aggregates, which we call galaxies and the universe. The natural sciences are subdivided into the physical sciences, the earth sciences, and the biological sciences. Each of these major groups then is further subdivided.

The physical sciences are essentially divided into physics and chemistry; the biological sciences into plant and animal studies (botany and zoology), and the earth sciences into geography and geology. It is also true that the divisions between the various sciences are becoming less distinct. It has become almost impossible to become knowledgeable in biology without at least a rudimentary knowledge of chemistry and physics. The study of paleontology (the study of fossils) certainly is rather difficult without a knowledge of anatomy. We meet an extreme example in ecology, which includes both zoology and botany, as well as various fields of chemistry, earth sciences, and physics.

As a long-time worker in the discipline of science, I recognize that the average person, whether pastor, teacher or layman, cannot cope with the developments and ramifications of the many fields of science

in our day and age. In fact the time has long passed where any one individual could speak with authority on the subject of science as a whole. Actually we have reached that stage where any one field of science has become too cumbersome for a single individual to master.

So instead of geologists, we have geochemists, geophysicists, stratigraphers, paleontologists, structural geologists, etc. In place of chemists, we have physical and organic chemists, metallurgists, colloidal chemists, biochemists, to name just a few. It certainly is understandable that the scientific layman may feel overwhelmed by the profound statements issuing from scientists speaking and writing at all levels. One normal reaction to this situation is to assume that all statements by scientific experts are undisputable facts and react to this situation by considering that theological surrender is the only recourse remaining.

The physical sciences have the advantage that they are characterized by a relatively large number of verifiable explanations or hypotheses, as well as some that have not been verified. It is in these sciences that we find most of our scientific laws. For example in physics we have Boyle's Law pertaining to the expansion of gases under changing pressures, Charles' Law pertaining to the expansion of gases under changing temperatures, Ohm's Law which deals with the relationship of resistance to voltage and current in electrical circuits, etc. In chemistry we have a number of like laws. On the other hand we find that the biological and earth sciences are char-

acterized by relatively few verifiable hypotheses. Most have not and cannot by their very nature be verified. It also is in these areas that we find few if any laws. Interestingly enough one biological law is *omne vivum et vivo* or *All life from life*.

The scientific method

The basic philosophy of science seems to be embodied in the concept of the scientific method. The philosopher Francis Bacon (1960) described this at an early date in the following manner:

There remains simple experience, which, if taken as it comes, is called accident; if sought for, experiment. ... But the true method of experience, on the contrary, first lights the candle, and then by means of the candle shows the way, commencing as it does with experience duly ordered and digested, not bungling or erratic, and from it educing axioms, and from established axioms, again new experiments; even as it [was not] without order and method that the divine word operated on the created mass.

Today the scientific method is considered to be composed of the following elements:

1. The recognition of a phenomenon that requires explanation.
2. The gathering and organizing of all available data concerning that phenomenon.
3. Experimental observation involving the phenomenon, which often requires quantitative measurements.
4. The development of a hypothesis

Contents

What Is Science?.....	1
Dinosaurs Are Not Big Lizards.....	1
Friedrich Küchenmeister — Parasitologist.....	1
...without excuse! Testimony of the PNAS.....	5
Matters of Fact... How Did Dinosaurs Survive the Flood To Make Tracks and Nests ?.....	6
Speaking of Science	
Mars Red-Faced Without Water.....	8
Velociraptors as Tree Climbers.....	8
Lotus Glass Repels Water, Dirt, Bacteria.....	9
Molecular Machines on Parade.....	9
Your Throat Has Tasteful Antennae.....	10
Plants Use Hourglass Mechanism.....	10
DNA Organization Is Fractal.....	11
Math Matters: Is Mathematics a Religion?.....	11
All by Design: How Not To Be Seen, Part 2.....	12

Creation Matters

ISSN 1094-6632
Volume 14, Number 5
September / October 2009

Copyright © 2009 Creation Research Society
All rights reserved.

General Editor: Glen W. Wolfrom

For membership / subscription information,
advertising rates,
and information for authors:

Glen W. Wolfrom, Editor
P.O. Box 8263
St. Joseph, MO 64508-8263

Email: CMeditor@creationresearch.org
Phone/fax: 816.279.2312

Creation Research Society Website:
www.creationresearch.org

Articles published in *Creation Matters* represent the opinions and beliefs of the authors, and do not necessarily reflect the official position of the CRS.

regarding the phenomenon by inductive reasoning, this in turn being a working basis for further experimentation.

5. After sufficient experimentation has been carried out to be statistically valid, the hypothesis may be elevated to the status of a theory.

Some other considerations: It may happen that after an interval of time for experimentation and general wide testing of the validity of the theory by other workers in the field, the theory may be raised to the status of a scientific law. Another part of the scientific method is the capability to make further deductions and predictions based on the resulting hypothesis.

As the base of scientific knowledge expands, some time-honored laws have had to be altered or even abandoned. For example, the law 'matter can neither be created nor destroyed' has had to be altered by adding the qualifying phrase 'through chemical processes.' Therefore, every theory and law represents the best understanding at a given point in time.

A key point for the scientific layman to understand is that, while all scientists subscribe to the scientific method, not all theories or laws have been developed through its rigorous application. Many theories are not founded on observed, measurable, repeatable behavior.

It also might be well to point out the difference between a description and an explanation. Although many people regularly confuse the two, even using the two words interchangeably, they are not synonymous by any means. For example, we have many descriptions of gravity, even to the extent of having a number of laws describing its behavior. But to this day we do not have a single explanation as to why it works and what it actually is!

The present and the past

Another of the complicating features of this whole matter is the fact that there are really two aspects to scientific inquiry. The first aspect deals with the here and now. Scientific inquiry into the here and now concerns problems which can be studied, observed, and measured. One example is in natural history, where the life histories of plants and animals are studied and described. Another is found in the identification and classification of rocks and minerals. Such problems

can be the subject of an observed experiment, and in some fields, treated mathematically (as in chemistry or physics). In other words, in these fields one can and should use the scientific method.

With regard to the practical applications of actual empirical data, there need be no disagreement between macroevolutionists and creationists. Much of the subject matter of science is factual and thus subject to objective observation. Many years ago, I attended a state university as a graduate student, majoring in biology. In the majority of the courses taken at the time, the question of origins was never even raised. The subject matter was essentially empirical in nature. It was possible under such conditions, for

When studying the past, one really cannot use the scientific method. One cannot observe past phenomena as a basis for drawing conclusions. In these circumstances one can only use one's theories of past phenomena (which may or may not be true) as a basis for one's conclusions. ... By no stretch of the imagination can this sort of exercise be classed as empirical science.

a creationist and a macroevolutionist to work successfully side by side in apparent harmony.

But on the other hand, it is true that there are those scientific fields where large sections of the subject matter are dealt with in an attempt to understand the past. Some writers will differentiate these fields by referring to the *historical sciences*. These would include much of historical geology, a good deal of structural geology, paleontology, astronomy (other than descriptive), etc. When studying the past, one really cannot use the scientific method. One cannot observe past phenomena as a basis for drawing conclusions. In these circumstances one can only use one's *theories* of past phenomena (which may or may not be true) as a basis for one's conclusions. This process is hardly the scientific procedure as understood by Bacon. By no stretch of the imagination can this sort of exercise be classed as empirical science.

Such theories are listed as scientific theories because they deal with scientific subjects, not because they have been arrived at by way of the scientific method. Some have maintained that this whole area belongs more in the field of metaphysics. There is also the concept of assumptions. These are statements which are 'taken on faith.' They are **assumed** to be true. This is quite a different matter than laboratory experimentation, and/or other observation. (Incidentally, I believe that most of us do operate with one major assumption, namely, 'what is seen must be believed.' In the area of science, other assumptions are few and far between.)

From another standpoint one often finds the terms **pure** and **applied** science in use. Pure science implies scientific investigations proper, without any thought of financial return but having as their objectives simply the acquisition of additional knowledge of our environment. University laboratories are more likely to be engaged in pure scientific research. Industries that have research laboratories may incidentally be engaged in pure science, but the aim nevertheless is an activity that, in the end, will lead to a process or product that will yield financial returns. When we think of applied science, such professions as medicine, engineering, aeronautics, electronics, etc., come to mind. Commercial laboratories are more likely to be engaged in applied scientific research.

Some limitations of science

Over 1900 years ago, Pilate asked the question "What is truth?" Philosophers for many centuries before and after Pilate have been asking out of their uncertainty, "To what degree of certainty can we know anything?" On the other hand, there have always been those who were dogmatic and out of their own reasoning proclaimed they knew the ultimate answer. Francis Bacon (1600) recognized these two extremes in his *Novum Organum* (*New Organon*) when he pointed out:

... those who have taken upon them to lay down the law of nature as a thing already searched out and understood, whether they have spoken in simple assurance or professional affectation, have therein done philosophy and the sciences great injury.

He continued:

There are those on the other hand who have taken a contrary course, and asserted that absolutely nothing can be known.

But finally he says:

The more ancient of the Greeks (whose writings are lost) took up with better judgment a position between these two extremes — between the presumption of pronouncing on everything, and the despair of comprehending anything.

Certainly a reading of present-day scientific literature represents all three of these positions. Unfortunately, literature on the elementary and popular levels holds more to the first category.

Having said that, we have the contradiction that rather than science giving us definitive answers based on scientific evidence and laws, we find a plethora of uncertainty. We can detect this in reading general discussions dealing with ‘scientific matters’ in all forms of the news media

today. The layman in the field of science readily can recall any number of examples where hoards of experts, i.e., scientists, lined up on both sides of a given question. Each proclaimed positive evidence favoring his/her side.

This type of disagreement applies to present day phenomena. Some examples are the discussions pro and con of the physiological damage wrought by the use of tobacco; the benefits from fires in forests; the whole matter of the greenhouse effect; the revival and complete reversal of the discussion on the dangers of using cyclamates; etc. In each of these instances the argument involves the position on both sides of a given scientific question with no firm resolution in sight. If scientific judgments were as precise and as certain as is usually implied, this sort of scenario would not be possible. Rather there should be a single conclusion presented based on unequivocal evidence.

In the light of this lamentable state of affairs, the scientific layman can be forgiven if he has doubts about the certainty of any

pronouncements at all concerning the definitive statements we find in the literature concerning the nature and origins of life in the past, particularly as to duration. It also would be salutary for scientists in general to recall that Thomas H. Huxley (1901A) once stated:

...there is not a single belief that it is not a bounden (sic) duty with them to hold with a light hand and to part with cheerfully, the moment it is really proved contrary to any fact, great or small.

References

- Bacon, F. 1960. *The New Organon* (Library of Liberal Arts, F.H. Anderson, Editor). Bobbs Merrill, New York, pp. 33, 89-90. [note: *The New Organon* was originally published in 1620, in Latin.]
- Huxley, T.H. 1901. *Darwiniana*. Appleton, New York, pp. 468-469.

—CM—

Küchenmeister ...continued from page 1

comes from deeply held religious views.

A creationary worldview can often give an advantage to researchers. How often time and resources have been wasted in scientific research done from an evolutionary perspective.

Being a creationist did not hinder Küchenmeister's scientific activities; rather, it was the basis for them. He was a true experimental scientist, proving his view was correct by a series of experiments.

The era of experimental parasitology was born when, between March 18 and April 9 of 1851, Küchenmeister fed foxes with a typical cysticercus, *Cysticercus pisiformis*, obtained from rabbits. This experiment initiated an explosion in feeding experiments over the next decade or so. (Farley, 1974, p.63)

So Küchenmeister may be appropriately designated as the father of experimental parasitology. Farley (1974, p.65) concludes,

Clearly, however, the honor of having refuted the old beliefs regarding parasitic worms rests with Steenstrup and Küchenmeister; it was their concepts that led the other parasitolo-

gists to discover the various lifecycles and thereby to present a model which completely replaced the old idea that worms were generated from diseased host tissue.

Küchenmeister's work was not just of academic interest. It was important to our understanding of how to prevent infection by parasitic worms. The United States Department of Agriculture website credits him with developing scientific meat inspection by veterinarians (Blue Ribbon Task Force, 2000).

In addition to Farley's book, more can be read about Küchenmeister in books by Bondeson (1999) and Zimmer (2000). Küchenmeister's (1857) book, *On Animal and Vegetable Parasites of the Human Body — A Manual of their Natural History, Diagnosis, and Treatment*, has also been translated into English.

References

- Blue Ribbon Task Force. 2000. *The Future of FSIS Veterinarians: Public Health Professionals for the 21st Century*. USDA Food Safety and Inspection Service, page 2. <http://origin-www.fsis.usda.gov/OA/pubs/vets-final.pdf> (accessed 25 October 2009)
- Bondeson, J.1999. *The Feejee Mermaid and Other Essays in Natural and Unnatural History*. Cornell University Press, Ithaca, NY.
- Farley, J. 1974. *The Spontaneous Generation Controversy from Descartes to Oparin*. The Johns

- Hopkins University Press, Baltimore, MD.
- Küchenmeister, Friedrich. 1857. *On Animal and Vegetable Parasites of the Human Body - A Manual of their Natural History, Diagnosis, and Treatment*. Sydenham Press, London. [note: It can be viewed online by searching "Küchenmeister parasites" in Google Scholar.]
- Zimmer, C. 2000. *Parasite Rex: Inside the Bizarre World of Nature's Most Dangerous Creatures*. Simon and Schuster, New York.

Watch for the 2010
Resource Catalog
from CRS Books!

Sometimes I am amazed at just how much light God can give to some people and yet they still fail to see the truth. For instance, consider this quote taken from an article on biochemical evolution published in the *Proceedings of the National Academy of the Sciences*:

Problems recur with hypotheses for the assembly of the earliest molecules with the properties commonly associated with "life." These include the unlikelihood that complex self-replicating molecules such as RNA could form by chance encounters even over geological time; the difficulty of protecting such molecules, once formed, from dilution and destruction by high temperatures, hydrolysis and ultra-violet radiation; and finally the difficulty of imagining how self-organization alone could lead to the encapsulation of a complex hierarchy of biochemical reactions in a membrane to form the simplest unicellular organism. (Parsons, 1998)

I was flabbergasted when I read this. It sounded like a creationist's cataloguing of a list of problems, showing how science teaches against a natural origin of life. It even alluded to the concerns I expressed, in the previous issue of *Creation Matters*, about dilution of chemicals (Stout, 2009). The article was not printed in a creationist journal, but instead was published by the National Academy of Sciences. The NAS is not exactly a friend to creationism. Indeed, they have published an article specifically attacking our position (NAS, 2009). So, what is going on?

The opening sentence of the article explains how the authors would this time wiggle out of the problems they so readily acknowledged:

Mineral surfaces were important during the emergence of life on Earth because the assembly of the necessary complex biomolecules by random collisions in dilute aqueous solutions is implausible.

What? Their thesis was that biomolecules necessary for life must have started on mineral surfaces because their occurrence in the face of known problems in dilute solution was beyond belief even for an evolutionist. With a little thought, it becomes apparent that this argument is a smokescreen. Mineral surfaces acting as catalysts do not offer solutions for most of the known problems against a natural formation of the larger molecules of life. Here are a few of the difficulties:

1. A serious problem for the appearance of RNA molecules is that the processes that are needed to form their constituent building block molecules require conflicting conditions — processes which form any single one of the components destroy the others — and these problems are not resolved by assuming life started on mineral surfaces (Shapiro, 1986).

2. The building block components used to make RNA molecules act as contaminants against chain elongation because of cross linking and end termination. That is, they react with the RNA bases as well as at the 3' and 5' terminal ends of the chains from the time it starts to form. End termination prevents a chain from growing to its proper length, and cross linking interferes with its proper biological activity. If RNA nucleotides were ever to form under natural conditions, then wherever they exist, the components used to make them will also be found.

Furthermore, since dissociation, not formation, will be thermodynamically favored, there will always be an abundance of partial or incomplete ribonucleotides and amino acids. Yet, it is these very components that act as contaminants against chain formation. This problem is so serious that whenever experiments are done in a laboratory to simulate supposed pre-life synthesis of nucleotides into chains, the experimenters use purified nucleotides as a starting point. If they include the building block components, then the experiments invariably fail because of the resulting contamination. Mineral backbones do nothing to alleviate this major issue.

3. Sugars in RNA and DNA are exclusively right-handed. However, whenever natural processes form sugars, equal or nearly equal amounts of both right- and left-handed sugar molecules are formed. A chain of nucleotides with mixed left- and right-handed sugars takes on unusual twists and shapes, making replication much more difficult. Mineral surfaces do not alleviate this problem.

4. Getting a specifically required sequence of RNA bases is just as difficult on a mineral surface as in dilute solution. The odds against this are effectively insurmountable and are not reduced by the authors' proposed solution of mineral surfaces acting as catalysts.

5. Some evolutionists believe that life originated with amino acids linking into chains to form proteins, not with nucleotides linking into chains to form RNA. The same kinds of problems that prevent successful RNA formation would also prevent successful protein formation, although the authors did not discuss this particular issue. The important thing is that mineral surfaces do nothing to resolve these issues.

Indeed, one could write a book on the various problems which are not helped by mineral surfaces. The arguments presented in the journal are meaningless. They avoid the actual issues and come to conclusions contradicted by known facts. In effect, the authors have acknowledged the implausibility of a natural origin of life and have done nothing to solve the natural problems interfering with it.

In Romans 1:20-21, God says that a person is "without excuse" who does not glorify Him as Creator. I believe that articles such as this one in PNAS, which acknowledge problems and issues but do not deal honestly with their implications, provide an illustration of why God says this.

"Praise the LORD! For it is good to sing praises to our God; for it is pleasant, and praise is beautiful" (Psalm 147:1).

References

- Parsons, I, M.R. Lee, and J.V. Smith. 1998. "Biochemical evolution II: Origin of life in tubular microstructures on weathered feldspar surfaces." *Proceedings of the National Academy of Sciences* 95:15173-6. Available online at <http://www.pnas.org/content/95/26/15173.full.pdf+html> (accessed 26 September 2009)
- Stout, T. 2009. ...without excuse! The testimony of chemical equilibrium. *Creation Matters* 14(4):4.
- National Academy of Sciences. 2009. *Creationist Perspectives*. <http://nationalacademies.org/evolution/CreationistPerspective.html> (accessed 26 September 2009)
- Shapiro, R. 1986. *Origins: A Skeptic's Guide to the Creation of Life on Earth*. Summit Books, New York, pp 182-186.

—CM—

Matters of Fact...

by John H. Whitmore, Ph.D.

How Did Dinosaurs Survive the Flood To Make Tracks and Nests?

Editor's note: Dr. Whitmore of Cedarville University serves as guest respondent to this issue's featured question. You may submit your question to Dr. Jean Lightner at jean@creationresearch.org. It will not be possible to provide an answer for each question, but she will choose those which have a broad appeal and lend themselves to relatively short answers.

Q Many animal fossils and fossilized footprints, tracks, nests, etc., are found in layers high up in the strata, on top of layers that were laid down earlier in the Flood event. My question is: How did those animals — and, apparently, groups of animals in some cases — survive the catastrophic events accompanying the deposition of the lower layers?

A Background: In general, the geologic record is divided up into four pieces or divisions. The lowermost “piece” is referred to as the Precambrian. Most of these rocks were created during the Creation Week or were formed between the Creation Week and the Flood. For the most part, they lack fossils. Most Creation geologists believe rocks representing deposits from Noah’s Flood begin sometime late in the Precambrian and also include the next two main divisions, named the Paleozoic and Mesozoic. Most of the fourth main division accumulated in post-Flood times; at least that is the opinion of most Creation geologists who hold to the young earth perspective. Paul Garner did a very nice job explaining these divisions in a recent article.¹ The Paleozoic and Mesozoic contain primarily marine rocks that cover vast expanses of the continents. Individual rock layers in these divisions can often be traced across continents and, in some cases, between continents,² implying worldwide catastrophe that laid these formations down. Since these rocks primarily contain marine fossils, and are very extensive on continental areas, there is good reason to believe they were made during the Flood.

Some Possible Explanations: The problem comes, and I think here is the gist of your question, how is it that we find terrestrial animal footprints and “nests,” apparently made during the Flood, when there are layers of extensive marine deposits in the rocks below? How were these animals able to survive marine inundation in order to make footprints in the rock layers above? Footprints are found in Paleozoic, Mesozoic, and Cenozoic rocks. Paleozoic footprints primarily represent small reptiles and amphibians. Some of these tracks are believed to have been made underwater,³ as animals crawled up the slopes of submarine sand dunes (Figure 1). These animals apparently could swim and crawl underwater, explaining why their tracks often appear and disappear suddenly.

The bigger problem is with dinosaur tracks that show up in the Mesozoic rocks. Occasionally, clutches of dinosaur eggs and scatterings of eggshells have also been found in these deposits, supporting a conclusion that there was exposed land, at least temporarily, during the Flood year. Tracks and nests high in the record of the Flood deposits suggest the possibility that some dinosaurs were able to



Figure 1. Vertebrate tracks in Coconino Sandstone.



Figure 2. Bird tracks in Green River Formation.

swim. It is true that the continents were submerged with water during the Flood. We know this from Scripture (Genesis 7:18-20) and from the evidence of marine fossils on the continents.

However, we also believe that because of continental movements and violent continental collisions during the Flood, continents occasionally emerged, exposing freshly laid marine sediments. Dinosaurs with swimming abilities that were able to survive the Flood to this point probably scampered up onto the freshly exposed land, making tracks and quickly depositing clutches of eggs. By the way, several well documented published reports of swimming-dinosaur tracks do exist,⁴ so there is some merit to thinking dinosaurs could swim.

We are not sure how many weeks into the Flood year the Mesozoic rocks were laid down (it is the Mesozoic rocks that contain all the dinosaur fossils, footprints, and “nests”), but some dinosaurs must have been

able to survive until this point, probably by swimming. Most of the tracks occur in areas where there are vast quantities of marine rocks below them (the Rocky Mountain region, for example), so it is unlikely that dinosaurs survived on some high land area, without being first swept out to sea before they made their tracks and “nests.”

You may wonder why I keep placing “nests” in quotation marks. This is because they really aren’t nests in the sense of bird nests, with which we are all familiar. Most dinosaur “nests” are scatterings of egg shells. Some exceptional examples of dinosaur eggs exist where there are clutches of eggs, together in an organized fashion. In all the examples with which I am familiar, there is no reason not to believe that the eggs were laid and then quickly buried.

Cenozoic tracks are common too, but I think for the most part they were made following the Flood. Bird tracks (Figure 2) and nests are common in the Green River Formation of Wyoming, for example. For a further discussion on how to determine when rocks were made with respect to the Flood, I refer you to a recent paper that Paul Garner and I co-authored.⁵

References

1. Garner, P. 2008. Time for an upgrade? *Answers* 3(4):46–50, 60–61.
2. Ager, D.V. 1983. *The Nature of the Stratigraphical Record*, 2nd ed., Macmillan Press, London. [See Chapter 1 on the Persistence of Facies, for example.]
3. Brand, L. and T. Tang. 1991. Vertebrate footprints in the Coconino Sandstone (Permian) of northern Arizona: Evidence of underwater origin. *Geology* 19:1201–1204.
4. Milner, A.C., M.G. Lockley, and J.I. Kirkland. 2006. A large collection of well-preserved theropod dinosaur swim tracks from the Lower Jurassic Moenave Formation, St. George, Utah. In J.D. Harris, S.G. Lucas, J.A. Spielmann, M.G. Lockley, A.R.C. Milner, and J.I. Kirkland (eds.), *The Triassic-Jurassic Terrestrial Transition*, *New Mexico Museum of Natural History and Science Bulletin* 37:316–328.
5. Whitmore, J.H. and P. Garner. 2008. Using suites of criteria to recognize pre-Flood, Flood, and post-Flood strata in the rock record with application to Wyoming (USA). In A.A. Snelling (ed.), *Proceedings of the Sixth International Conference on Creationism*. Creation Science Fellowship, Pittsburgh, PA, and Institute for Creation Research, Dallas, TX, pp. 425–448.

—CM—

Dinosaurs / Lizards

...continued from page 1

es between them and other groups of reptiles.

The most striking characteristic of the Archosauria is the triradiate pelvis. In the Lepidosauria (including lizards) the ilium extends dorsally, articulating with two, unfused, sacral vertebrae. The ischium and pubis are parallel to the ground surface, and fused in the midline (Romer, 1956, p. 320). In the archosaurs (including dinosaurs), the ilium is expanded along its dorsal margin, and articulates with three or four fused vertebrae. The ischium extends posteroventrally and the pubis anteroventrally. The pubes and ischii are fused laterally for most of their length.

The teeth in lepidosaurs are pleurodont. That is, they are set in a long groove in the jaws with a high outer and low inner wall. The individual teeth are fused to the outer wall of the groove without roots. In the archosaurs the teeth are thecodont. They are set in deep individual sockets which enclose the long, cylindrical root of the tooth. There are also lower jaw distinctions with the lepidosaurs having a more developed coronoid process, which forms the upper margin of the mandible behind the dentary bone.

Skulls are another important distinction between lizards and dinosaurs. In the lepidosaur skull (Romer, 1956, Fig. 62 p. 114) the maxilla is firmly joined with the lacrimal and jugal bones, and there is no anteorbital fenestra (opening in the skull in front of the eye). In the archosaurians the maxilla forms the anterior border, and the lacrimal and jugal the posterior border of a large

anteorbital fenestra. In the archosauria both the quadrate and quadratojugal bones form the jaw articulation, while in the lepidosaurs the quadrate forms the articulation.

It is difficult to describe complex vertebrae, so I have included rough pictures (Figure 1, not to scale). Consider the differences in the dorsal vertebrae. On the left is that of a lepidosaur (monitor lizard) and on the right is that of an archosaur (sauropod dinosaur).

Another key distinctive is the single headed ribs of a large monitor lizard (Varanus) compared with the double-headed ribs of a superficially similar dinosaur, like Thecodontosaurus.

There are also substantial differences in terms of locomotion/posture. From their skeletons, we believe dinosaurs had an upright stride (with legs typically falling straight down like a dogs), while a lizard's limbs are sprawled out to the side.

Metabolism

There is good evidence for differences in physiology as well. The dinosaurs appear to have had a much more "hot blooded" metabolism than do lizards. Lizards are unqualified ectotherms (without a way to make their own body heat), growing slowly and taking years to reach sexual maturity. They do not deposit fibrolamellar bone, a dense, interwoven tissue indicative of fast growth and high basal metabolism. Lizards also do not form large amounts of Haversian canals (channels running through a bone in which blood vessels and nerves are located), which are another indicator, though not unambiguous, of higher metabolism and growth rates. Dinosaurs display them (especially evident in juvenile dinosaur bones).

Table 1. Simplified Classification of Reptiles

Reptilia (Class)
Anapsida (Subclass)
Testudines (Order) [Turtles]
Synapsida (Subclass) [Extinct Mammal-like Reptiles]
Diapsida (Subclass)
Euryapsida (Infraclass) [Plesiosaurs]
Archosauria (Infraclass) ["Ruling Reptiles"]
Thecodontia (Order) ["Primitive" Triassic Reptiles]
Pterosauria (Order) [Pterosaurs]
Rhamphorhynchoidea (Suborder)
Pterodactyloidea (Suborder)
Phytosauria (Order) [Aquatic crocodile-like carnivores]
Saurischia (Order) [Lizard-Hipped Dinosaurs]
Ornithischia (Order) [Bird-Hipped Dinosaurs]
Ornithopoda (Suborder) [Duck-billed dinosaurs]
Stegosauria (Suborder)
Ankylosauria (Suborder)
Ceratopsia (Suborder)
Crocodilia (Order)
Lepidosauria (Infraclass)
Rhynchocephalia (Order) [Tuataras]
Squamata (Order)
Sauria (Suborder) [Lizards]
Amphisbaenia (Suborder) [Worm Lizards]
Serpentes (Suborder) [Snakes]

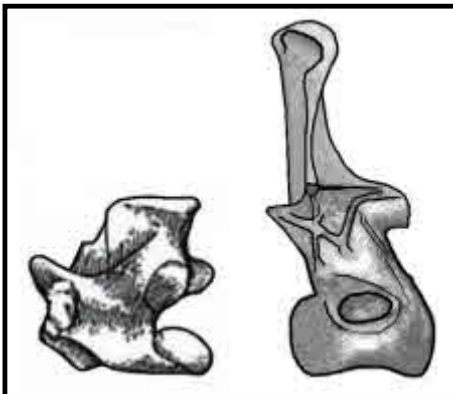


Figure 1. Differences in the dorsal vertebrae (not to scale). On the left is that of a lepidosaur (monitor lizard, from Auffenberg, 1988) and on the right is that of an archosaur (sauropod dinosaur, redrawn from various sources).

Big and small reptiles

Jackson's chameleon is not a triceratops; bearded dragons aren't descendants of ankylosaurs; and iguanas are not the modern version of iguanodonts. There are very distinctive differences in the skeletons. These differences, not size, are the distinguishing characteristics of dinosaurs. They are not just bigger, on average, than most other animals. There were also massive salamanders, lizards, and crocodiles in the same ecosystem, fossilized along with the dinosaurs. But their bones are not confused with dinosaurs. If scientists found a monitor lizard in the fossil record (and did not know of them in modern history), they still would not call it a dinosaur. The monstrous, sea-going mosasaur discovered in the fossil record is classified as a lizard, not a dinosaur.

Also, there were many small dinosaurs — some no larger than a turkey. So we have large lizards and small lizards. We have large dinosaurs and small dinosaurs. All might have grown bigger in the past (because of a pre-Flood environment and

because of fewer degenerative genetic elements). But lepidosaurs, like snakes and lizards, are more similar to each other (except in the characteristics that all reptiles share) than are lizards and dinosaurs. At the same time archosaurs, like dinosaurs and crocodilians, share more similar characteristics with each other than either of them do with lizards.

Linnaean taxonomy

Although taxonomic differences are not always hard and fast scientifically, they are useful for scientists to study organisms. We

observe certain anatomical similarities and naturally divide animals into convenient groups for our consideration. This discipline goes back far past the origin of Darwinism. Indeed, Carl Linnaeus, known as the Father of Taxonomy, lived from 1707–1778. As a Lutheran minister and avid gardener, Linnaeus was a creationist. “Linnaeus opposed the pre-Darwin evolutionary ideas of his day, pointing out that life was not a continuum, or a ‘great chain of being’, an ancient pagan Greek idea. He could classify things, usually into neat groups, because of the lack of transitional forms”(Batten, 2000).

References

- Anonymous. n.d. Reptile classification. Handout for Biol. 3233, Vertebrate Zoology, Dept. of Biology, Univ. of North Carolina at Charlotte. www.bioweb.uncc.edu/Biol3233/REPTID.htm (accessed 26 October 2009)
- Auffenberg, W. 1988. Gray’s Monitor Lizard. University Presses of Florida, Gainesville, p. 52. (accessed via Google Books, 25 October 2009)
- Batten, D. 2000. Ligers and wholphins? What next? *Creation Magazine* 22(3):28–33.
- Romer, A.S. 1956. *Osteology of the Reptiles*. Chicago: University of Chicago Press, p. 320.

—CM—

Speaking of Science

Editor’s note: Unless otherwise noted, S.O.S. (Speaking of Science) items in this issue are kindly provided by David Coppedge. Opinions expressed herein are his own. Additional commentaries and reviews of news items by David, complete with hyperlinks to cited references, can be seen at: www.creationsafaris.com/crevnews.htm. Unless otherwise noted, emphasis is added in all quotes.

Mars Red-Faced Without Water

The Martians are singing *How dry I am*. Scientists have a new explanation for how Mars turned red without water: it’s just dry dust tumbling in the wind. This new hypothesis was announced by *LiveScience*,¹ *ScienceDaily*,² *NewScientist*,³ and *Space.com*,⁴ based on a presentation at the European Planetary Science Congress last week.⁵

This has been dubbed a “surprising” new theory. Why? Because for many years scientists thought that water was required to rust the iron in the rocks. Lab experiments at the Aarhus Mars Simulation Laboratory in Denmark have shown that quartz grains mixed with magnetite in a tumbler turn red in a few months as the surfaces wear down and oxygen atoms bind to the magnetite, forming reddish hematite. Because hematite is deep red in color, it doesn’t take much of it to color the dust red. These experiments do not rule out water on Mars; they just remove water as a requirement for staining the surface red.

If this is the source of the redness on Mars, it has implications for the age of the surface. *Space.com* said, “since the process can occur relatively quickly, it could be that the thin red layer of dust on Mars is somewhat new.” How new? Jonathan Merrison said “millions of years instead of billions of years.” His experiments, though, reduced the sand grains to dust in just seven months, and they turned red quickly when magnetite was added.

The moyboys should be red-faced (moyboys: those recklessly spouting claims about “millions of years, billions of years”). Not only does this potentially undermine the astrobiologists’ hopes for water on Mars, it casts doubt on whether the surface is really billions of years old. Remember, even 100 million years is a tiny fraction of the assumed age of the solar system. What color was Mars before? Yellow? Green? Purple? Why are we seeing the tail-end of a rapid process if Mars dried up billions of years ago and its sand grains have been tumbling around for eons?

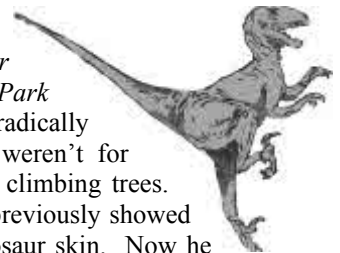


The truth is, they just don’t know. They weren’t there. The fact that a hypothesis this radical can upset everything previously believed about a planet should give one pause before accepting on faith the next moyboy pronouncement.

1. Moskowitz, C. (2009, September 21). How Mars turned red: surprising new theory. *LiveScience*. Retrieved September 28, 2009, from www.livescience.com/space/090921-mm-mars-red.html
2. Europlanet Media Centre (2009, September 21). It’s a grind to make Mars red: Planet’s color may not be due to rust. *ScienceDaily*. Retrieved September 28, 2009, from www.sciencedaily.com/releases/2009/09/090918102022.htm#
3. Than, K. (2009, September 19). Wind, not water, may explain Red Planet’s hue. *NewScientist*. Retrieved September 28, 2009, from www.newscientist.com/article/dn17814-wind-not-water-may-explain-red-planets-hue.html?DCMP=OTC-rss&nsref=online-news
4. Moskowitz, C. (2009, September 21). How Mars turned red: surprising new theory. *Space.com*. Retrieved September 28, 2009, from www.space.com/scienceastronomy/090921-mm-mars-red.html
5. Merrison, J.P., H.P. Gunnlaugsson, S.K. Jensen, and P. Nornberg. 2009. Mineral alteration induced by sand transport; a source for the reddish colour of Martian dust. *Icarus* (in press, published online 9/12/2009).

Velociraptors as Tree Climbers

Remember those sickle-shaped claws on the feet of *Velociraptor* that terrified visitors in the *Jurassic Park* movies? *NewScientist*¹ reported a radically different theory about them. They weren’t for eviscerating their prey; they were for climbing trees. Phil Manning (Univ. of Manchester) previously showed they were insufficient for tearing dinosaur skin. Now he is suggesting the animals used the claws as hooks to climb up into the trees.



Not everyone is buying into the idea. A serious problem is that much heavier dinosaurs like *Utahraptor* also possessed the claws.

We should avoid jumping to conclusions about extinct animals we cannot observe. There are no *Velociraptors* around to see how they used those claws. There are just fallible humans proposing various ideas that cannot be scientifically tested, other than to support whether or not such things were physically possible. Still, it is interesting to think that *Jurassic Park* may have the story

completely wrong. Maybe *Velociraptor* was the sloth of its day.

1. Anonymous (2009, September 10). Velociraptor's 'killing' claws were for climbing. *NewScientist*. Retrieved September 28, 2009 from www.newscientist.com/article/mg20327254.100-velociraptors-killing-claws-were-for-climbing.html?DCMP=OTC-rss&nsref=online-news

Lotus Glass Repels Water, Dirt, Bacteria

Imagine never having to wash your windows again. That would be a huge boon not only for window washers on skyscrapers, but for astronauts on the space shuttle or space station. It may become a reality, thanks to the lotus plant.

*ScienceDaily*¹ reported on work by a company in Atlanta that has developed a transparent coating for glass that renders it impervious to dirt and water. The secret: imitating the surface of a lotus leaf, which "contains innumerable tiny spikes that greatly reduce the area on which water and dirt can attach." NASA's Goddard Space Flight Center is taking a keen interest in this technology, because it can "prevent dirt from accumulating on the surfaces of spacesuits, scientific instruments, robotic rovers, solar array panels, and other hardware used to gather scientific data or carry out exploratory activities on other objects in the solar system." The latest work seeks to manufacture the material such that it can withstand the harsh space environment.

For us earthlings, the applications of lotus-leaf surface coatings to everyday objects — eyeglasses, windshields, camera lenses, and windows — promises a low-maintenance, clear view through the looking glass. And there's an extra benefit. The material also repels bacteria. Think of how hospitals could stay more hygienic with lotus-like surfaces on walls, windows and equipment.

This all began when someone looked at lotus leaves in the rain and noticed how the water beads up and runs off, leaving a clean surface. Look around at nature and notice what other technologies have already been designed and could be applied to human needs. (You may want to get an early start if you manufacture windshield wipers.) There's a bright future in biomimetics, no thanks to Darwin.

1. NASA/Goddard Space Flight Center (2009, September 23). Lotus-plant-inspired dust-busting shield to protect space gear. *ScienceDaily*. Retrieved September 28, 2009, from www.sciencedaily.com/releases/2009/09/090923112547.htm

Molecular Machines on Parade

Scientific papers continue to exhibit the exquisite mechanisms in the cell for handling all kinds of situations, through the operation of molecular machines. Here are a few examples from a recent issue of *Nature* (Sept 3, 2009).

1. **Molecular sieve:** What happens when a cell gets bloated? Too much water entering a cell can increase the pressure against the membrane, "potentially compromising the integrity of the cell," said Valeria Vásquez and Eduardo Perozo in *Nature*.¹ They described findings about a molecular sieve named MscL by Liu *et al* in the same issue of *Nature*.² MscL in bacteria is made up of multiple protein parts that form a pore in the cell membrane. The research team from Caltech and Howard Hughes Medical Institute found that the components flatten out and pivot, opening up the pore like an iris when sufficient pressure is applied.

This is called "**mechanosensation**" because it operates

automatically via mechanical pressure. "These channels act as '**emergency relief valves**,' protecting bacteria from lysis [disruption] upon acute osmotic down-shock," the authors said. "MscL has a **complex gating behaviour**; it exhibits **several intermediates** between the closed and open states, including one putative non-conductive expanded state and at least three sub-conducting states." The team's contribution was to image one of the intermediate states.

The research paper did not mention evolution. Vásquez and Perozo, however, said, "free-living cells **have evolved a variety of mechanisms** to deal with sudden variations in the physicochemical properties of their surroundings," and later said, "Most prokaryotes (bacteria and archaea) **have therefore evolved** a 'pressure-release valve' mechanism in which changes in membrane tension open up channels to form large, aqueous pores in the membrane," but they did not explain how evolution could have accomplished this. They made it sound like the bacteria purposely employed evolution (whatever they meant by the term) to solve a real problem. They did not explain how bacteria got through osmotic down-shock without the pressure release valves.

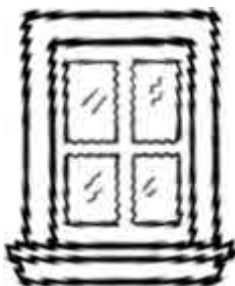
2. **Molecular taxicab:** Transfer RNAs (tRNA) are made in the nucleus but need to commute to work outside, in the cytoplasm, where the ribosomes are. They are small enough to barely squeeze through the nuclear pore complex (NPC) — the complicated gates in the nuclear membrane that control traffic in and out — but they don't avail themselves of that freedom, lest their exposed parts interact with the authentication mechanisms of the NPC. Instead, they hire a taxicab to escort them through. That taxicab, or "tRNA export factor," is called Xpot.

Xpot is a complex molecule that fits around the exposed parts of the tRNA. It literally "wraps around" the tRNA, undergoing conformational changes as it clamps on. Imagine a taxicab wrapping around you, and you get the picture. Xpot is general enough to fit all 20 kinds of tRNAs, but specific enough to protect their delicate active sites. It is also able to recognize and reject tRNAs that are immature. Only tRNAs that have passed a processing exam are allowed in the taxi.

The authors of a paper in *Nature* who studied Xpot said, "Xpot undergoes a **large conformational change** on binding **cargo, wrapping around the tRNA** and, in particular, binding to the tRNA 5' and 3' ends. The binding mode explains how Xpot **can recognize all mature tRNAs** in the cell **and yet distinguish them** from those that have not been **properly processed**, thus **coupling tRNA export to quality control**."³

As an additional control, Xpot does not interact with tRNA except in the presence of another factor in the nucleus called RanGTP. After safe transport through the nuclear pore complex, another factor in the cytoplasm unlocks the RanGTP, allowing the Xpot taxicab to unwrap from the tRNA. The tRNA then heads off to the ribosome to fulfill its work shift as a scribe, translating the genetic code into the protein code. "Transfer RNAs are among the most ubiquitous molecules in cells," they said, "central to **decoding information** from messenger RNAs on translating ribosomes."

The authors of the paper did not discuss how Xpot originated, but six times they said that parts of Xpot are either "conserved," "evolutionarily conserved" or "highly con-



served” (i.e., unevolved) throughout the living world.

3. **Molecular sherpa:** Kinesin is among the most fascinating molecular machines in the cell, because it literally “walks” hand-over-hand on microtubule trails, carrying cargo. In doing this, it converts chemical energy from ATP into mechanical work. Writing in this week’s *Nature*,⁴ Guydosh and Block of Stanford described direct observation of the binding state of the hands (called heads) of kinesin to the microtubule. They found that it walks tiptoe on the tightrope: “Here we report the development of a single-molecule assay that can directly report head binding in a **walking kinesin molecule**, and show that **only a single head is bound** to the microtubule **between steps** at low ATP concentrations.” The rear head has to unbind before the forward head can bind. This keeps the kinesin from getting stuck with both feet (heads) on the tightrope.

The fact that protein machines use energy to undergo conformational rearrangements, and that these “moving parts” perform functional work, places them squarely in the realm of machinery — except on a scale so tiny, their operations are only now coming to light. Molecular machines — the very concept is only a couple of decades old. This is phenomenal. It is marvelous and wonderful beyond description. You can almost sense the astonishment and excitement of these biophysicists uncovering these tiny wonders in the cell.

Who could have imagined this is how life works? Think of the centuries, the millennia, of people going about their business, oblivious to the fact that, at scales too tiny to imagine, a whole factory of automated molecular machines was keeping them alive. The few thinkers after the discovery of cells by Robert Hooke envisioned little people (homunculi) doing some of it, but our instruments were too coarse to elucidate the workings inside till recently — till our generation.

Next to the discovery of DNA and the genetic code this must be considered one of the most important discoveries in the history of science. If Antony van Leeuwenhoek was astonished at what he saw with his primitive hand lens, how much more should we be flabbergasted at what is coming into focus, now that we can discern the activity of individual molecules?

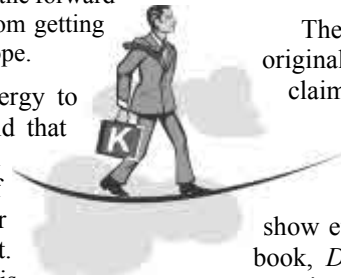
1. Vázquez, V. and E. Perozo. 2009. Structural biology: A channel with a twist. *Nature* 461:47–49.
2. Liu, Z., C.S. Gandhi, and D.C. Rees. 2009. Structure of a tetrameric MscL in an expanded intermediate state. *Nature* 461:120–124.
3. Cook, A.G., N. Fukuhara, M. Jinek, and E. Conti. 2009. Structures of the tRNA export factor in the nuclear and cytosolic states. *Nature* 461:60–65.
4. Guydosh, N.R. and S.M. Block. 2009. Direct observation of the binding state of the kinesin head to the microtubule. *Nature* 461:125–128.

Your Throat Has Tasteful Antennae



Our airways are lined with cells that have beating oars called motile cilia. Like galley slaves on a Roman ship, they beat in coordinated waves, setting up currents that propel dust and foreign matter out toward the mouth. Scientists just found out another amazing capability of these motile cilia: they can “taste” toxic chemicals and send out an emergency response call when they can’t beat fast enough to sweep the airways clean.

The findings by Shah *et al* were reported in *Science*.¹ In a *Perspectives* piece about the paper in the same issue,²



Kinnamon and Reynolds said that “human airway epithelial cells use elements of the bitter taste cellular signaling pathway to detect and eliminate potential noxious agents from the airways.” This was the first time motile cilia were found to be chemosensory.

The non-motile primary cilia that stick out like antennae on many cells were known to have the ability to detect foreign molecules and react to them. Motile cilia now are found to have this ability. They can essentially “taste” noxious chemicals, just like the tongue can. They react by beating faster, trying to get the chemicals out. They have receptors that can also signal more responses such as coughing or sneezing. That’s how your body can quickly and automatically go into emergency reaction to dispel harmful chemicals.

Their *Perspectives* article did not mention evolution. The original article mentioned it once, but only to refer to a paper that claimed that primary cilia and motile cilia are “evolutionarily related.”

Cilia are examples cited by Michael Behe as irreducibly complex structures that defy evolution and show evidence of intelligent design. In the years since his first book, *Darwin’s Black Box* (1996), first called attention to the amazing properties of cilia, much more has been discovered about them. Behe’s second book, *The Edge of Evolution* (2007), discussed them in much more detail. They are just as complex as the flagellar motor — perhaps more. They are built by a complex system of molecular trucks that carry the building materials from base to tip. They use ATP to beat like oars. They coordinate their movements with neighboring cells. Now we find that they are also loaded with chemical taste sensors and connected into numerous signaling pathways.

How are evolutionists going to explain all this? They can’t. They don’t. They just assume that natural selection can work any miracles required. Behe showed how this is contrary to evidence and common sense.

1. Shah, A.S., Y. Ben-Shahar, T.O. Moninger, J.N. Kline, and M.J. Welsh. 2009. Motile cilia of human airway epithelia are chemosensory. *Science* 325(5944):1131–1134.
2. Kinnamon, S.C. and S.D. Reynolds. 2009. Cell biology: Using taste to clear the air(ways). *Science* 325(5944):1081–1082.

Plants Use Hourglass Mechanism

Plants need to know when to flower and produce seed. They can read the sunshine, but what about plants living in shade or cloudy conditions? It turns out they have two mechanisms for telling time: a light meter and an hourglass. If the light meter doesn’t switch on, the hourglass lets the plant know it had better flower while it still has a chance to make seed.



*ScienceDaily*¹ reported on work by the Max Planck Institute for Developmental Biology, published in *Cell*.² The way the hourglass works is through micro-RNAs. By binding to messenger RNAs destined to start flowering processes via SPL proteins, they inhibit their actions. “Jia-Wei Wang and colleagues demonstrate that independent of external cues, the concentration of the microRNA declines over time, like sand running through an hourglass,” the article explained. “When the microRNA concentration falls below a certain level, enough SPL proteins are produced to activate the flowering process even in the absence of other regulators that measure day length or external temperature.”

The two mechanisms provide redundancy for the plant to ensure flowering. “The redundancy of environment-dependent and -independent mechanisms ensures that plants do not wait forever until flowering,” Max Planck director Detlef Weigel explained. “Better flower once, then [sic] never.”

Neither the Max Planck press release nor the scientific paper mentioned evolution once.

1. Max-Planck-Gesellschaft (2009, August 25). Blossoms of maturity: Newly discovered signaling pathway ensures that plants remember to flower. *ScienceDaily*. Retrieved September 28, 2009, from www.sciencedaily.com/releases/2009/08/090820123931.htm
2. Wang, J.W., B. Czech, and D. Weigel. 2009. miR156-Regulated SPL transcription factors define an endogenous flowering pathway in *Arabidopsis thaliana*. *Cell* 138(4):738–749.

DNA Organization Is Fractal

How would you pack spaghetti in a basketball such that you could get to any strand quickly? You might try the “fractal globule” method. You form little knots, or globules, on each strand. These become like beads on a string. Now you fold the beads into globules, and then fold those into higher-level globules. A simple operation makes any spot in super-globule accessible without having to untie any knots. The globule-of-globules-of-globules ordering of the material recalls those beautiful fractal patterns in geometry that keep repeating a design all the way down.

A paper in *Science* suggested that this is how DNA is organized in the nucleus.¹ DNA appears to be folded into “fractal globules” possessing a hierarchical organization. Lieberman-Aiden *et al.* explained:

Various authors have proposed that chromosomal regions can be modeled as an “equilibrium globule”: a compact, densely knotted configuration originally used to describe a polymer in a poor solvent at equilibrium.... Grosberg *et al.* proposed **an alternative model**, theorizing that polymers, including interphase DNA, can **self-organize into a long-lived, nonequilibrium conformation that they described as a “fractal globule.”** This highly compact state is formed by an unentangled polymer when it crumples into a series of small globules in a “beads-on-a-string” configuration. These beads serve as **monomers in subsequent rounds of spontaneous crumpling** until only a **single globule-of-globules-of-globules remains.**

The resulting structure resembles a Peano curve, a **continuous fractal trajectory that densely fills 3D space without crossing itself**. Fractal globules are **an attractive structure for chromatin segments** because they **lack knots and would facilitate unfolding and refolding**, for example, during gene activation, gene repression, or the cell cycle. In a fractal globule, **contiguous regions** of the genome tend to form **spatial sectors whose size corresponds to the length of the original region** In contrast, an equilibrium globule is highly knotted and lacks such sectors; instead, linear and spatial positions are largely decorrelated after, at most, a few megabases The fractal globule has **not previously been observed**.


At resolutions currently available, it was not possible to prove that DNA is organized in fractal globules: “We conclude that, at the scale of several megabases, the data are **consistent** with a fractal globule model for chromatin organization,” they said, adding: “Of course, we cannot rule out the possibility that other forms of regular organization might lead to similar findings.”

Measurements so far, however, are consistent with the fractal model and inconsistent with the equilibrium-globule model. Their computational methods “confirm the presence of **chromosome territories** and the **spatial proximity of small, gene-rich chromosomes**,” they said. This points to “an **additional level of genome organization** that is **characterized by the spatial segregation** of open and closed chromatin to form two genome-wide compartments.” This is what is consistent with the “fractal globule, a **knot-free**, polymer conformation that **enables maximally dense packing while preserving the ability to easily fold and unfold any genomic locus.**”

This is amazing and wonderful to consider. Not only does DNA contain a vast library of genetic instructions, it is organized in a way that maximizes both packing and accessibility. There are molecular machines that “know” how to pack DNA this way, but they themselves were coded in DNA. The whole system is mechanized, optimized and integrated in levels we are only beginning to understand. There was no mention of evolution in this paper (obviously).


1. Lieberman-Aiden, A., N.L. van Berkum, L. Williams, *et al.* 2009. Comprehensive mapping of long-range interactions reveals folding principles of the human genome. *Science*. 326:289–293, DOI: 10.1126/science.1181369.

—CM—



Math Matters

by
Don DeYoung, Ph.D.



Is Mathematics a Religion?

Some mathematicians indeed have claimed that their work is a form of pure religion. George P. F. von Hardenberg (Pseudonym, Novalis, 1772–1801) once commented, “The life of God is mathematics; all divine ambassadors must be mathematicians. Pure mathematics is religion. Mathematicians are the only blessed people.” (Eves, 1977, p. 27)

Karl Schellbach (1804–1892) of Germa-

ny also “believed that mathematicians were priests who should expose as many people as possible to the realms of mathematical blessedness and glory.” (Eves, 1977, p. 27)

The definition of *religion* may be subject to debate. However, Novalis, Schellbach, and many others clearly have made mathematics the top devotion of their lives. It has shaped their values and consumed their lives.

The same can be true for those who

rigorously defend biological evolution. There are many false religions available to those who choose such paths. Mathematics may be the language of creation, but it is no substitute for the Creator who established mathematics in the first place.

Reference

- Eves, H.. 1977. *Mathematical Circles Adieu*. PWS-Kent Publishing Company, New York.

—CM—



September / October 2009
Vol. 14 No. 5

All by Design

by Jonathan C. O'Quinn, D.P.M., M.S.

How Not To Be Seen, Part 2

At depths of between about 200–1000 meters, the mesopelagic zone of the sea offers nowhere for marine animals to hide from predators. There are several amazing ways in which many marine animals avoid detection by predators. One of them is known as silvering.

Certain species of fish living in these depths can literally make themselves appear transparent, and therefore invisible, using reflective scales that are oriented vertically, irrespective of the curvature of the fish's flanks. These scales act as mirrors. Fish looking at a vertically oriented mirror cannot distinguish between direct and reflected light, making the mirror invisible from the side. Mesopelagic hatchetfish, which also have other means of avoiding detection, possess such scales along their sides.

These scales are made of multiple stacks of guanine crystal sheets that reflect nearly 100% of incident light, making these fish visible only from exactly above or below. Living at depths at which many animals can produce bioluminescent light, these mirrors do pose a risk of making the fish stand out at night, however. These fish have a clever solution to that problem. Spe-

cialized pigment-containing cells known as chromatophores cover the reflective scales, and at night, they disperse a dark pigment to cover the scales.

Evolution is a blind, unthinking process, yet the design of these fish demonstrates an intelligent understanding of the manipulation of light. Evolution has no answer to how such an ingenious design could have accidentally occurred in stages.

Bibliography

1. Warrant E.J. and N.A. Locket. 2004. Vision in the deep sea. *Biol. Rev.* 79:671–712.

Figure caption: Silver hatchetfish (*Argyropspectus aculeatus*). Courtesy of NOAA (National Oceanic and Atmospheric Administration).

