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

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Compelling Evidence for an Upper Cenozoic Flood/Post-Flood Boundary: Paleogene and Neogene Marine Strata that Completely Surround Turkey

Timothy L. Clarey and Davis J. Werner*

Abstract

The location of the Flood/post-Flood boundary has been debated for decades. The two most commonly proposed candidates are (1) the K-Pg boundary and (2) near the top of the Neogene. In an effort to resolve this issue, we examined the Paleogene and Neogene strata in the region containing the nation of Turkey, the presumed landing site for the Ark. We found uninterrupted marine strata, such as carbonate, salt and glauconitic sands, well above the K-Pg boundary, extending from Europe to the Middle East, that entirely surround modern-day Turkey. These findings lead us to conclude that the Flood/post-Flood boundary logically must lie above the level of these marine layers. We propose that the most likely boundary is near the top of the Neogene, that is, near the N-Q (Neogene-Quaternary) boundary.

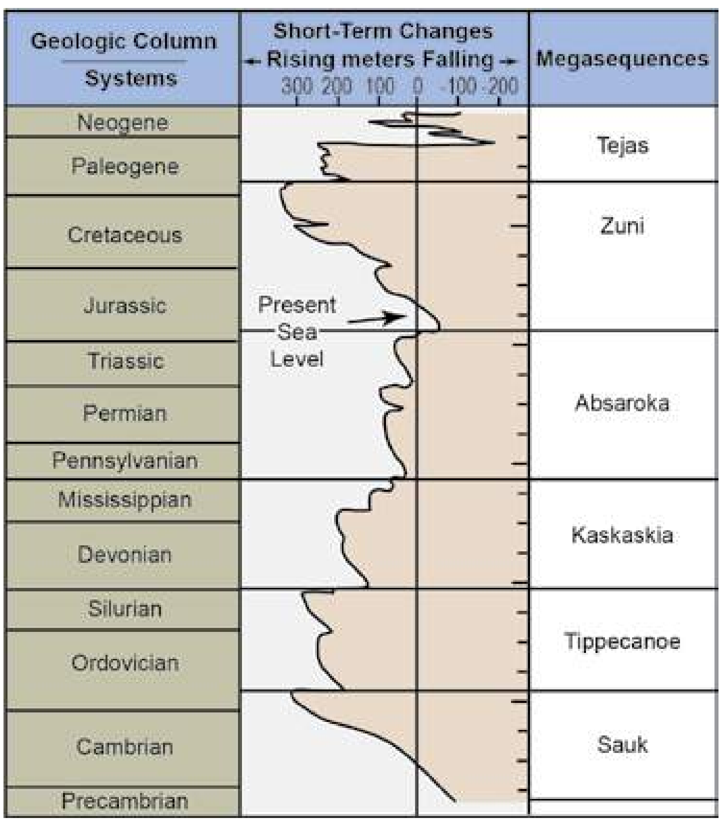

Figure 1. Chart showing the secular timescale, presumed sea level curve, and the six megasequences (Modified from Vail and Mitchum, 1979). The Tertiary system (Tejas megasequence) is now composed of the Paleogene and Neogene systems.

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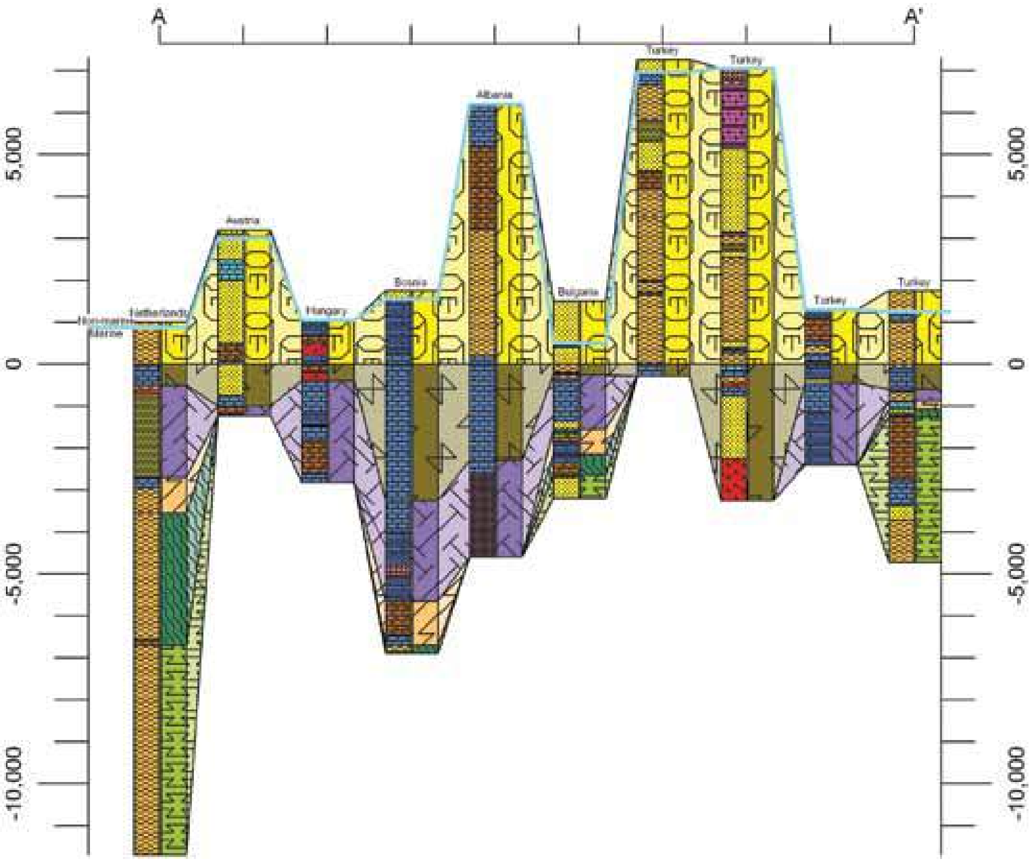

Figure 3 ***(left)*****. Stratigraphic cross section A-A' extending from Europe to Turkey showing lithology and megasequence intervals. Flattened on the base of the Tejas, which is approximately the same level as the K-Pg boundary. The blue line extending across the section within the Tejas megasequence shows the marine/non-marine boundary. Non-marine rocks are above the blue line in all cases. Location of section shown on Figure 6. All scales are in meters.**

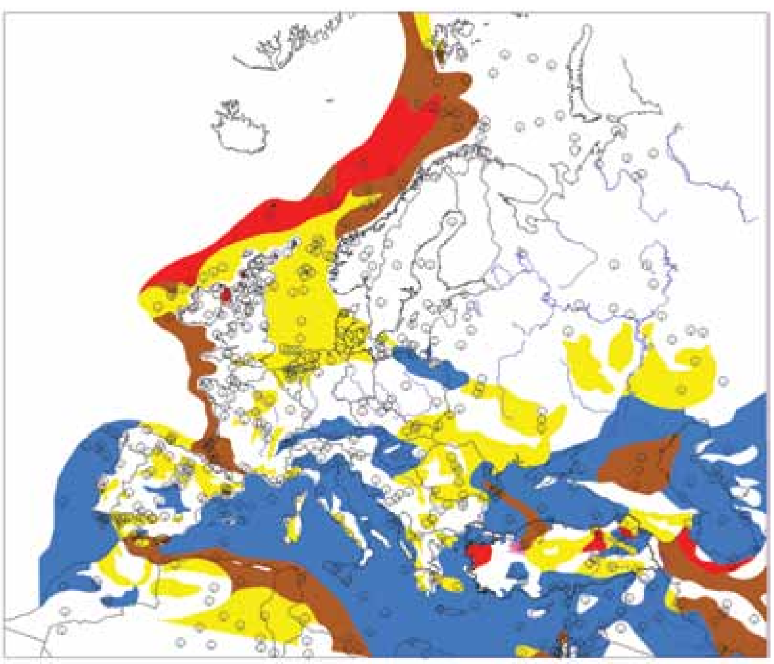

Figure 2. Basal lithology map for the Tejas megasequence for Europe, North Africa, and portions of the Middle East. Color legend is shown in Fig. 4.

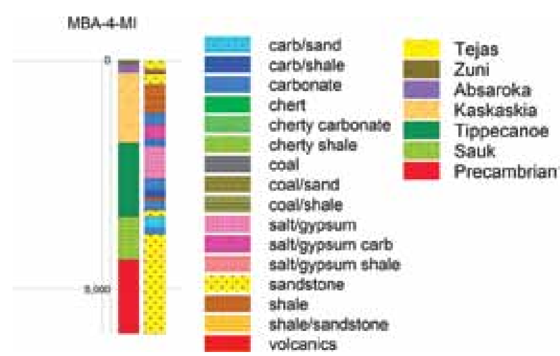

Figure 4. Example stratigraphic column from the Michigan Basin. The colors for the various rock types (lithology) and the megasequences (stratigraphy) serve as the key for the two cross sections (Figs. 3 and 5).

Introduction

The correct identification of the Flood/post-Flood boundary is of utmost importance to the creationist community because it has such profound implications as to post-Flood history. Placing the boundary at the beginning of the Cenozoic portion of the rock record implies, for example, that the Cenozoic mammals must all descend from mammals that survived the Flood cataclysm on the Ark. Over the past few decades, much has been published on the location of the Flood/post-Flood boundary, with debate back and forth relative to its location in the rock record. The two locations advanced more than any others in the creation literature are the Cretaceous-Paleogene, or K-Pg, boundary and a location in the Upper Cenozoic.

The K-Pg location has been championed by many in the creation paleontology community and several prominent geologists. Austin et al. (1994) tentatively advocated the K-Pg Flood/post-Flood boundary based on a "qualitative assessment of geologic maps worldwide":

> Therefore, we tentatively place the Flood/post-Flood boundary at approximately the Cretaceous-Tertiary (K/T) [K-Pg] boundary. We believe further studies in stratigraphy, paleontology, paleomagnetism, and geochemistry should allow for a more precise definition of this boundary.

However, few global studies have been completed since 1994 to further delineate their "tentative" boundary. And especially absent are large-scale, detailed stratigraphic studies that examine the rocks near the proposed boundary.

Those who have advocated a Flood/post-Flood boundary higher in the rock record in the Upper Cenozoic include creation scientists Roy Holt, Mike Oard, and John Baumgardner. Over the years, there has been much debate between the two sides, but no agreed upon resolution. Today, over 25 years later, the debate continues.

Most of those who conclude that the K-Pg marks the end of the Flood have used paleontological studies (Ross, 2012, 2014a; Whitmore and Wise, 2008; Wise, 2009) or local studies of individual units like the Green River Formation (Whitmore, 2006) or studies of a single small nation, like Israel (Snelling, 2010). These scientists have argued that the K-Pg boundary marks the end of marine deposition across the globe, asserting that the truly massive volumes of post-K-Pg sediments observed globally are merely the result of local, post-Flood catastrophes (Ross, 2012, 2013, 2014a, 2014b; Ross et al., 2015; Snelling 2009, 2014; Whitmore, 2013; Whitmore and Garner, 2008; Whitmore and Wise, 2008; Wise, 2002, 2009, 2017).

By contrast, other creation scientists have argued that Flood processes lasted well beyond the K-Pg boundary and continued throughout much of the Cenozoic (Paleogene and Neogene) rock record (Baumgardner, pers. comm. 2017; Clarey, 2016a, 2016b, 2017a, 2017b; Holt, 1996; Oard, 2006, 2007, 2010a, 2010b, 2011, 2013a, 2013b, 2016a, 2016b, 2017a, 2017b). These scientists interpret most of the Cenozoic strata as the result of the receding phase of the Flood. They pick a Flood/post-Flood boundary in the Upper Cenozoic, somewhere near the top or the bottom of the Pliocene (Upper Neogene). This paper uses stratigraphic data across multiple continents, in a region that encompasses the nation of Turkey, in an attempt to bring clarity on the matter.

A Logical Implication of the K-Pg Boundary as the Beginning of the Post-Flood Era

Unfortunately, identification of the K-Pg boundary as the beginning of the post-Flood era has led to a recent acceptance of evolution or "hyper-evolution" by several in the young earth creation community (Wise, 2017). For example, Wise (2009) has openly advocated that some type of four-legged creature "walked" off the ark and then somehow evolved rapidly into the whales we find in the Cenozoic rock record. More generally, his view is that any creature that first appeared above the Lower Eocene in the fossil record level must have "evolved" from an animal that had previously exited the ark (Wise, 2009). Clarey (2017b) has pointed out the difficulties that this vast amount of genetic transformation demands, especially considering the short time spans available and the time requirements necessary for large mammals to attain sexual maturity. Furthermore, Clarey (2016a, 2017b) and Wise (2009) have both noted that these proposed "evolutionary" changes would have had to occur within a few centuries at most between the end of the Flood and the onset of the Ice Age.

In addition, Wise's (2009) pro-evolutionary views have fanned the flames for the critics of young earth creationism (Doyle, 2019). Even old earth advocates, like Hugh Ross, have correctly attacked these ideas of rapid evolution (Doyle, 2019). However, the need for rapid post-Flood evolution disappears completely if the end of the Flood indeed lies higher in the rock record. No "walking whale ancestors" are needed if the boundary is in the upper Cenozoic. In that case, first appearances of fossils above the Lower Eocene level correspond simply to animals buried in the latter stages of the Flood. Their order in the record is merely their order of burial.

In other words, the Cenozoic record is no different from the Paleozoic and the Mesozoic, other than it represents the receding phase of the Flood and, accordingly, contains some different fossil creatures from the pre-Flood world (Clarey, 2017b). In fact, the entire Phanerozoic fossil record consists of sudden appearances, stasis and sudden disappearances of all types of creatures, plants and animals. It is just that the Cenozoic is dominated by larger mammal fossils and more flowering plants compared to the earlier deposits. Ecological zonation seems to best explain these fossil differences within the Phanerozoic strata (Clarey and Werner, 2018a).

Previous Studies of North African and Middle Eastern Stratigraphy

Clarey (2016a, 2016b, 2017a, 2017b) has recently sided with the advocates for the higher Cenozoic Flood boundary. He has presented five geological arguments that Flood sedimentation processes were in operation until well past the K-Pg point in the record (Clarey, 2017b). One of his strongest lines of evidence in these earlier papers is an uninterrupted and continuous carbonate layer across North Africa and the Middle East, from the Cretaceous upwards through, and including, the Upper Cenozoic. He noted that this carbonate layer extends upwards to the top or middle of the Miocene in many countries like Libya, Iraq, Iran, southeast Turkey, Qatar and Oman (Kendall et al., 2014; Clarey, 2017b).

Clarey (2017b) concluded that the Flood could not have ended across North Africa and the Middle East until at least the post-Miocene stage of the record. The uninterrupted carbonate and salt/gypsum rocks that so widely extend across the K-Pg boundary absolutely preclude that boundary as marking the Flood's end.

Methods of the Current Study: European Stratigraphy

To help address further the Flood/post-Flood controversy, we compiled an additional 499 stratigraphic columns across the European continent using oil industry wells, outcrops, seismic data and published cross-sections. At each location, we input detailed lithology data and the Sloss (1963) megasequence boundaries (Fig. 1). These data were input into Rockworks (ver. 17), a commercial software program for geologic data.

From these data we created isopach maps for each of the six megasequences across Europe and corresponding basal lithology maps for the lowermost units in each megasequence (Parkes and Clarey, 2019). We also constructed two regional cross sections using selected stratigraphic columns. One section went across Central Europe and Turkey and another one extended from the Caspian Sea, across Turkey, and south to Syria and Iraq.

Results

Probably of most relevance to the Flood/post-Flood debate is the basal Tejas map shown in Figure 2. This map represents the first rocks deposited and preserved on top of the K-Pg boundary across Europe. The basal Tejas map is the same level as the one we had earlier created across Africa (Clarey, 2017b, his Fig. 9). However, this time we included the nation of Turkey and areas to the north. We compiled both maps as Figure 2. Note how the carbonate rocks (shown in blue) of the lowermost Tejas form a near continuous circle around the nation of Turkey. This lowermost Tejas carbonate layer is part of the same carbonate system we identified earlier across North Africa and the Middle East (Clarey, 2017b).

Figure 2 clearly demonstrates that the Flood waters had not yet receded in any direction around Turkey by the time of deposition of these layers. Recall that Iraq is where the Tower of Babel was most likely located. This is where civilization probably initiated after Noah and his family exited the ark. And the strata across Iraq and Syria (to the south of Turkey) and the areas to the north of Turkey both indicate extensive, uninterrupted marine deposition from the Cretaceous level all the way up through the Middle Miocene level (Grabowski, 2014) and above. The Flood could not have been over at the K-Pg level in this area. There is too much preserved marine rock surrounding the nation of Turkey in the Paleogene and the Neogene for that to be a viable possibility.

Furthermore, our regional cross sections (A-A' and B-B', Figs. 3 and 5, respectively) confirm that a strong marine influence extended well into the Upper Cenozoic across much of Central Europe. Figures 3, 5, and 6 show the regional cross sections and their map locations flattened on the base of the Tejas, which is very near to the K-Pg boundary. Each section shows the corresponding stratigraphic columns, including the megasequences and the lithology at each site. Figure 4 shows the various rock types (lithology) and the megasequences (stratigraphy) we compiled in our study at each stratigraphic column. It also serves as the key for the two cross sections (Figs. 3 and 5).

We also added a blue line marking the bounding surface between marine rocks (below) and non-marine rocks (above). Note, that most of the Tejas across Europe is composed of marine rocks. The marine/non-marine delineation line is based on detailed studies of the geology at each stratigraphic column. For section A-A' (Fig. 3), Vandenberghe et al. (2014) noted that there was still considerable marine influence across northern Europe (Netherlands) through the Miocene (with ample glauconitic sands) and even into the lowermost Pliocene. And it was not until the Pliocene that the marine sedimentation pattern was broken in the Lower Rhine Valley (Vandenberghe et al., 2014). This same pattern extends from the Netherlands across Austria (Janoschek and Matura, 1980), Hungary (Kazmer, 1986), Bosnia (Hrvatovic, 2005), Albania (AKBN, 2019), Bulgaria (Graf, 2001) and even across parts of Turkey (Bozkaya et al., 2007; Caglar, 2009; Kaymakci et al., 2009; Okay, 2008) (Fig. 3). Nearly all of these columns show marine rocks extending upwards through Miocene and even as high as Pliocene strata,

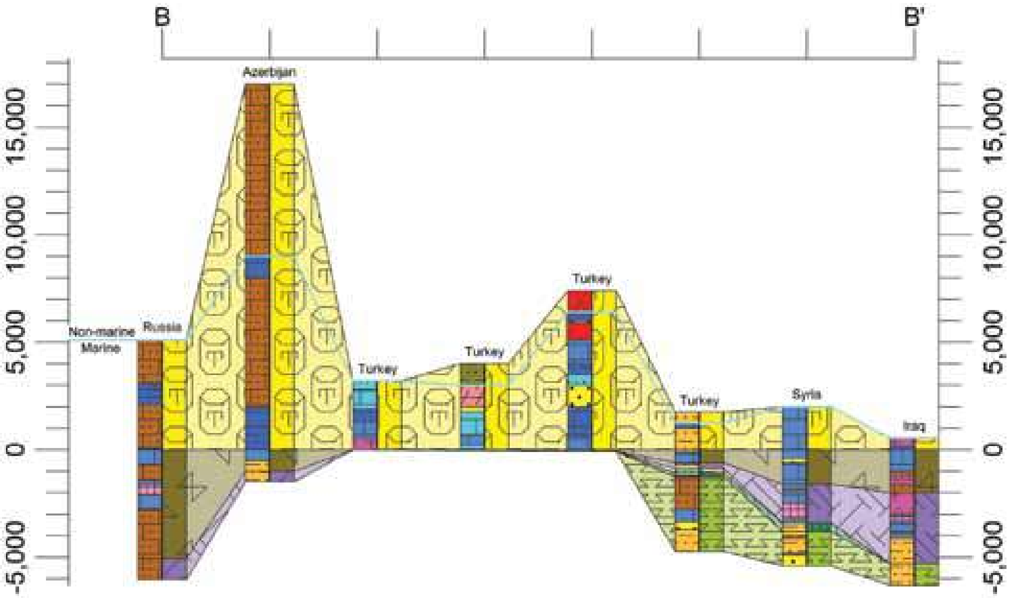

Figure 5. Stratigraphic cross section B-B' extending from the Caspian Sea, across Turkey, to Syria and Iraq showing lithology and megasequence intervals. Flattened on the base of the Tejas, which is approximately the same level as the K-Pg boundary. The blue line extending across the section within the Tejas megasequence shows the marine/non-marine boundary. Non-marine rocks are above the blue line in all cases. Location of section shown on Figure 6. All scales are in meters.

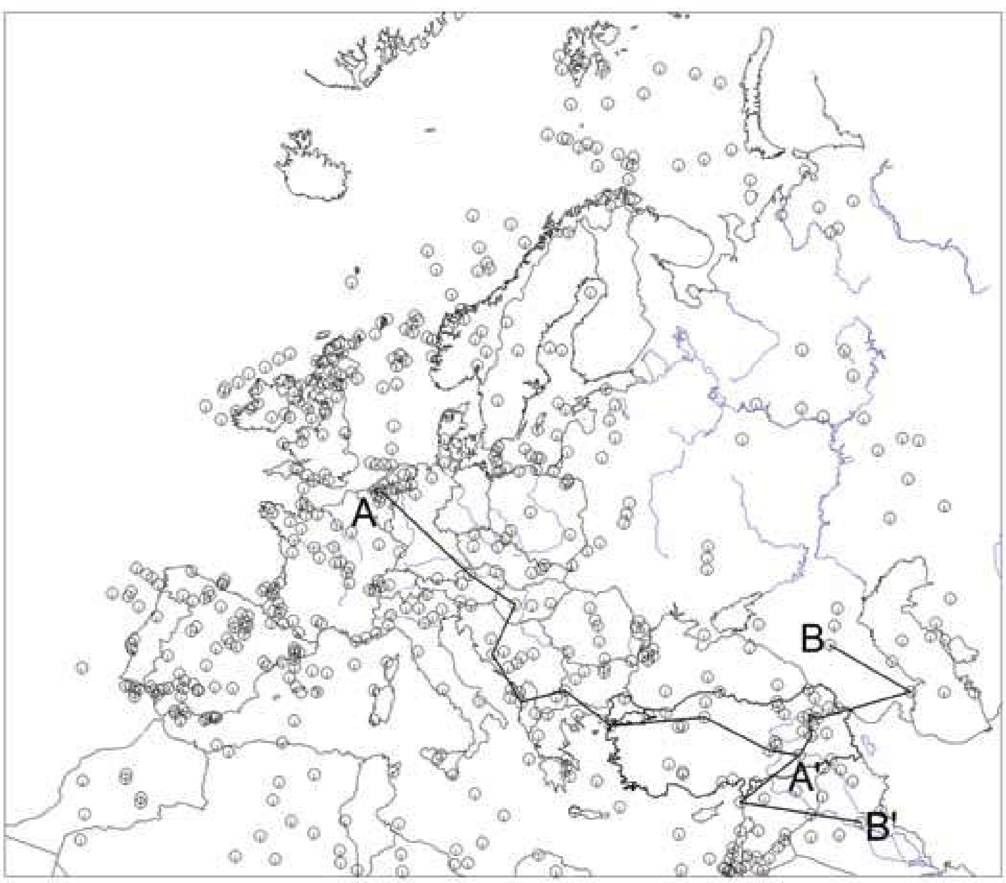

Figure 6. Location map for Stratigraphic Sections A-A' and B-B' showing Europe and parts of Africa and the Middle East. Circles show the locations of the column data used in the construction of Fig. 2.

depending on surface erosion levels at each column location.

Section B-B' (Fig. 5) also shows that the strong influence of Upper Cenozoic marine strata extended east of Turkey to the Caspian Sea area (Guliyev et al., 2001) and also south of Turkey into Syria and Iraq as earlier noted (Clarey, 2017b). The marine/non-marine boundary is either in the Miocene or Pliocene across these columns also, depending on the local surface erosion level (Keskin, 1994; Ulmishek and Harrison, 1981; USGS, 2010).

Conclusions: A New Flood/Post-Flood Boundary at the N-Q

These results dramatically conflict with the choice of the K-Pg as the Flood/post-Flood boundary. Instead, the sedimentary rocks across much of Central Europe, North Africa and the Middle East indicate marine depositional processes continued without interruption from the Cretaceous through the Upper Cenozoic. Many locations show continuous deposition of carbonate rocks right across the K-Pg boundary, from the Cretaceous through Miocene. These results demonstrate that the vast majority of European Cenozoic strata were not post-Flood, but instead represent the receding phase of the Flood. Massive marine deposits across such vast areas of the world indicate Flood processes were still active well into the Upper Cenozoic.

Stratigraphic data is a directly observable record of what has been deposited. Although some of the rock record has obviously been destroyed by erosion, a sufficient volume is preserved globally and can be compiled directly from subsurface data and outcrops.

Figures 2, 3, and 5 show thick layers of Paleogene and Neogene carbonate strata and other types of marine sediments that completely surround and indeed blanket much of the nation of Turkey, the presumed landing place of the ark. How could Noah and the animals have gotten off the ark while these marine layers were still being actively deposited? No other data is as compelling in this debate. In fact, we consider this to be as close to "proof" of a high Flood/post-Flood boundary as you can get in a forensic analysis. The Flood/post-Flood boundary must be placed high in the Upper Cenozoic.

We propose that the correct Flood/post-Flood boundary is near the top of the Pliocene, or close to that level, coinciding with the top of the Neogene and the base of the Quaternary. There is even a major recognizable extinction in the rock record at this level also (Pimiento et al., 2017). Hence, we propose calling this Flood/post-Flood boundary surface the N-Q (Neogene-Quaternary).

These results clearly call into question the claim that marine sedimentation was largely over at the K-Pg level (Austin et al., 1994). In fact, our findings indicate just the opposite is true. Stratigraphic data demonstrate that the marine realm continued, uninterrupted, from the Cretaceous level up through most of the Cenozoic, including much of the Neogene, across Europe, North Africa and the Middle East. This is compellingly strong evidence that the Flood was not over until late in the Cenozoic. Noah could not exit the ark into water. Nor could the Tower of Babel be constructed in water.

Any scientific debate must be measured by the strength of the data supporting each viewpoint. Massive volumes of rock data that support an Upper Cenozoic Flood/post-Flood boundary are far more compelling than conclusions based on limited fossil data from isolated locations. Plant and animal macro-fossils are infrequent in most of the sediment record and are largely dependent on surface exposures and can be misinterpreted. By contrast, rocks are not restricted to surface exposures. Oil wells have penetrated thousands of meters into the subsurface, giving us three-dimensional control beyond what can be observed only at the surface. Rock layers are much more continuous and massive in extent and volume. We can correlate the same rock layers across vast regions, often spanning entire countries and in some cases major portions of continents (Clarey and Werner, 2018b). The overwhelming strength of the global rock record needs to be included and acknowledged in any assessment of the Flood/post-Flood boundary location. It simply cannot be ignored or relegated to secondary importance.

The sheer volume and extent of marine rocks deposited during much of the Tejas megasequence is what tips the scale in favor of the N-Q Flood/post-Flood boundary. Stratigraphic data across Europe, North Africa, Turkey, and the Middle East are so comprehensive and compelling that it makes it nearly impossible to argue otherwise.

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A Little Flood Geology

Part I: Importance of Flood Geology

Peter Klevberg*

Abstract

Floods are a key category of geologic processes. Creationists often refer to "Flood geology," while those who try to emphasize evidence for intelligent design without any reference to the Bible often avoid geology entirely, and those with traditional old earth beliefs sometimes downplay the effects of floods. Floods observed in today's world make important analogues to megafloods, including the Deluge of Noah's day. This paper provides some examples of geologic work by floods and related processes in Central Montana as experienced by the author and also provides ideas about how these may apply to the study of earth history. It is important to recognize the limitations of analogues, especially effects of scale with these episodic events. Part I introduces flood geology and provides data and interpretations related to observed floods, starting with basic open channel flow equations and principles of scour analysis. Initial scour estimates for a flood in the study area are presented. Scour analysis is complex and beset by much uncertainty, but it is still very useful since science must be constrained by real world data.

The Importance of Flood Geology

Geologists universally recognize the importance of floods, but the larger the scale, the larger the controversy. When the traditional view of earth history was popularized by James Hutton, Charles Lyell, and others, the goal was to explain away nearly all unusual events, especially those mentioned in the Bible (Rudwick, 2005). Several researchers have made important contributions to our understanding of how belief in an ancient earth and uniformitarianism has provided justification in the minds of many to reject the Bible (Milton, 1997; Morris, 1989; Mortenson, 2004; Reed, 2001) and other ancient historical sources, just as Hutton, Lyell, and many of their influential contemporaries intended. A global flood is entirely incompatible with the naturalistic world history needed to deny God's judgment on sin, and so many notable individuals followed Lyell's example in attempting to explain geologic features through slow, presently observable geologic processes. Obviously, the sentiment behind these developments was not motivated by a humble, detached, objective search for

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truth! Enlightenment intellectuals denied the reliability of all ancient records and proclaimed their inherent superiority over previous generations (Ruse, 2011). Unfortunately for uniformitarians, science has been very unkind to them. Floods do occur, and the importance of flood geology often hits close to home.

Geotechnical engineers and engineering geologists frequently estimate scour depths of rivers to determine whether bridges are adequately supported, or other structures protected from natural disasters. "During the 20th century, floods were the number-one natural disaster in the United States in terms of number of lives lost and property damage" (Perry, 2000, p.1). Property damage of some of these floods was valued in the billions of dollars (Perry, 2000), and the total annual flood damage in the United States is several billion dollars (O'Connor and Costa, 2003). While God promised never to destroy the earth again with a *mabbul* (or *mabbuwl*, translated "flood" in Genesis 9:11), He never promised that local floods—some very large—would not occur, some of which have been very destructive (Figure 1). Flood scour may be the single most common cause of bridge failure (New York State Department of Transportation, 2016).

Figure 1. The Busy Bee Café in early June 2011. During the flood, the water was at least to the top of the tables. Photograph courtesy City of Roundup.

The Mechanics of Floods

A rule of thumb in geology is that most geologic work by rivers occurs during infrequent floods, with the majority of time accomplishing very little. The reason for this is simple: energy. Erosion is largely governed by stream flow (hence stream power or bed shear stress), the nature of the bed materials, and the slope of the bed. This is known as the "stream power law," written on a unit basis (Costa, 1983) as:

$$\omega = \gamma_f DS\mathbf{v} \qquad (1)$$

Where ω is the unit stream power vector, γ_f is fluid density (or unit weight), D is flow depth, S is bed slope, and **v** is mean velocity. There are some basic relationships evident in the stream power law. Water density increases with sediment load. For a given reach, bed slope is generally nearly constant, and stream power is proportional to it. Stream power is proportional to depth and velocity. Depth and velocity are related, and velocity can be inferred from depth. In most cases, as depth increases, velocity does too, following a parabolic distribution since the boundary layer where shear stresses resist movement remains at the stream bed. (The exception to this depth-velocity proportionality is when velocity exceeds critical flow or hydraulic jump occurs.)

For a stream bed armored with gravel or bedded in sand (i.e. cohesionless materials), a shear stress threshold must be reached before the rocks or sand (or silt) grains begin to move. Above this value, more of them move faster, while below this value, they do not move at all. The unit rate of erosion can be described thus (Benito, 1997):

$$q_e = k(\omega - \omega_c)^n \qquad (2)$$

Where q_e is the rate of erosion per unit width, k is a material-specific constant, ω is the magnitude of unit stream power, and ω_c is the critical stream power or erosion threshold. Below a unit stream power of ω_c, negligible erosion will take place. As stream power increases above ω_c, dramatic changes can take place. For example, the inferred intensity of the Missoula Flood was greater than the Bonneville Flood despite the fact that the Bonneville Flood is believed to have released five times the total potential energy (Benito, 1997). Critical stream power is a key variable; virtually no geologic work occurs until ω_c is exceeded. Equation (2) shows that unit erosion is related to the excess stream power (stream power greater than ω_c) by a power relationship; it is nonlinear.

Based on conservation of energy, it is possible to estimate the amount of energy available for erosion. Since conservation of energy means energy is neither created nor destroyed but only changed in form, the total of potential energy and kinetic energy at one cross-section must be equal to this sum plus any tributary additions at a downstream cross-section, subtracting any dissipative losses. Dissipative losses are lumped together as *head loss* due to friction, and these include frictional heating of the water, noise, and geologic work. Geologic work includes erosion (physical weathering and transport) and deposition. As found in any fluid mechanics textbook, this relationship can be expressed as:

$$h_f = LS_f + C(\alpha_2 v_2^2 - \alpha_1 v_1^2)/2g \qquad (3)$$

where h_f is head loss due to friction, L is the length of the study reach, S_f is the frictional slope (related to Manning's roughness coefficient or the similar Chezy equation coefficient), C is the energy loss coefficient related to channel uniformity, α_1 and α_2 are velocity head coefficients for the upstream and downstream cross-sections, respectively, v_1 and v_2 are mean velocities for the upstream and downstream cross-sections, and g is the acceleration due to gravity. From equation (3), one can see that the effect of velocity is to the second power. The relationship between head loss and velocity is nonlinear.

Alluvial channels tend to reconfigure through erosion and deposition to achieve an equilibrium with minimal energy loss (Chang, 1979). Floods sometimes cut off meanders, smooth out irregularities in bed slope, and provide other examples of Chang's hypothesis.

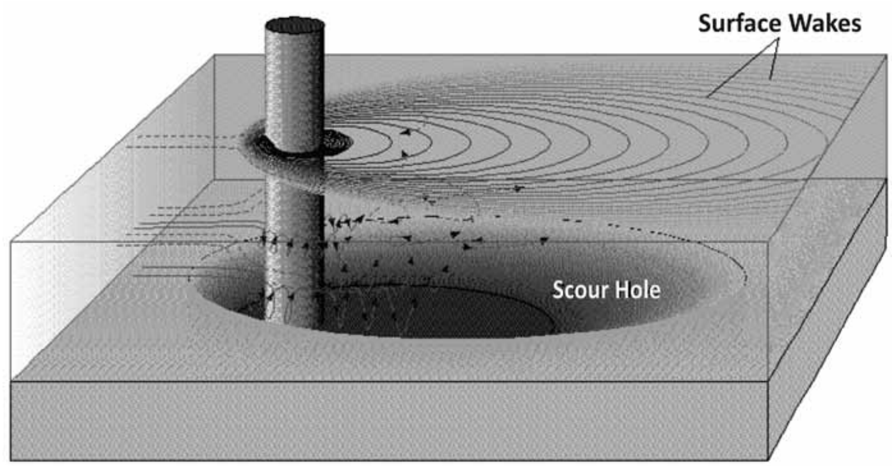

Figure 2.

Practical Application

This head loss equation is the basis for the HEC-RAS computer program produced by the U.S. Army Corps of Engineers and widely used to model stream behavior. HEC-RAS is commonly used in hydraulic engineering studies of streams. The Corps of Engineers has the primary national responsibility for wetland, flood, and river management in the United States.

The primary flood geology interest of the Federal Highway Administration has been scour: bridge pier scour, contraction scour where roadways limit channel widths, and abutment scour where bridge abutments encroach on flood plains or stream channels. There are three levels of analysis (Holnbeck and Parrett, 1997): Level 1 is qualitative, Level 2 is quantitative, and Level 3 is site specific modeling. Level 2 analysis typically uses standard programs such as HEC-RAS, HEC-2, and WSPRO. These are simplified one-dimensional analyses. It is seldom economically justified to develop a Level 3 analysis, which demands not only laborious finite element or finite difference modeling but also departs from most of the simplifying assumptions used with common flood geology and hydraulic engineering equations.

Two of the most important simplifying equations are uniformity and steadiness. Unsteady flow waxes and wanes, and this is the nature of floods. However, this assumption is usually appropriate since the peak flow is what is normally the matter of interest. Uniformity is more difficult. When a stream channel is sinuous, with changes in width and depth, it is nonuniform. Uniformity can be approximated as the limit of the reach length is reduced (a la calculus or finite element modeling). Results are often difficult to predict. Sometimes uniformity can be adequately approximated with a change in roughness coefficient or some other simple modification; sometimes it is not so simple. Obstructions, such as boulders and bridge piers, are deviations from uniformity (Figure 2). During floods, flow across a flood plain may exceed flow in the channel. Flood geology can be complex, both in terms of hydraulic processes (transport) and sedimentation (removal and deposition of sediment).

A specific example from the Judith River of Montana (Figures 3 and 4) will be presented in Part II of this series. HEC-RAS was used to model flood flows in 2011, but river geometry and the changes in stream channel configuration during and after the 2011 flood posed challenges. Applying the simplified Level 2 method (Holnbeck and Parrett, 1997) to an approximate channel and flood plain configuration based on survey data and field estimates produced the initial estimates of contraction scour shown in Table 1.

These estimates are generally conservative (Holnbeck and Parrett, 1997) and intended to overpredict scour to provide a margin of safety, but actual scour that occurred in 2011 was locally greater. Since the foundations were undermined or moved laterally, scour proximate to the damaged piers was at least 11 feet (3.3 m) deep in these areas. This was from a stream that is typically easy to wade across.

The scour function is clearly nonlinear. The last column shows the ratio of approach depth (y_{app}) to depth at the bridge section (y_{brg}) which is a 5/3-power function to obtain the variable for matching with the scour curve. At first, the scour nearly doubles with a doubling of water depth, but then drops off as flow gets deeper; however, the 5/3-power function shows that the *difference* in flow depth governs. The response of scour depth to flow depth is highly dependent on channel geometry. Another factor at this site is the presence of bedrock 18 feet (5.5 m) below the streambed. This

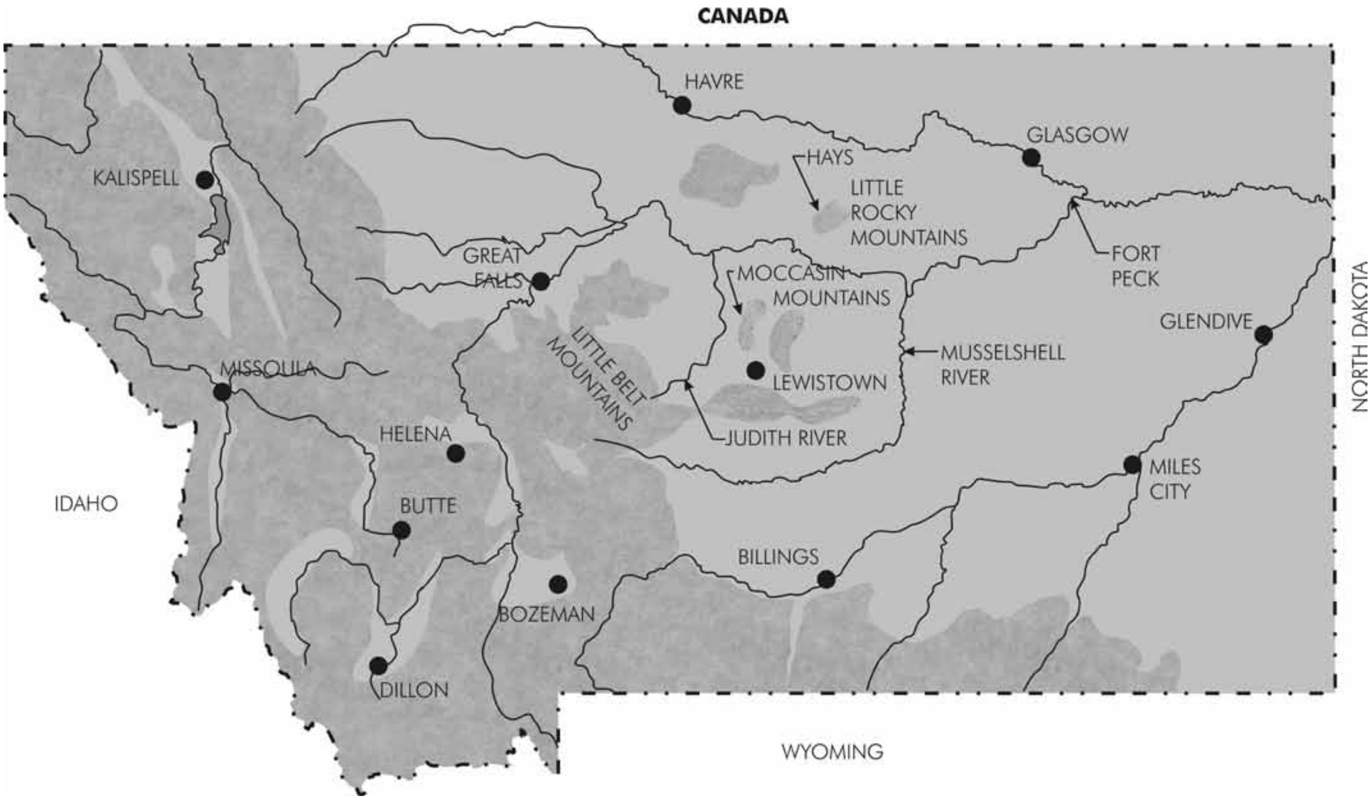

Figure 3.

would normally limit scour, though that is dependent on unit power (Holroyd, 1990). While the scour depth in this small, shallow, gravel-bedded river is computed to be less than the flow depth, that is not always the case, as some spectacular bridge failures from other states and countries have illustrated (Figure 5), sometimes with scour depths of several meters (tens of feet). Evidence from the Judith River in 2011 indicates that considerable deviation from predicted scour depth may also have occurred, as will be shown in Parts II and III of this series.

Table I. Estimated Flow and Scour Depths. Judith River, Montana—2011 Flood.

Estimated Flow Depth, Approach Reach	Estimated Flow Depth at Bridge	Estimated Scour Depth	$(y_{app}/y_{brg})^{5/3}$
1 ft. (0.3 m)	1 ft. (0.3 m)	0 ft. (0 m)	1.00
3 ft. (0.9 m)	3 ft. (0.9 m)	1.4 ft. (0.4 m)	1.00
6 ft. (1.8 m)	9½ ft. (2.9 m)	2.7 ft. (0.8 m)	2.15
12 ft. (3.6 m)	14 ft. (4.2 m)	1.6 ft. (0.5 m)	1.29

An anonymous reviewer of an early draft of this paper brought to my attention work done in Colorado. He stated:

> McCoy, commenting on the work of Anderson et al. (2015) involving a single storm in the Colorado Front Range that eroded what was calculated as "hundreds to thousands of years [*sic*] worth of accumulated hillslope material." This observation leads him to question: "How do surface processes shape the landscape in which we live? Is it the every-day flow of rivers that gently, yet persistently, erodes and transports sediment from highlands to ocean basins, dissecting the land surface into networks of ridges and valleys? Or is it cataclysmic events of incredible magnitude that, despite their infrequency, conspire to shape

Figure 4. Judith River at low flow.

Earth's surface?" And then referring to the importance of this distinction of rate, he commented, "accurate portrayal of the magnitude and spatial-temporal patterns of sediment fluxes is critical for understanding how landscapes evolve." (McCoy 2015, p. 463)

Expanding Our Knowledge

There are many hydraulic equations for stream competence that have been derived largely from actual observations (Klevberg and Oard, 1998), partly due to the complexity and variety of processes, and to a lesser extent, various choices in conventions. Each time a flood occurs, it is an opportunity to test our theories and learn new things.

Very large floods, larger than any observed in available historical records but with inferred peak flows in excess of 10^6 m^3/s, are called "megafloods" (or "superfloods"). These have been inferred from geologic evidence and include the Bonneville Flood and Missoula Flood. The most powerful flood ever recorded, of course, is the Deluge in Genesis 6–8. Greater extent and greater energy clearly would produce much more geologic work.

A great many examples can be found for geologic analogues. The examples chosen for this series were selected primarily because I had the opportunity to work on these projects as part of my regular job, but Montana is also particularly well suited to display some of the main points of this paper. Other stimuli for researching and getting some Central Montana flood and geologic information in print included, "The geology and geography of floods," by O'Connor et al. (2002) and my previous work on the paleohydrology of deposits on higher planation surfaces (Klevberg and Oard, 1998).

Equivocal Terminology

The popularity of the term "Flood Geology" among creationists may be unfortunate. Many concepts not related to floods are sometimes lumped under this term. *Flood geology* as more commonly used (O'Connor et al., 2002) refers to the geologic processes active in floods as we observe them. (*Flood basalt* is basalt produced in a flood of erupted lava, not water, but that is normally clear from context.) That a global flood could produce a great many phenomena not observed in local or regional floods will be explored further in Part IV of this series. I will use the term only in reference to flood processes and deposits, regardless of whether the scale is local, regional, or global.

Conclusions

Much knowledge has accrued from observation of floods and the geologic work they do. These include the following.

- In general, most geologic work by rivers occurs during infrequent floods, with little geologic work between. This is contrary to the traditional uniformitarian idea that small changes over long periods of time have produced most or all of the geologic features seen today.
- Floods are considered the primary type of natural disaster in the world. Geologic change caused by floods represents a large portion of the geologic work that takes place in the modern environment.
- Stream power is proportional to flow depth, bed slope, and velocity. Velocity is related to depth and bed slope; thus, the stream power equation is nonlinear. This explains to a large degree why floods have such a disproportionate effect on geologic change.
- Stream power must exceed the bed shear stress threshold before significant erosion commences. Below the critical bed shear stress, removal and transport of earth materials is insignificant.
- The rate of erosion is proportional to the surplus of stream power above ω_c.

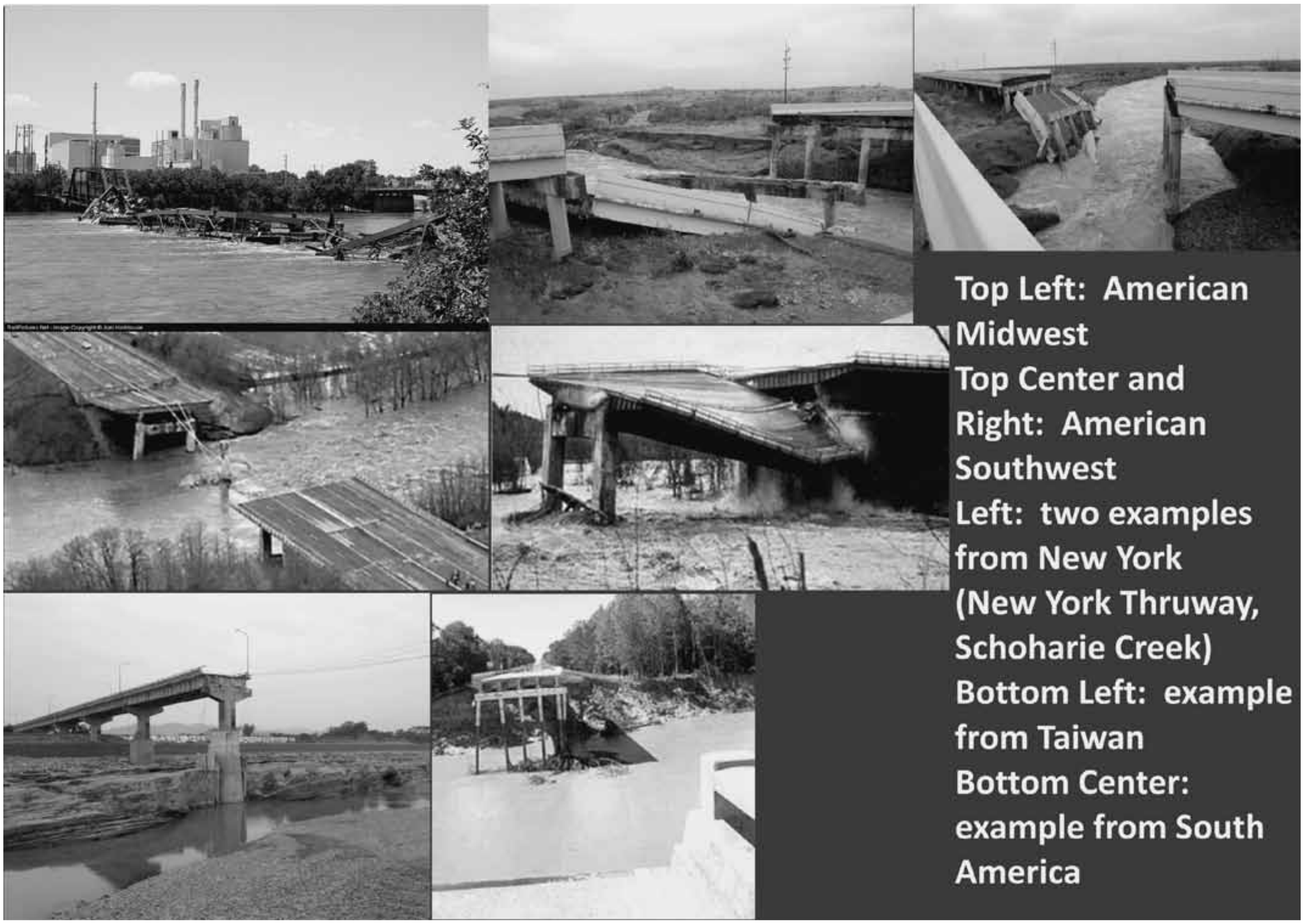

Figure 5.

This relationship is also nonlinear.

- Head loss, which is the sum of resistive and dissipative factors, is partly proportional to the square of difference in velocity between upstream and downstream reaches (i.e. change in current speed down the channel). Thus, a change in the current speed produces a nonlinear effect in flow resistance.
- Alluvial channels tend to reconfigure to achieve the minimal energy loss state. This requires geologic work to reduce dissipative losses from channel constrictions and obstructions.
- The assumption of steady flow is usually appropriate when the peak flow is of interest. The assumption of uniform flow can be more problematic, especially at larger scales.
- Estimation of scour depth is complex. Typical methods are normally conservative but observed scour depths sometimes exceed predictions. Scour depths of several meters have been observed at bridge piers, sometimes with disastrous results.

Science must be constrained by real world data. Through first-hand experiences, important principles of geology in particular and science in general can be demonstrated that should prove useful to others.

Acknowledgements

This series benefited from the very helpful criticism of the reviewers. *Deum laudo* (Proverbs 17:10).

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Do Viruses Appear to Cluster Like Created Kinds?

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Abstract

In the book of Genesis, the creation of plants and animals is described, yet the creation of microbes (including viruses) is not mentioned. Some biologists think viruses are on the border between living and non-living organisms, since they cannot exist independently outside of their host. Some propose that retroviruses and the associated mobile genetic elements found in various animal species originated from within the host genome and fulfilled structural and regulatory functions, and were later exogenized.

Previous creationist works have studied the baraminological relationships among insects, fungi, bacteria, and archaea using genomic data, but not that of viruses. This paper aims at performing such a genetic study in order to shed light on the possible baraminic relationships between prokaryotic viruses, otherwise known as bacteriophages.

In this study, 159 bacteriophage strains which had 200 or more orthologous proteins in their genome were examined using the Gene Content Method. Eight phage clusters were found with varying sizes and varying host organisms. Some phage clusters infected only one family of bacterial hosts, whereas others were more promiscuous. Phages within some of the smaller clusters had a tight range for genome size, ORF number, GC%, and host morphology. In two larger clusters, phages infecting different bacterial host genera showed no significant genetic difference. Several smaller phage clusters were found, which were already described in the scientific literature, thereby adding candidate bacteriophage strains to these groups. It appears that God may have created several kinds of bacteriophages to keep various bacterial populations under control.

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Introduction

In Genesis 1:11–12 (NKJV) we read about the creation of plants:

> Then God said, "Let the earth bring forth grass, the herb that yields seed, and the fruit tree that yields fruit according to its kind, whose seed is in itself, on the earth"; and it was so. And the earth brought forth grass, the herb that yields seed according to its kind, and the tree that yields fruit, whose seed is in itself according to its kind. And God saw that it was good.

Similarly, in Genesis 1:21–25 (NKJV) God created the different kinds of animals:

> So God created great sea creatures and every living thing that moves, with which the waters abounded, according to their kind, and every winged bird according to its kind. And God saw that it was good. And God blessed them, saying, "Be fruitful and multiply, and fill the waters in the seas, and let birds multiply on the earth." So the evening and the morning were the fifth day. Then God said, "Let the earth bring forth the living creature according to its kind: cattle and creeping thing and beast of the earth, each according to its kind"; and it was so. And God made the beast of the earth according to its kind, cattle according to its kind, and everything that creeps on the earth according to its kind. And God saw that it was good.

Genesis 1 deals with the different kinds of macroscopic plants and animals, which are observable to the naked eye. More specifically, a living creature, in the biblical sense, is an animal which has a soul, or נֶפֶשׁ (nephesh) in Hebrew. There is no information in the Bible that directly refers to microorganisms or their origin. It has become increasingly evident that microbes aid in digestion, and produce vitamins and minerals as part of a symbiotic relationship with their hosts. According to the biomatrix or organosubstrate theory (Francis, 2003; Linares et al., 2016), microbes were created as a link between multicellular organisms and the physical world to extract inorganic materials and to participate in the geochemical cycling of elements and compounds. Therefore, according to this view, microbes would have been created on days three, five and six, along with their plant and animal hosts (Gillen, 2008). Also, since microorganisms, such as archaea and bacteria show signs of life as defined in modern terms, such as cell division and metabolism, it is possible, that they were also created according to their kind; however, the Bible remains the sole highest authority in this question (Acts 17:10–11). Indeed, two baraminology studies have shown that Nucleocytoplasmic Large DNA Viruses (NCLDVs) and archaea form several species clusters, which are continuous with each other, and discontinuous with all other species (O'Micks, 2016; Yaugh, 2016). NCLDVs may be degenerate bacteria, and not viruses, due to the sheer size of their genomes as well as the presence of genes in their genomes, which have functions characteristic of cellular organisms.

We can now turn to viruses, and ask the question, as to whether they were also created "according to their kind." This we must ask, since virus strains have been known to originate from one another via mutation. For example, HIV has been hypothesized to have originated from SIV (Simian Immunodeficiency Virus) (Sharp and Hahn, 2011). The evolutionary origin of viruses does not make sense, for two good reasons. First, their mutation rate is several orders of magnitude higher than that of cellular organisms, yet viruses have never been observed to evolve into anything other than viruses. For example, the mutation rate of the poliovirus RNA-dependent RNA polymerase is 4.5×10^{-4} per bp (Wells et al., 2001). This despite bacteriophages being the most abundant biological entities on the planet, with an estimated 10^{30} phage particles (Brüssow and Hendrix, 2002). Second, due to this tremendous mutation rate, viruses are theoretically constantly on the verge of mutational catastrophe, meaning that since they mutate so fast, their genome is constantly on the verge of being lethally damaged by mutations.

On the other hand, we must be cautious about whether viruses or other mobile genetic elements can be classified as created kinds, especially in higher organisms. Instead, they could have originated from the host genome (Tomkins, 2015) and then later exogenized. For example, elements such as LINEs, SINEs, Alu repeats and other elements make up more than one third of the human genome (Terborg, 2009). Such a large number of mobile elements present in the human genome could certainly not be due to exogenous origin, since they would certainly have been detrimental to the host genome's stability. Rather, such elements could have originated within the host genome itself. For example, Endogenous Retroviruses (ERVs) take part in gene regulation, DNA repair and recombination (Liu and Soper, 2009), and could have exogenized to form present day retroviruses.

Viruses are mainly known to cause diseases, such as hepatitis, colds, mumps, rabies, polio, and smallpox; therefore, these specific strains could not be part of the original good creation, when there was no pain, death or disease (Genesis 3:17–19). However, the majority of viruses could have possibly played a more benign ecological role as vectors in exchanging genetic elements between microorganisms, like bacteria, a process known as horizontal gene transfer (HGT) (Bergman, 1999). For example, some viruses have been employed today in cancer therapy (Norman and Lee, 2005). After the Fall, viruses would have come under the effect of the curse, and along with certain mutations, would have become pathogenic (Kim, 2006).

Living organisms are defined as being able to reproduce their own species in-

Table 1. List of 19 groups of bacteriophages defined by the bacterial genus that they infect along with the number of bacteriophage strains in that group, as well as the number of clusters with five members or more that they are found in (listed in Table 2).

Bacterial genus	Number of species	Number of clusters found in genus
Enterobacteria	36	4
Synechococcus	25	1
Escherichia	17	2
Bacillus	12	1
Mycobacterium	9	1
Prochlorococcus	7	1
Vibrio	7	1
Klebsiella	6	4
Aeromonas	5	0
Cronobacter	5	2
Cyanophage	5	1
Salmonella	5	2
Shigella	4	1
Staphylococcus	4	0
Yersinia	4	1
Sinorhizobium	3	0
Citrobacter	2	1
Edwardsiella	2	1
Pectobacterium	1	1

dependently. Viruses are somewhere on the border of life and non-life; they are capable of replicating within a cellular context, as are viroids, prions, plasmids and transposons. This means that viruses are incapable of independent existence, but rather are dependent on the cellular machinery of host cells in order to replicate. Viruses also have a non-cellular structure, and a much smaller genome compared to cellular organisms.

In order to further address this question, a recently-developed gene-based baraminology method was applied (O'Micks, 2017) which defines baraminology membership based on gene content similarity. This method has been applied to NCLDVs (O'Micks, 2016), archaea (Yaugh, 2017), insects (unpublished data), and fungi (O'Micks, 2017). Therefore, in this paper this same method will be applied to prokaryotic viruses to see whether these viruses form clusters of species, similar to cellular organisms examined in previous studies. For this, data from the Prokaryotic Virus Orthologous Groups (pVOGs) database (Grazziotin et al., 2017). From here 159 prokaryotic viruses (PVs) were selected that had at least 200 proteins in their genomes, which correspond to pVOGs (see Table 1), and then ran the Gene Content Method (GCM) on them, as detailed in the Materials and Methods section.

A previous analysis on bacteriophage genome content similarity was done on 93 Bacillus bacteriophage strains, uncovering 12 clusters, and 14 singletons (Grose et al., 2014a). What was characteristic of this analysis is that two phages were considered members of the same cluster, if their protein content similarity was at least 40%, which is a cutoff used by the CoreGenes software that determines common gene content for a set of input species (Turner et al., 2013). As we can see in Table 2, the mean JCV for the eight discovered clusters is above this cutoff limit. Furthermore, there is low standard deviation in average basic phage properties, such as genome size, GC%, ORF number, and virus morphotype. Hatfull (2012a) found that GC% varies only slightly within bacteriophage clusters, something which was also reported by O'Micks (2015) in several bacterial genera. Grose and Casjens (2014b) also defined clusters of *Bacillus* subgroups by measuring pairwise genome sequence similarities between pairs of phages, where the sequence similarity was at least 50%, over half of the genome.

Bacteriophages are the most predominant biological entities on the planet. In general, bacteriophages have a preference for a particular host bacterial species, or even strain or serovar; this can also serve as a barrier for the exchange of genes. However, sometimes phages can infect host species from several different genera or families, such as those from *Escherichia*, *Lactococcus*, *Mycobacterium*, *Pseudomonas*, *Staphylococcus*, and *Streptococcus* (Jacobs-Sera et al., 2012). The expansion of host range of phages usually fails, due to the difficulty in the mutation of host attachment proteins (Hall et al., 2013). No phages have been discovered that have jumped the barrier between gram-positive and gram-negative bacteria (Jacobs-Sera et al., 2012).

Table 2. Clusters of bacteriophages with at least five members, predicted by the GCM.

Bacterial host genera	No. strains	Mean JCV ± stdev	JCV range	ORF number range	p-value
Citrobacter, Edwarssiella, Enterobacteria, Escherichia, Klebsiella, Pectobacterium, Salmonella, Shigella, Yersinia	65	0.66±0.14	0.41–1.0	203–288	$2.3x10^{-25}$
Cyanophage, Prochlorococcus, Synechococcus	37	0.54±0.11	0.32–0.98	201–4556	0.0
Vibrio	7	0.88±0.03	0.84–0.93	304–335	$5.6x10^{-35}$
Enterobacteria, Klebsiella	5	0.88±0.06	0.81–0.95	200–210	$6.6x10^{-12}$
Mycobacterium	9	0.63±0.07	0.55–0.81	204–241	$5.3x10^{-35}$
Bacillus	12	0.5±0.22	0.27–0.91	203–272	$6.1x10^{-26}$
Cronobacter, Enterobacteria, Klebsiella, Salmonella	8	0.51±0.24	0.27–0.88	209–241	$2.6x10^{-10}$
Cronobacter, Enterobacteria, Escherichia, Klebsiella	5	0.73±0.12	0.62–0.97	249–293	$6.8x10^{-8}$

Results and Discussion

After running the GCM on the data, we see that eight PV clusters arise of varying sizes, with 5–65 members, and with a different mean JCV and a different range of JCVs (Table 2). Those which infect 19 different families of prokaryotes were analyzed; each cluster had at least five members. These clusters, however, are not homogenous, in that their members infect different host families of prokaryotes. For example, PVs which infect prokaryotes from the families *Enterobacteria* and *Klebsiella* were found in four clusters, and PVs which infect prokaryotes from *Cronobacter*, *Escherichia*, and *Salmonella* were found in two clusters. These results mean that different groups of phages are sometimes capable of infecting the same set of hosts. The predicted virus clusters will be described as to their host range, and similarity to other strains of viruses in the following paragraphs.

Enterobacteria, Escherischia, and other phages

Currently, several hundred *Enterobacteriaceae* phages have been sequenced, many of which infect multiple host genera (Grose and Casjens, 2014b). The first cluster consists of 65 phages (of which 33 have *Enterobacter*, 15 *Eschersichia*, 4 *Shigella*, 4 *Yersinia*, 3 *Salmonella*, 2 *Citrobacter*, 2 *Edwardsiella*, 1 *Klebsiella*, and 1 *Pectobacterium* hosts). Despite the size of the cluster and the variety of bacterial hosts, the phages belonging to this cluster have a mean JCV of 0.66, with a range of 0.41–1.0, and between 203–288 ORFs.

When comparing those phages that infect *Enterobacter* hosts and those that infect *Eschersichia* hosts, we can see that there is hardly any difference between them, meaning that host preference does not play a major role in virus clustering. For example, the mean JCV calculated when one phage infects an *Enterobacter* host and another infects an *Escherischia* host, we get a mean JCV of 0.72, as opposed to 0.7 for only *Enterobacter* hosts, and a slightly higher value (0.79) for only *Escherischia* hosts (see Table 3). The p-value for JCVs between these two genera is 0.79, which is highly insignificant, meaning that the JCV algorithm differentiates between

Table 3. Comparison of bacteriophages, which infect *Enterobacter* and *Escherischia* hosts.

Comparison	Mean JCV ± std. dev.	JCV range
Within *Enterobacter*	0.7 ± 0.13	0.48 – 1.0
Within *Escherischia*	0.79 ± 0.13	0.56 – 1.0
Between *Enterobacter* and *Escherischia*	0.72 ± 0.14	0.48 – 1.0

phages that infect bacteria from these two genera.

Synechococcus + *Prochlorococcus* + cyanophages

In the second cluster there are 25 *Synechococcus* phages, seven *Prochlorococcus* phages, and five Cyanophages; again, similar phages infect different hosts. The reason that *Synechococcus* phages are in the majority compared to *Prochlorococcus* phages is because they have a wider host range (Hambly and Suttle, 2005), making it possible for more strains to arise through HGT. Also striking is that fact that bacteriophages which infect both genera of bacteria cluster well with each other. As we can see in Table 4, the mean JCV and JCV range hardly differs regardless of whether we look at bacteriophages which infect only *Prochlorococcus*, those that infect only *Synechococcus*, or both together. Sullivan (2003) showed that 93% of 58 *Synechococcus* lysates contained *Myoviridae* viruses, 65% of 43 *Prochlorococcus* lysates contained *Myoviridae*, and 98% of 107 *Prochlorococcus* lysates showed *Podoviridae*. Lu and Hodson (2001) found similar results. Although the majority of phages in this group infect *Synechococcus*, the same phages could possibly infect other bacterial hosts.

Table 4. Comparison of bacteriophages, which infect *Synechoccus* and *Prochlorococcus* hosts

Comparison	Mean JCV ± std. dev.	JCV range
Within *Prochlorococcus*	0.52 ± 0.13	0.35 – 0.91
Within *Synechococcus*	0.56 ± 0.13	0.35 – 0.98
Between *Prochlorococcus* and *Synechococcus*	0.56 ± 0.13	0.35 – 0.98

Mycobacterium phages

Mycobacterium phages are very diverse, and more than 200 completely sequenced genomes of these phages form some 20 clusters along with their sub-clusters (Hatfull, 2010, 2012b). The majority of phages which infect *Myocobacterium* species are specific to *M. smegmatis*, but 10% can also infect *M. tuberculosis*, a species with a genome roughly two-thirds the size of *M. smegmatis*, and a longer doubling time (Jacobs-Sera et al., 2012).

The nine *Mycobacterium* phages in this study had a relatively low mean JCV of 0.63. *Mycobacterium* phages are rather diverse, without constituting discrete populations. Their genomes can contain up to 30% orphan genes (Pope et al., 2015), which could account for the relatively low mean JCV. Their genome size has a tight range of 106–110 Kbp, which have 216–247 genes.

Vibrio phages

This smaller groups of phages, which have a similar genetic make-up, have very much the same host range. For example, five of the seven *Vibrio* phages in cluster 3 have a mean JCV of 0.88 and a JCV range of 0.84–0.93. They also have a tight genome size range of 246–248 Kbp, a GC% range of 41.23–42.6, and between 378 and 390 ORFs (Luo et al., 2015).

Bacillus phages

Bacillus bacteriophage Bastille belongs to the L4 subgroup of *Bacillus* phages, whereas four of them (Spock, BigBertha, B5S, and B4) belong to the L5 subgroup, and Bcp1 belongs to the L7 subgroup (Grose et al., 2014a). As we can see in Figure 1, the *Bacillus* bacteriophage cluster consist of two subclusters, L4+L5 and L7. These subclusters also have a similar range for genome size, GC%, and number of ORFS, and all belong to the family *Myoviridae*.

Phages belonging to smaller, mixed clusters

The fourth cluster contains three phages which infect *Klebsiella* hosts, and two which infect *Enterobacter* hosts. They have a mean JCV of 0.88 and between 200–210 ORFs, which is quite a narrow range. Maciejewska et al. (2017) found that from this cluster, *Klebsiella* phage KP27 shows similarity with *Klebsiella* phages KP15, Miro, and Matisse, and *Enterobacter* phage phiEap-3; the latter three were also put in the same cluster by the GCM as well as *Enterobacter* phage RB43, which Maciejewska et al. (2017) did not detect. The phages in this cluster show a highly similar level of genome organization as well. For example, the genomes of phages vB_KpnM_KP15 and vB_KpnM_KP27 are 174,436 and 174,413 bp, respectively, with a DNA sequence identity of 96%.

The genome of *Cronobacter* phage vB_CsaM_GAP31 was determined by Abbasifar et al. (2012). It shows high similarity with *Salmonella* phage SSE-121, which has also been studied here, as well as *E. coli* phages vB_EcoM-FV3 and rV5. Even though only eight phages were found in the seventh cluster, they infect bacteria from four different genera. Their genomes contain 209–241 ORFs. The double-stranded DNA genome of phage GAP31 has 147,940 bp with a GC% of 46.3%.

Enterobacter bacteriophage vB_PcaM_CBB is a member of cluster eight, which has five members, and is classified as a "jumbo-sized phage," characterized by atypical hairy structures along its contractile tail structure. It has a wide host range and is similar to phages *Enterobacter* phage vB_KleM-RaK2,

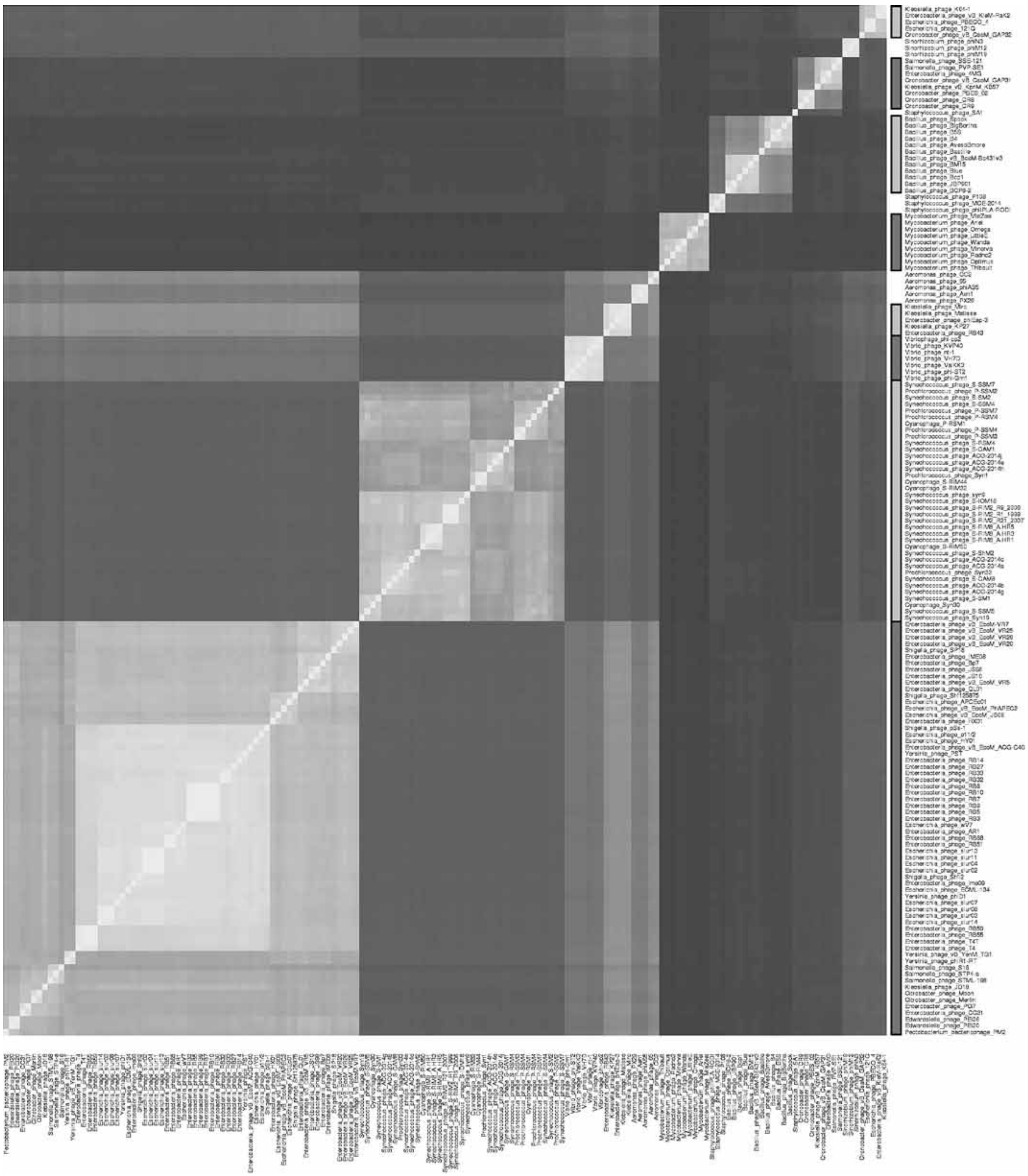

Figure 1. Heatmap of 159 prokaryotic virus strains. Alternating light and dark gray bars show several larger clusters. Lighter colors represent higher JCV values, closer to 1, denoting species which are similar to one another (same group). Darker colors represent lower JCV values, closer to 0, denoting species which are dissimilar to one another (separate group).

Escherichia phage PBECO_4, *Escherichia* phage 121Q, and *Cronobacter* phage vB_CsaM_GAP32 (Buttimer et al., 2017). Phage vB_PcaM_CBB shares 33–38% of its proteins with these other phages, yet a mean JCV of 0.73 was found for the members of this cluster. These phages have been rarely isolated, so they remain to be fully characterized. These phages are unique in that their DNA sequence has low similarity to other phages, and have a high number of species-specific proteins. Abbasifar et al. (2014) suggest putting them into their own virus subfamily.

Conclusion

In conclusion, we can see that bacteriophages form clusters somewhat similar to living organisms. Some are restricted to a single host, whereas others infect several hosts. However, with the extremely large number of phage particles and the speed at which new strains appear across the planet, it would be premature to say that there is a relatively complete picture of bacteriophage genetic diversity. Further, phages replicate differently from living organisms, and their genetic content is also more mosaic due to HGT. However, viruses belonging to the same cluster are highly similar to each other, and have a very similar genome size, genome sequence similarity, number of ORFs, and even GC%, which varies only slightly within a tight range. This could be due to limited HGT and base pair mutations.

Since viruses are not considered to be living organisms by many definitions and replicate differently than plants and animals, the cluster forming pattern could have other causes. Since phages, the focus of this study, seem to be designed to specifically target bacteria, which are not considered living in a biblical (nephesh) sense, they may have existed before the Fall. Thus bacteriophages may have been created according to the kinds of organisms from which they originated, to help modulate populations of bacteria.

Materials and Methods

Data for pVOGs was downloaded from ftp://ftp.ncbi.nlm.nih.gov/pub/kristensen/pVOGs/downloads/All/All-vogtables.tar.gz for 2,976 bacteriophage species. This database contains about 300,000 proteins clustered into 9,518 conserved orthology groups by the COG algorithm (Tatusov, 1997). From this database the top 159 viral strains were selected, which had at least 200 orthologs. The virus strains were analyzed using the Gene Content Method described in O'Micks, 2017. Annotation for different viruses was found at the Actinobacteriophage Database at http://phagesdb.org/.

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What the Cold-Water Cure Teaches Us About Darwin

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Abstract

The cause of Darwin's long-term health problems has been the subject of several books and scores of academic publications. Among the many theories include Darwin's acknowledgment that his goal was to "murder God" by developing a creation theory that negated the most common reason given for belief in Him, namely the beauty and complexity of the physical world. This theory Darwin developed to that end was natural selection, although Darwin himself had doubts about the ability of the mechanism he proposed to account for all of creation. As will be reviewed, a good case has been made by several Darwin scholars for the murder hypothesis causing guilt that accounts for many, if not most, of Darwin's psychological problems (which, in turn, had a large influence on causing his many physical maladies). The "cold-water episode" recounted in this paper supports this conclusion.

Introduction

Darwin's serious health problems were well-documented both by himself and others. Columbia University psychiatrist Dr. Ralph Colp, whose career focus was researching Darwin's health, wrote two books and over eight major peer-reviewed articles on the topic. Darwin's health problems included various combinations of severe psychological (or psychologically influenced) issues. These included severe depression, fits of hysterical crying, shaking, severe anxiety, insomnia, fainting spells, muscle twitches, trembling, nausea, vomiting, depersonalization, visual hallucinations, malaise, vertigo, cramps, bloating, nocturnal flatulence, headaches, nervous exhaustion, dyspnea, tachycardia, tinnitus, and sensations of loss of consciousness and impending death (Bergman, 2015).

That Darwin suffered from several severely disabling maladies is not debated. The only debate is the exact cause (Katz-Sidlow, 1998). Although Darwin consulted over 20 doctors, a definitive diagnosis was never rendered (Colp, 2008). As a youth, he lived an active life involved in hunting and numerous outdoors activities. George Pickering, in an extensive study of Darwin's illness, concluded it was only after around age 30, when he began developing his theory of evolution, that Darwin became an "invalid recluse" (Pickering, 1974, p. 34). Darwin scholar Michael Ruse concluded that Darwin "was an invalid from the age of 30" until he died at the age of 73 (Ruse, 2003, p. 1523).

Why was Darwin plagued by so many major, and at times incapacitating, health problems? The detailed research on Darwin's health by Colp and others has ruled out most of the common theories, including Chagas disease, and peptic ulcers caused by the bacterium Helicobacter pylori. What remains is a theory that attempts to explain his

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Figure 1. The man behind the Water Cure, Dr. James Manby Gully, about 1860. From Wiki Commons. In the public domain.

health problems as psychologically caused, including anger turned inward. As Colp explained, Darwin was "unable to openly express his anger" and, as is common, "turned the anger against himself"—a common reason for the depression, anxiety, and other symptoms Darwin faced most of his life (Colp, 2008, p.117). Colp added "he always had difficulty in expressing serious anger" (Colp, 2008, p. 39).

Two of the main reasons for his anger, in this case against God, were the death of his beloved child, Annie, and his war against God and Christianity (Keynes, 2002, p 210). The problem with speculating that Annie's death was the initiating cause of Darwin's psychologically-related health issues is that his health problems began more than a decade before Annie died. However, psychologically-related health issues do correspond temporally to when he was developing his ideas of natural selection as a substitute agent for God.

It's Like Committing a Murder

As I documented elsewhere, Darwin made it clear that the goal of developing his theory of evolution by natural selection was, in effect, to "murder" God by creating another creator to account for the existence of life, namely natural selection (Bergman, 2020). Darwin knew that the main reason in his day that people believed in God was because of the evidence of creation (Shermer, 2000, p. xiv). If he could come up with another theory that explained the origin of the physical creation, Darwin realized that the main reason people give for believing in God would no longer exist. This would result in many giving up belief in God, which history confirms is exactly what happened (Fuller, 2017). In a letter to Joseph Hooker, dated January 11, 1844, Darwin wrote, in contrast to his original belief, that he now believed "species are not immutable (it's like confessing a murder)." (Darwin Correspondence, vol. 3, p. 2). Marty, in a detailed discussion titled "Darwin on a Godless Creation: 'It's like confessing to a murder'" explained in detail the background of Darwin's statement about murder:

> Before marriage, Charles Darwin had confessed everything to [Emma]. He was in the process of rewriting the history of life. That, according to his convictions, all living things descended from a common ancestor. And that species were not to be attributed to God's endless creativity, but were the product of a blind, mechanical process that altered them over the course of millions of years (Marty, 2009).

The meaning of Darwin's statement has been the subject of several detailed studies, most agreeing with the interpretation reviewed here (for a careful review see Colp, 1986; See also Bergman, 2017, pp. 16, 18, 56, 78, 103, 110, 269). An analysis by Freud's disciple, Ernst Jones, from a study of Darwin, who compared

> the reactions of the two men who discovered the relation of Natural Selection to Evolution, which meant displacing God from His position as …. Creator specially concerned with mankind, and removing Him to an infinitely remote distance…. Darwin, the one who stood in such awe of his own father, said it was 'like committing murder'—as, indeed, it was unconsciously…. He paid the penalty in a crippling and lifelong neurosis, and in an astonishing display of modesty, hesitancy, and dubiety concerning his work. The other, A. R. Wallace, compensated for the displacement of the supernatural by bringing it back in another sphere, by his quite naïve adherence to spiritistic beliefs (Jones, 1990, pp. 193–194).

Colp summarized Jones' conclusion that, by murder, Darwin "meant 'parricide,' the murder of God the father"

Figure 2. Darwin's favorite child, Anne, who died at age ten, likely from tuberculosis. From Wiki commons. In the public domain.

(Colp, 1977, p. 30). One of the world's leading Darwin scholars, Michael Ruse, agreed with Jones, writing that

> Darwin knew his theory was much better than Chamber's … but it was evolutionary and materialistic nonetheless…. When telling Hooker of his evolutionism, Darwin confessed that it was like admitting to a murder. It was murder … of Christianity, and Darwin was not keen to be cast in this role. Hence the *Essay* [which became the *Origin of Species* published in 1959] went unpublished (Ruse, 1979, p. 185).

Colp adds the word *murder* related to the discussion of Darwin's implications, namely to Darwin's

> moral feelings about his theory of evolution: evolution operates not by the morally tolerable Lamarckian mechanism of "slow willing," but by the morally intolerable mechanism of "murder," the massive murder of all unfit, aptly describes and characterizes the War of Nature (Colp , 1977, pp. 29–30).

Colp further observed that Darwin realized that "his theory would be viewed with opprobrium equivalent to that attached to murder and that he would receive a punishment equal in severity to that given to a murderer" and for "the murder of God, of Christianity… Darwin must have believed that it was honest, manly, and courageous to confess what he really believed and to face his punishment." (Colp, 1986, p. 15). Indeed, Darwin received as punishment a life of illness.

This goal of "murdering God" also created a nearly lifelong conflict with Darwin's conscience which began when he devised a naturalistic evolution theory. This conclusion is clear when Darwin said he would "give absolutely nothing for the theory of nat[ural] selection if it required miraculous additions at any one stage of descent" [letter to Charles Lyell, dated October 11, 1859; *Darwin Correspondence*, vol. 7, p. 345; Darwin, Francis (editor). 1888. *The Life and Letters of Charles Darwin*. London, UK: John Murray, p. 210 and John Cobe, 2008, p. 275]. Only a non-theistic explanation would be acceptable—one that had no need for God at any stage of evolution.

The Water Cure

The water cure was then a trendy Victorian spa treatment. Charles Dickens, Alfred Lord Tennyson, Thomas Carlyle, Florence Nightingale, and other well-known British all went there for therapy (Price, 1981). The treatment basically involved use of a lot of very cold water, both drinking and bathing in it; in short, keeping patients as internally hydrated and externally moist as possible for as long as possible (Priessnitz, 1842, pp. 20–30).

The cold-water cure evidently was originated by Vincenz Priessnitz, a poor farmer considered to be the founder of the modern hydrotherapy movement. Priessnitz got the idea from observing an injured deer return several times to a cold spring to bathe his wounds (Kang and Pedersen, 2017, p. 174). When Priessnitz suffered from crushed ribs as a result of an accident, the local doctor wrapped his chest, causing even more pain. Among the cures Priessnitz attempted to employ to relieve the pain was the water cure, which was the only one he felt was successful.

Priessnitz believed that the body naturally healed itself, but at times needed outside help (Kang and Pedersen, 2017). He concluded that rapid changes in temperature that were part of the water-cure treatment allowed skin pores to open, evacuating toxins from the blood. Priessnitz's own experience motivated him to begin treating others. As time went on, he modified his treatment protocol, which did not involve drugs or even herbal medicines. He believed the extreme conditions caused by major water temperature variations disturbed the body balance of so-called humors which, in turn, facilitated healing.

Priessnitz also required his patients to add strenuous exercise to their daily regimen, and sometimes required his patients to fast. The food served was bland and mostly hard, and large quantities of water, a minimum of twelve glasses and as many as thirty glasses a day, were the only drink allowed. According to Metcalfe, the publicity from several lawsuits against Priessnitz failed to shut down his spa treatment center (Metcalf, 1898, chapter 2).

Actually, the publicity encouraged others to attempt his treatment and his treatment system made Priessnitz a famous and wealthy man, which helped his protocol to spread to other parts of the world (Kang and Pedersen, 2017, p. 175). Priessnitz personally relied totally on his cold-water cure when he became sick or needed medical attention, and he refused to see a physician for the rest of his life. He died at the young age of 52.

Darwin Attempts the Water Cure

In March of 1849, after every other medical treatment Darwin tried from England's leading physicians failed to cure his nearly lifelong incapacitating health problems, he decided to take a chance on the so-called "Water Cure" (Colp, 1977, p. 39). Darwin took his wife, their six children, a governess, and servants to Malvern in order to experience the cold-water treatment based closely on Priessnitz's program (Colp, 2008, p. 45). Darwin first learned about the treatment from friends, and then read Dr. Gully's best-selling book *The Water Cure* before he went to Malvern.

This "treatment" was administered by a former medical school classmate of his, Dr. James Manby Gully. Gully had not originally planned to practice medicine, but when the family's Jamaica coffee plantation failed because their slaves gained their freedom in 1834, Gully had no choice but to see patients full-time. In the 1840s, he opened a resort in Malvern, Western England, based closely on the technique developed by Priessnitz (Gully,1849; Wilson, 1843). The specific treatment used frequent very cold water baths, drinking copious amounts of water, exercise, and a restricted diet; the details varied depending on the patient and Gully's experience with variations of the protocol. The details of the treatment Darwin received rely on Darwin's correspondence and his wife's diaries because, as far as is known, any notes Gully made on the treatment he used on Darwin have not survived (Ullman, 2009).

Dr. Gully diagnosed Darwin as suffering from a form of indigestion called "nervous dyspepsia," a common diagnosis for the many patients Dr. Gully treated. Gully also diagnosed Darwin with "chronic excess and congestion of blood in the nutritive blood vessels … of the stomach" (Colp, 2008, p. 45). This diagnosis illustrates how much of the practice of medicine at the time was based on suppositions about physiological mechanisms rather than experimentally-derived evidence.

Darwin's treatment in Malvern began as an ordeal for the whole family. After a good night's sleep in a local villa, the Darwin family woke at 5 a.m., the servants wrapped Darwin in wet sheets, and then doused him with buckets of very cold water. This was followed by a long group hike that included plenty of hydration breaks at various wells and mineral springs along the way. Back at their cottages, breakfast consisted of biscuits and more cold drinking water. The rest of the day consisted of Malvern's main activity, namely bathing and drinking water.

Dr. Gully supported a theory that disease is caused by a faulty blood supply to the internal viscera. This condition was treated by hydrotherapy which Gully believed drew blood *away* from the inflamed inner organs and toward the skin, providing relief (Gully, 1849). Dr Gully also claimed that he had "successfully treated cases of long-standing dyspepsia with a daily treatment of hydrotherapy … [and] the hygienic water treatment seldom, if ever, fails to cure it" (Colp, 2008, p. 45). Gully also stressed cleanliness, which was not widely practiced in his day. Resolution of infection by improved hygiene, not the cold-water therapy, may be a confounding reason why some of his patients got better.

Between cold-water baths, Darwin might have a refreshing cold-water enema or be strapped into a wet abdominal compress called a "Neptune Girdle."

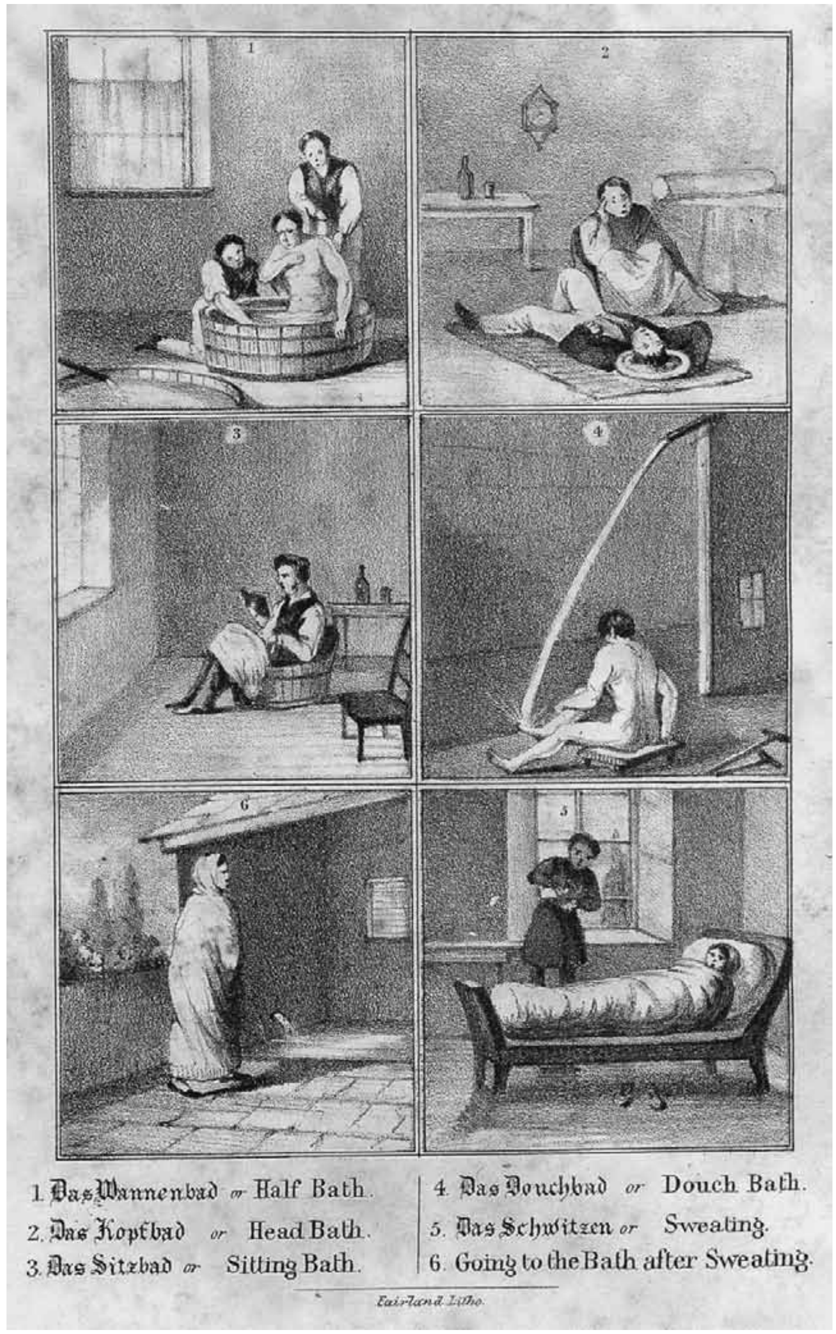

Figure 3. The Water Cure Treatment described in German and English.

Baths usually lasted until dinner, which often consisted of boiled mutton, fish, and some local mineral water. Foods strictly avoided included sugar, butter, spiced tea, and bacon. The long day ended with a very tired Darwin crashing into his very dry bed (Kean, 2012, p. 289).

After four months of this hydro-sanitarium, Darwin vomited less at first, then remained vomit free for months, concluding ,"I feel certain that the Water Cure is no quackery" (Letter to Hooker, dated March 28, 1949, Correspondence, vol. 4, p. 227). He soon felt so good that he was able to hike seven miles a day without problems. He claimed he now felt better than at any time since his *Beagle* trip. Previously, he sometimes had a difficult time walking more than a city block. When Darwin left Malvern, he sent a letter to his cousin. After noting that Dr. Gulley "must be making an immense fortune," Darwin declared his vomiting and other health problems were "absolutely cured" (Letter to William Darwin Fox, dated July 7, 1849, Correspondence, vol. 4, p. 246).

Back at Down House, he continued the Water Cure in a slightly less rigorous form, even constructing a sweat lodge that he used each morning, followed by a polar bear plunge into a 640-gallon cistern he had constructed and filled with very cold (40°F) water (Kean, 2012, p. 289). Darwin faithfully followed this arduous treatment for months. Unfortunately, when Darwin returned to his goal of working on his theory designed to murder God and Christianity, his poor health soon returned, supporting the theory that his goal of murdering God was an important factor in his illness.

It may be that the four-month vacation while living in a very different environment at the spa had a very beneficial effect on Darwin, as vacations often do. Bathing in frigid water and the other aspects of the Water Cure could have diverted his mind from concerns about his evolution theory to the cold he experienced. This is exactly how transcutaneous electrical nerve stimulation (TENS) is theorized to work, namely by diverting one's mental focus to the sharp pain produced by the machine's electricity away from the dull pain produced by the back pain (Johnson and Martinson, 2007). The fact that his major health problems plagued him for most of the rest of his life also supports the importance of his work on evolution as a major factor in causing his health problems.

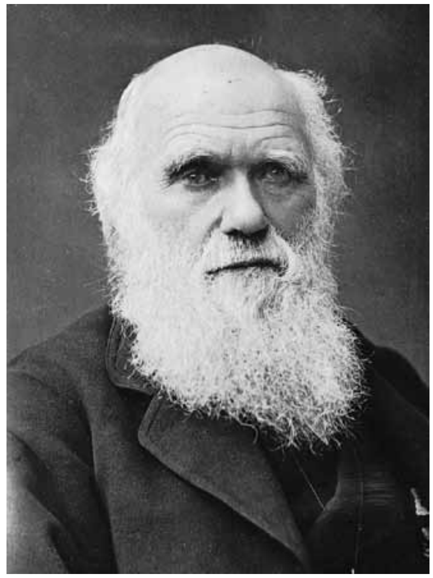

Figure 4. Charles Darwin shortly before he died at the age of 73. The picture was taken in 1881; he died in 1882. He looked much older than 73. From Wiki Commons. Public Domain.

The beneficial results of the treatment without any experimental connection to gastrointestinal physiology indicate that Darwin's nearly lifelong debilitating health problems were mostly psychological. When his ten-year-old daughter Anne became ill, she was also taken to Malvern for the water treatment. However, this did not cure her malady, ending in her death, most likely from tuberculosis caused by *Mycobacterium tuberculosis* (Colp, 2008, pp. 51–52; Keynes, 2001, 219).

The claim that cold-water therapy could treat injury and illness discouraged many a person from seeking proper medical treatment and to instead rely on the water cure. Drinking plenty of water, especially in hot climates, frequently exercising, and daily bathing, are all well-known practices contributing to better health. Conversely, as a cure-all and to eschew medical treatment as Priessnitz and many of his followers advocated, the practices can be lethal if taken to an extreme (Kang and Pedersen, 2017, p. 183). Darwin also became disillusioned with Dr. Gully's acceptance of clairvoyance, as well other ideas with which he disagreed. These two events caused Darwin to abandon the Water Cure. He soon developed all of his previous symptoms, including stomach problems, dizziness, vomiting, and fainting.

Darwin later tried electrical shock therapy, various herbs, phrenology, and other treatments, with little improvement. Both Darwin and those who studied his health problems noted that his illness was strongly correlated with certain stressful events in his life which likely only aggravated the major source of his stress—his guilt over murdering God (Barloon and Noyes, 1997, p. 138; Desmond and Moore, 1991, p. 456). We know that many of his stressful events were short-lived, unlike the underlying stress caused by guilt, and if he avoided them, he was able to keep from increasing his stress significantly above his usual level.

This fact leads to the conclusion that his open goal of murdering God was a significant catalyst in his health problems, no doubt due to internal conflicts and guilt. His guilt is illustrated by his mixed feelings towards the Church, exacerbated by the fact that his wife was an active, devout Christian. Darwin was very generous financially with the local church of England that his wife and children attended. Unfortunately, later in life, most or all of his children became atheists or agnostics, and many were involved in the eugenics movement (Blaney, 2011).

Darwin initially called the Tierra Del Fuego natives he encountered during his five-year voyage on the HMS *Beagle* the lowest human race, actually a link between the apes and man. He added that there was zero possibility that this race of people could be civilized. Darwin later learned that a trusted missionary friend of his, who also was a part of the *Beagle* voyage, had considerable success in converting many of the natives to civilized Christians. This and other experiences influenced him so greatly that, until the end of his life, Darwin regularly supported that specific mission.

Conclusions

I agree with Darwin's wife, Emma, who diagnosed her husband's health problems as "always affected by his mind" (Colp, 2008, p. 51). Professor Hopper opined that Darwin establishing the idea of evolution changed the world by negating the reason that most people believe in God. Destroying the evidence for God as the creator was, in Darwin's words, like confessing a murder, namely the murder of God. This, of course, produced enormous internal conflicts in Darwin's mind that took a major toll on his health. He died of congestive heart failure at age 73, a comparatively young age for a British upper class male (Hopper, 2009, p. 29).

No evidence exists that his heart caused his lifelong stress, but his health problems likely contributed to his heart failure. Lastly, the facts are that Darwin enjoyed very good health until the time he began working on his theory of origins in his 30s, but then was largely an invalid thereafter, except when his mind was diverted while indulging in the cold-water cure.

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eKINDS Project Paper

Strategies for More Clearly Delineating, Characterizing, and Inferring the Natural History of Baramins I:

Establishing Baraminic Status, with Application to the Order Galliformes (Class: Aves)

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Abstract

Baraminology is the study of created kinds, or baramins. A major goal of this branch of creationary science is identifying which species known today descended from a common kind of organism created at the beginning, as described in the opening chapter of Genesis. While numerous baramins have been tentatively identified, more work needs to be done to better establish and characterize these baramins. Here, using the galliform birds, or landfowl, as our example, we discuss and illustrate strategies that include examination of biblical data, tracking down hybridization data, opportunities for further studies using statistical baraminology, and incorporating rapidly accumulating molecular data. In the process we not only present further evidence substantiating that different families in the avian order Galliformes belong to a single baramin, but highlight future research opportunities that could further our understanding of this baramin. In future papers we will explore the diversity and relationships within this group and attempt to understand key aspects of their natural history from a biblical perspective.

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Introduction

One of the goals of baraminology is to identify species that are truly related because they descended from the same created kind, or baramin (Genesis 1:11–12, 21–22, 24–25). This information is valuable for a variety of reasons. It may allow detailed inferences about the design of organisms as it relates to their ability to reproduce and fill the earth. For example, it can help us discern what characteristics (coat color, beak size, etc.) were designed to vary, and to what extent. This can help guide investigations to identify the underlying causes of changes in these characteristics (Lightner, 2016). It may also help us as we attempt to delineate other baramins. Still further, it also allows specific inferences about the natural history of the kind.

Currently, while numerous baramins have been tentatively identified (Wood, 2016), there are no baramins that can be considered well-established, much less well-characterized from a biblical perspective. Lightner (2013) produced an estimate of 196 avian "ark kinds" based on available evidence, including hybridization and taxonomic placement. Independently, Ahlquist (unpublished) arrived at "around 216" avian baramins from a preliminary survey of the DNA X DNA hybridization data of Sibley and Ahlquist (1990).

In her paper, Lightner (2013) stressed the need for more research to clearly delimit baramins, and also emphasized that "considerable research needs to be done to evaluate the types of diversity typical within kinds and suggest the type of differences that may help delimit the boundaries of a kind." (p. 465). Toward that end, we will re-evaluate one putative baramin, augmenting Lightner's study with newer molecular data in combination with a re-evaluation of traditional avian taxonomic characters from a baraminological perspective. These data will be presented in greater detail in Part III of this series. In the process, we hope to lay out a strategy that will encourage and guide future baraminologic studies.

The "landfowl kind" tentatively identified by Lightner (2013) is equivalent to the order Galliformes of traditional classifications. This well-studied order comprises the chickens, pheasants, turkeys and allies, a total of nearly 300 species placed in five families (Gill and Donsker, 2019). As their name suggests, these birds have been most successful in colonizing open areas, grasslands, steppes, and even deserts, but they are found in nearly all terrestrial habitats including rain forests. The cracids are highly arboreal. Grouse live in boreal and Arctic regions. Landfowl are worldwide in distribution, exclusive of New Zealand (one extinct species), much of Polynesia, and Antarctica. A few have reached oceanic islands. They have not been successful in marshlands and the littoral (shore) zone. A more technical summary of the characteristics of landfowl appears in Appendix 1.

Here, we review the different lines of evidence important to establishing the baraminic status of the group; this includes lines of evidence not yet documented in the creationist literature. In part two of this series we will review the members of the group, highlighting some important diversity displayed within the baramin. Later in the series we evaluate relationships between the various members, and finally suggest possible routes for colonization by landfowl following the Genesis Flood.

Lines of Evidence

While some creationists may desire a "silver bullet" or single tool to assign organisms to a specific baramin, such a tool does not, and likely never will, exist. Instead, a more detailed and holistic approach is necessary to confidently assign organisms to a baramin, while delimiting the baramin as well. This may seem cumbersome to some, but we view it as an exciting, God-given challenge. By studying multiple aspects of organisms, we come to understand them better, and are able to more fully appreciate the beauty, marvelous design, unity and diversity God has placed in His creatures. Additionally, from a scientific perspective, multiple lines of evidence pointing to the same conclusion will demonstrate the robustness of a biblical model in biology.

Biblical Evidence

Scripture provides some information that applies to avian kinds in general. For example, flying creatures were not only created according to their kinds, but also blessed and instructed to fill the earth (Genesis 1:20–22). This suggests that birds were designed to adapt to a wide variety of habitats, and a cosmopolitan distribution is expected to be common within created kinds. There may be some deviation from this, given that the world is cursed (Genesis 3:14–19). Yet God continues to uphold the world (Colossians 1:16–17), and a frequent cosmopolitan distribution of baramins would reflect His intent that the world be inhabited (Isaiah 45:18).

A second important detail involves the historic Global Flood. For most creatures on the Ark, only a single pair was preserved. Yet clean animals were preserved by sevens (Genesis 6:18–7:10). Where clean and unclean animals are discussed in more detail, it appears there were more clean birds than land animals. In fact, unclean birds are specified in a relatively short list. No landfowl are included in that list (Leviticus 11; Deuteronomy 14). Thus, clean birds, including landfowl, potentially carried more genetic diversity through the population bottleneck created by the Flood than most kinds. This doesn't mean all of it contributed to what we see today, however, because some of these birds would have been used for sacrifice or food, potentially before they had offspring (Genesis 8:20; 9:3).

The Bible does specifically mention some members of the Galliformes, both domestic and wild. A detailed examination has been presented by McConnachie (2007), and McConnachie and Brophy (2007, 2008). The results indicate the importance of these species at the time they are mentioned, but do not provide sufficient information to infer relationships within the landfowl or their relationship to other groups.

Hybridization

The existence of hybrids is generally regarded as the unambiguous indication that two species belong to the same kind (Marsh, 1947; Wood and Murray, 2003; Lightner et al., 2011, *inter alia*). Unfortunately, for many groups, hybrid data are lacking—whether from wild or captive birds. A few groups—notably the landfowl, waterfowl, hummingbirds, birds of paradise—contain numerous records of hybrids occurring in the wild, interspecific as well as intergeneric, that aid in assessing relationships. In wild birds, hybridization occurs most frequently in groups that have a polygynous mating system or others in which the pair bond is very short. In some cases, the pair-bond lasts no longer than copulation, although a female may spend some time in assessing the "best" male with whom to mate. The classic paper on these phenomena is Sibley (1957).

In some avian groups—including landfowl, waterfowl, pigeons, finches and tanagers—interest in aviculture has provided the source of many birds kept in captivity. Aviculturists have a monetary incentive in producing crosses among diverse taxa in hopes of obtaining colorful or otherwise interesting birds for the trade. This in turn has benefited the study of baraminology. The "scorecard" of the enterprising aviculturist is the unusual species he has managed to breed in captivity; it is even more rewarding if he can make viable crosses between exotic species. Unfortunately, aviculturists are not often scientists, and their successes are not published, at least in periodicals that are regularly searched by ornithologists. The principal sources of bird hybrids are the compendia by Gray (1958) and McCarthy (2006). They list hybrids connecting four (Phasianidae, Numididae, Odontophoridae, and Cracidae) of the five landfowl families.

The possibility of hybridization between cracids and other landfowl invites further comment. Gray (1958) as well as McCarthy (2006) listed several interfamilial hybrids involving cracids. They were accepted by McConnachie (2007), McConnachie and Brophy (2008), and Lightner (2013) as evidence for inclusion of the cracids within the landfowl kind.

Although some of the hybrid reports were from old literature and possibly of questionable veracity, Ruschi and Amdon (1959) published evidence of a putative hybrid involving a male guinea fowl (*Numida meleagris*) and a female guan (*Penelope superciliaris*), and provided a photograph of the bird. The photograph, as printed, is small and simply looks like a cracid. In the same paper they noted that Ruschi had observed in his aviaries probable hybrids of a male *Pipile jacutinga* X female domestic chicken (*Gallus gallus*) and a male *Crax blumenbachii* X female *Gallus gallus*.

This evidence was later disavowed by Amadon in a monograph of the Cracidae (Delacour and Amadon 1973, p. 5).

> The Cracidae stand well apart from these other families of gallinaceous birds. Hybrids are known between such diverse types as pheasants, guineafowl, and turkeys, but not between cracids and other galliforms. All reports to the contrary are erroneous, including one (Ruschi and Amadon) to which the junior author was unfortunately a party.

The reasons for this change of attitude by Amadon are not given, perhaps out of deference to his Brazilian colleague. One might surmise that the "open" nature of Ruschi's aviaries combined with inattention to detail may have been factors, but this is conjecture. None of the principals is alive to provide details. Accordingly, Ahlquist wrote to Mary LeCroy and Helen Hays, both long-time employees in the ornithology department of the American Museum Natural History, to see if they recalled any discussions of the hybrids.

Ms. LeCroy responded (*in litt*., July 3, 2016), "I knew nothing about this supposed hybrid guinea fowl x cracid! I mentioned your letter to George Barrowclough [curator of birds]. It surprised him, too, but he did remember that there is a guinea fowl x chicken in our collection." She also said that, to the best of her knowledge, Ruschi's specimens are still in Brazil.

If any of the hybrids have been saved, it would be possible to extract DNA from a piece of dried skin. Given the substantial genetic gap between cracids and other galliforms, even degraded DNA would provide an answer to the bird's parentage.

Ahlquist also wrote to Paul Johnsgard of the University of Nebraska-Lincoln, an authority on waterfowl and landfowl, especially their hybrids. Dr. Johnsgard graciously replied (*in litt*., May 29, 2016) that he could not add to the discussion.

Fortunately, the story does not end in deadlock. The numerous putative hybrids cited by Gray (1958) and McCarthy (2006) seem to fall into the categories of "anecdotes," "hearsay accounts," "unsubstantiated claims," and "ambiguous documentation." The numerous and persistent reports of cracid X phasianid hybrids, however, suggest that such probably exist.

Gunski et al. (2001) report on viable F1 hybrids between *G. gallus* and *Crax fasciolata*. They showed that the 2n chromosome number of *Crax fasciolata* is 88 whereas that of *Gallus* is 78 and that hybrids had 2n = 83. The F1 birds showed differences between the fourth and eighth chromosome pairs as well as the sex chromosomes. Unexpectedly, they were able to obtain viable F2 hybrids with individuals bearing differences in both number and morphology of chromosomes. Thus, the vexing question of cracid X phasianid hybrids has a definitive answer!

Despite the unique breeding system (highlighted in part II of this series), no one has denied the affinities of megapodes to landfowl. Although hybridization occurs among some megapode genera (McCarthy 2006, pp. 39–40), no hybrids are known between them and other landfowl, nor should they be expected, given the genetic distance between them. The absence of hybrid data and these differences are major considerations that have led to some creationists proposing that the megapodes constitute a separate baramin (McConnachie and Brophy, 2008). However, all studies, whether morphological or molecular, attest to a sister-group relationship of megapodes to other landfowl. Part III of this series will summarize and analyze the results of more than two dozen papers from morphology, behavior, ecology, and genomic DNA sequences to hypothesize relationships among all landfowl and to provide a reasonable post-Flood dispersal of the groups around the world.

As valuable as hybrid data are, their lack says nothing about the relationship of different species. In addition to lack of reproductivity opportunity, various other barriers can arise that prevent organisms within the same baramin from being able to hybridize. Biologists recognize five such categories: (1) mechanical isolation in which the reproductive organs are incompatible; (2) temporal isolation in which the breeding seasons are different; (3) behavioral isolation in which the displays, including vocalizations, of species are different; (4) habitat isolation in which breeding localities are not the same; (5) gametic isolation in which sperm and egg are not compatible or where the chromosomal components are so different that a zygote cannot be formed.

For these reasons, other methods have been developed to help assess if two organisms under consideration belong to the same baramin.

Statistical Baraminology

To address the need to identify baraminic status even in the absence of useful hybrid data, a number of statistical baraminology tools have been developed (reviewed in Wood, 2006). Generally, datasets assembled by scientists doing cladistic studies are used. Both baraminic distance correlation (BDC) and multidimensional scaling (MDS) have been used on datasets for various bird taxa (Wood, 2005, 2008). The interpretation of the results is not always clear, especially when the datasets do not appear to be holistic. For example, some of the avian datasets were limited to characters based on the syrinx. A study specifically dealing with landfowl suggested there was discontinuity between taxa that are known to have hybridized (McConnachie and Brophy, 2008). We agree with these authors that this emphasizes the need for multiple lines of evidence to establish baramins. We also suggest that the emphasis should be on congruence—not consensus—among the data. This is given in the flow chart below, but the principles are meant for data other than molecular sources. As we will explore in Part III of this series, the ideal is congruence among data sets. Congruence, as opposed to conflict, is achievable more often than frequently anticipated.

A major source of anatomical data on birds has been produced by Livezey and Zusi (2006), but has yet to be used in statistical baraminology. The authors have identified and described 2954 characters, evaluated the character states for each, and analyzed them for 185 exemplar taxa using cladistic techniques. Their monograph features 36 pages of drawings showing the essential skeletal features and includes a CD with the complete 185 X 2954 data matrix. Separately, they have published the taxonomic results from their analyses (Livezey and Zusi, 2007).

Since the authors did not sample species extensively in any group, baraminologists will need to seek out skeletons and do some original research. This is true especially for the songbirds (Passeriformes) which tend to be relatively uniform overall and offer the investigator fewer characters. The baraminologist seeking to work with any passerine group may well break new ground in discovering suitable characters. Potentially, such an undertaking could be quite valuable.

The characters utilized by Livezey and Zusi are mainly osteological; therefore, they can be employed without having extensive training in anatomy. One would need to become familiar with the avian skeleton, preferably through an instructor; obtain access to a museum collection; have a binocular dissecting microscope, ideally equipped for photography; and exercise appropriate care with fragile bird bones.

We suggest a flow chart for such a study.

1. Choose a group and visit a museum or assemble material via a loan.
2. Determine which characters may provide suitable signal for relationships within the group of interest.
3. Code the characters appropriately.
4. Analyze the data using standard baraminological methods, or
5. Better yet, devise an original analytical protocol and write the code for it.

This involves a good deal of work, but the enterprising investigator could produce a study of considerable significance.

Recently, another statistical tool has been developed that uses molecular data (O'Micks, 2017). This involves comparing proteome data using an all-versus-all comparison. This technique demonstrates clear discontinuity between humans and all simians (apes and monkeys; Lightner and Cserhati, 2019). Currently, the major limitation of this technique is the lack of full proteome data from enough species to make good comparisons on taxa of interest. For example, Lightner and Cserhati (2019) include four species from Galliformes and two from Anseriformes in their analysis. However, this only includes species from three of the five galliform families. Further, when only two species group together, as in Anseriformes, one cannot calculate a p value. Thus, there is insufficient data to make a strong case for Anseriformes being a separate kind, rather than just a distinct lineage within the same kind as the galliform birds. When both taxa are better represented, this technique may provide a much clearer picture.

DNA Evidence

A major goal of the papers in this series is to bring together the body of molecular evidence, especially that from DNA, and to synthesize it in a context that is suitable for determining avian baramins and inferring their natural history. We understand that God made DNA in correspondence to the way birds live. In other words, given a God of organization, we expect songbirds like a robin and a sparrow to have more of their DNA in common than either would with a duck. Take away the time scale and evolutionary (i.e., *universal* common ancestry) assumptions, and we expect to derive a network in two (or, really three) dimensions of how the realm of birds is organized.

After decades of work in molecular systematics, Dr. Ahlquist (co-author of this paper), provides the following personal perspective.

> From the early days of electrophoretic comparisons of protein systems, such as egg-white, we were aware that the ultimate source of genetic information for determining relationships among birds lay in the DNA itself. In the meantime, we had to be content with indirect methods. The elucidation of the genetic code (amino acid codons) was proceeding, the determination of amino acid sequences of individual proteins was in its infancy, and Robert Holley had not yet published the nucleotide sequence of the first yeast alanine transfer RNA.
>
> In our naiveté, we assumed that reading off the genetic message for a bird would be not much more difficult that reading this sentence. Repeated DNA had not yet been discovered, nor had introns, transposable elements, and a variety of sequences that were initially (and erroneously) termed "junk" DNA. Once the group at the Carnegie Institution in Washington applied DNA hybridization in microorganisms, we jumped on the bandwagon (1964) only to be defeated by the extensive existence of repeated sequences, the pitfalls of radio-labeling avian DNA in tissue culture, and a host of other technical problems. When we returned to DNA hybridization in 1974—after a decade of mixed success using multiple electrophoretic procedures, immunological methods, two-dimensional peptide mapping, and amino acid composition of peptides—most of the technical difficulties had been worked out to the point where birdwatchers could apply the method.
>
> At the time it was feasible to sequence DNAs, although the available methods precluded the investigation of large numbers of taxa. We were interested in the "big picture" of avian relationships and chose DNA hybridization as the means toward worldwide coverage. As a result, we were excoriated for using phenetic data (by the cladists) and pilloried for not assembling complete data matrices (not enough time). We were making a minimum of 125 comparisons per week, sometimes as many as 250. That would have been impossible with sequencing methods. Given over 30 years of 20/20 hindsight and retrospection, we would have missed many facets of bird relationships had we done otherwise. Of course, we made mistakes, but others were stimulated to take up the cudgel.
>
> Some sought to augment our work with better techniques (sequences) and additional taxa; others strove to prove us wrong at any cost. In the end it makes little difference, for more and better data were produced, and they continue to be gathered at an exponential rate. The work undertaken by ourselves, by Herbert Dessauer on reptiles at Louisiana State University Medical School and Morris Goodman on primates at Wayne State University opened the floodgates for a generation of investigation.

The use of DNA turns out to be not so simple as reading off a sequence of nucleotides. Over the past several decades, scientists have discovered a variety of epigenetic factors that, in effect, change the meaning of the original sequence. In this case the Greek prefix επί- means "over" or "beyond" and can refer to factors that modify, turn off, or change the expression of a gene, apart from the sequence itself. These epigenetic factors are by no means well understood, but they may have played a role in the rapid diversification of species in the years following the Flood.

DNA sequence data are being generated rapidly. Our burden is to synthesize the mass of these data relative to the definition of baramins. This brings us to the task of how to accomplish that goal. Essentially, successive approximation plays a pivotal role in the process.

What follows is a flow chart employing the same strategies that Sibley and Ahlquist used implicitly or explicitly in their previous work. Part III of this series will further address the relevance of this flow chart wherein we apply the principles to numerous studies that have been published on landfowl.

It is interesting to note that little is said about the analytical procedures used by experimenters. Each lab has its own preferred method of analysis. To argue over which methods are better will produce a Gordian knot tangential to what we need to accomplish. For the most part, we leave the statistical debates to those who have the time and expertise to engage in them.

1. A new study of DNA sequences can be expected to produce several results. (a). Most of the clusters of allegedly related species will be similar to those produced during the first 150 years of avian systematics. (b). Some of the results will initially be contrary to conventional wisdom but upon further reflection will be reasonable. (c). A few suggestions will be greeted by such terms and phrases as "outlandish," "impossible," "make no sense at all," and the like.
2. Ideally, other labs will have produced data on the same group(s). Likely, they will include the sequences of different genes, a different array of taxa, and different analyses. Such studies should yield several to many clusters containing approximately the same species. These examples of congruence give one confidence in reality of such clusters. If the "outliers" or "difficult" taxa appear in these studies, this suggests that we need to determine if there is other evidence in support.
3. DNA data do not exist in a vacuum. It is our contention that if the clusters of species, as suggested by the molecular evidence, are real, then there will be evidence from other sources in congruence, or agreement. At this point, the search for additional evidence will extend to all attributes, including but not limited to morphology, behavior, song, ecology, life history, etc. Some of these characters are not quantifiable, and a few border on being almost anecdotal, but years of experience as a taxonomist teach that "good data, like nuggets of gold, are where you find them."
4. Most clusters will emerge as being unambiguous. Most problem taxa will be found to be not so problematic after all. The important point is that we assemble as much evidence as reasonable and not rely on one or a few characters. Since our search is heuristic, it is unlikely to be biased in favor of DNA sequences wherein there are "thousands" of characters. In this respect our conclusions also will be holistic. Central to the above discussion is an example, and we provide such in our discussion of the relationships of the Rock Partridge (*Ptilopacus petrosus*) as outlined in a subsequent paper. Finally, a few species will remain recalcitrant until more and better data are found. We will list these as *incertae sedis*.
5. DNA sequence data are often available as appended or supplementary materials with a published paper. They are also accessible via GenBank. Therefore, baraminologists can reanalyze them using algorithms that are not dependent on evolutionary assumptions, or a molecular clock. Further, we challenge a statistically astute investigator to develop new computer methods to meet these needs.

Other Characters

Many characteristics of birds are not quantifiable, hence are not accommodated by statistical barminology. These include, but are certainly not limited to, behavior, song, ecology, and life history traits. An ornithologist will be aware of numerous subtle features—whether derived from field work or museum specimens—that could indicate or corroborate possible relationships.

Conclusions

Clearly delimiting the boundaries of a baramin is a first and necessary step in the science of baraminology. This cannot be done by applying a single "test," but requires intense study and consideration of additional lines of evidence, even in the better studied groups such as landfowl. More molecular evidence will be provided in Part III of this series, where relationships among landfowl and their natural history is inferred. Evidence from all sources should be considered, including pertinent biblical comments, hybridization data, morphologic and molecular data, and more subtle evidence based on extensive study of the group. In the process, baraminologists will gain a deeper appreciation for awesome patterns and design in God's creatures.

This insight naturally leads to other aspects of baraminologic study. By assessing diversity within a group, we can begin to describe what types of characters vary, and how. We can gain a deeper understanding of how God provided for His creatures to reproduce and fill the earth. This can be extended beyond a morphologic description, as we investigate ecological and molecular aspects that effect such changes. Future papers in this series will explore these areas in more detail as they apply to landfowl, and hopefully spark an interest in other creation researchers to study the awesome works of the LORD in his creation.

For you make me glad
by your deeds, O LORD;
I sing for joy
at the works of your hands.
How great are your works, O LORD,
how profound your thoughts!
Psalm 92:4–5 (NIV)

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Appendix 1. A Definition of Landfowl

Were a non-specialist presented a series of photographs of birds, likely he could correctly identify most, if not all, of the

Landfowl Kind. Asked, however, to define what characteristics led to his conclusions, he would be lost beyond a few generalizations. A skilled bird watcher can identify a flying bird accurately at great distance based on an "overall impression," "Gestalt," or "jizz," none of which can be easily put into words. This is similar to—but less formalized than—the cognitum concept (Sanders and Wise, 2003; Sanders, 2010; Lightner et al., 2011).

The heart of baraminology is discontinuity, especially in a matter as fundamental as the definition of a baramin. Wood and Murray (2003, p. 81) define discontinuity as "a significant difference between two sets of organisms detected in a holistic analysis." A few avian baramins, such as hummingbirds and parrots, can be defined in a sentence or two. Others require a combination of anatomical characters in order to achieve clarity. In some instances, where the principal diagnosis is based on genetic characters (DNA sequences), we seek consistent clusters from the evidence of several to many genes, ideally coupled with a congruent suite of features such as morphology, behavior, ecology, and others.

The determination of traditional morphological characters in systematic ornithology began with Thomas Henry Huxley in the mid-19th century and concluded with the massive *fin de siècle* works of Fürbringer (1888), Gadow and Selenka (1891), and Gadow (1893). In between, many investigators added to the characters which hopefully would be useful in unraveling avian relationships. None was universally successful, so it was the principal contribution of Hans Gadow to derive a list of "about 40" characters which, taken together and appropriately weighted, formed the basis for a technical diagnosis for each group of birds. In a sense Gadow's effort was a precursor to "numerical taxonomy" of the latter half of the 20th Century

The history of these discoveries, as well as the strengths of weaknesses of each character, have been reviewed in detail by Sibley and Ahlquist (1972, 1990). A generation ago, it was obligatory for a serious ornithologist to be able to "translate" any of Robert Ridgway's technical diagnoses. With the movement in biology away from anything traditional, probably fewer than 10% of practicing ornithologists can do so today. Nonetheless, such a diagnosis is critical to achieve an unambiguous meaning of the avian baramins.

Space prohibits the description, drawing, and details for these characters. The reader should consult a classical textbook on ornithology such as Van Tyne and Berger (1959, pp. 21–107, 559–586) or an anatomical compendium such as that edited by Baumel (1993).

We have taken the following from Ridgway and Friedmann (1946, pp. 2–3), condensed, and rearranged it to omit variable characters and eliminated the Hoatzin Kind.

Technical Diagnosis. Landfowl (Order Galliformes).

Terrestrial or arboreal rasorial birds with nares holorhinal, impervious; bill relatively short (much shorter than head) with maxilla vaulted, its tip overhanging that of the mandible, vaulted, not compressed; angle of mandible produced and recurved; rhamphotheca simple. Palate schizognathous; palatines without internal lamina; maxillopalatines not coalesced with each other or with the vomer; quadrate bone double; basipterygoid processes absent but represented by sessile facets on anterior part of sphenoidal rostrum. Sternum deeply 4-notched or cleft with median xiphoid process long and narrow, the internal processes much shorter, and external processes shorter still and bent over posterior ribs, their extremities expanded; coracoids without a subclavicular process and with basal ends overlapping or crossed; 16 cervical vertebrae; ankylosed sacral vertebrae preceded by a free vertebra, this by four ankylosed heterocoelus vertebrae. Hallux always present; deep plantar tendons of Type I (if reaching the hallux proceeding from flexor hallucis longus, not from flexor digitorum longus. Intestinal convolutions of Type V (plagiocoelus); crop present, globular, stomach a gizzard; gall bladder present; caeca large. Aftershaft present; neck without lateral apteria; adult downs on pterylae only. Young ptilopaedic and nidifugous. Distribution cosmopolitan except Polynesia, New Zealand, and Antarctica.

A Flawed Light-in-Transit Argument (from Forty Years Ago)

Max Lorentz*

Abstract

Four decades ago, Akridge (1979) argued in *CRSQ* that energy conservation requires the in-transit creation of light from distant sources. Examination of his argument shows that, besides being flawed on *a priori* grounds, it uses an incorrect prescription for the electric field of a non-static charge; the argument is thus without merit. However, consideration of this argument provides our community with a salutary reminder of the importance of critical self-examination.

Introduction

Working through old copies of *Creation Research Society Quarterly* (in preparation for an article on the history of creationary astronomy) has been a fascinating exercise. The quantity and quality of astronomical data has increased greatly since the *Quarterly*'s inception in 1964, and the nature and sophistication of creationary argumentation has changed accordingly.

In 1979, G. Russell Akridge published a *CRSQ* article arguing for the in-transit creation of light from distant stars (Akridge, 1979). Indeed, the article's title asserts—quite boldly—that in-transit creation of light is "more than a possibility," and the article itself claims that energy conservation actually mandates this conclusion. However, subsequent issues of the *Quarterly* seem to contain neither response to nor evaluation of the argument; the lone exceptions are a brief mention by Morton (1982)—who lauds the paper as "brilliantly argued"—and another by Williams (1990)—who describes it as "a very interesting paper."

Whether brilliantly argued or not, the paper is clearly of interest because of what is at stake. If, as Akridge contends, the laws of physics demand in-transit creation of light, then the light-travel time issue simply dissolves—as does (arguably) the fundamental reality of most of astronomy. If, on the other hand, it turned out that a straightforward calculation could falsify Akridge's claim, then the article's appearance in *CRSQ* (after peer review) would be a potential embarrassment to those of us who believe in a recent creation (albeit a minor embarrassment after the lapse of forty years)—in which case, the proper recourse would be to correct the invalid claim. The occasion would also serve as a reminder of the need to exercise care in the arguments we frame, lest we inadvertently give secularists an opportunity to mock the truth. (They will indeed mock regardless—for naturalism is fundamentally presuppositional—but we should not by our own negligence hand them additional occasions to do so.)

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It is thus worthwhile, even after the passage of four decades, to consider the validity of Akridge's argument. If it is valid, then it is worth rescuing from the obscurity into which it has fallen. If, on the other hand, the argument is invalid, then it is worthwhile to use its flaws as an occasion for self-reflection. In pointing out its flaws, the goal is not to disparage a brother in Christ (who is now with the Lord) but rather to pursue the truth and to follow the biblical mandate to test all things (1 Thessalonians 5:21).

Thus, in the following sections we first summarize Akridge's argument and present some preliminary considerations. We then perform a basic electrodynamic calculation to evaluate the argument's merit, and we close with some reflections on the importance of self-evaluation to our community. This article assumes some familiarity with classical electromagnetic theory; Appendix A provides a brief review of Maxwell's Equations and the Dirac delta function. In addition, this article does not seek to address (or take a position on) in-transit creation of light *per se*; its focus is specifically Akridge's argument and its implications.

Overview of the Argument

Akridge's argument is easy to state: after the initial creation of a charge, its electric field **E** must propagate outward at the speed of light. Thus the field will occupy an increasing volume of space with the passage of time. However, the energy U of an electromagnetic field depends on $E^2 + B^2$, integrated over all space (B being the magnetic field strength, which in this case vanishes). Using the standard expression for the electric field of a static point charge, Akridge argues that as the field expands and occupies more volume, its total energy will increase as well; therefore he claims that the expanding field violates energy conservation.

Hence, Akridge concludes that the electric fields of all charged particles must have been created at the same instant as the particles themselves; furthermore, these fields (rather than expanding) must at the moment of their creation have extended throughout all of space. Thus, since light consists of electric and magnetic fields, the light of all luminous bodies must have been created (throughout all of space) at the instant the bodies themselves were created. Therefore, he claims, the light from distant stars was created in transit, and the long ages inferred from distant starlight are not problematic to a young-earth position.

Evaluation

A priori considerations

It should be clear at the outset—before performing any calculations—that something is wrong with this argument. For instance, pair production (of an electron-positron pair from a photon, $\gamma \rightarrow e^{-}+e^{+}$) is a common occurrence in high-energy physics; it regularly creates positive and negative charges *de novo* (while conserving net charge). And though the fields of the new particles will almost completely cancel out (their charges being equal and opposite), the cancellation will not be perfect at any time after their creation, simply because the particles do not occupy the same positions in space. Hence, if Akridge's argument were sound, these newly created fields would simultaneously spring into existence throughout all of space—whereas in reality, the fields propagate with the speed of light.

In addition, if energy conservation requires simultaneous creation of electric fields throughout space, then energy conservation is inconsistent with special relativity. For, by relativity of simultaneity, the field creation can be simultaneous in only one set of inertial frames, and thus (were Akridge correct) energy could be conserved in those frames only. But in fact Maxwell's equations provide a Lorentz-invariant theory which guarantees conservation of energy in all inertial frames.

Furthermore, the argument makes some significant assumptions. For instance, even if we grant the simultaneous creation of these fields, on what grounds would we expect them to oscillate, as they must do in order to constitute light? Why would the fields not remain static until the motion of the charges disturbs them? Or, if the fields are not static, why would they not be randomly fluctuating—given that they are causally disconnected from the charges that (somehow) are responsible for generating them? And even if (somehow) the fields were to oscillate and propagate as light, why would this light encode an entire coherent virtual history?

These problems signal the existence of a fundamental flaw in the argument itself; we now turn to an examination of that flaw.

Calculating the electric field

Akridge's error lies in his equation for the electric field of a non-static charge. He begins with the unobjectionable fact that the strength of the electric field r units distant from a static charge q is $E(r)=q/4\pi\epsilon_0 r^2$ (where ϵ_0 is the permittivity of free space). Akridge then assumes that the field of a newly created charge is exactly like the field of a static charge except for being truncated (after time t) at a radius ct (where c is the speed of light). In other words, he assumes that the field strength at time t after the creation of the charge q is

$$E(r,t) = \begin{cases} \dfrac{q}{4\pi\epsilon_0 r^2} & \text{if } r < ct \\ 0 & \text{if } r > ct. \end{cases} \tag{1}$$

Equation 1 is the prescription employed by Akridge (in the fourth paragraph of his article) for the electric field of a newly created charged particle. If this prescription is correct, then the remainder of his argument follows.

However, reference to standard electrodynamics texts quickly reveals that Equation 1 is *not*, in fact, the correct prescription for the electric field of a varying charge. Although the electric potential V does behave in such a manner, the electric field **E** does not. (See, for instance, Griffiths, 1999, pp. 423–424, or other standard electrodynamics texts.) Ironically, Akridge's own Appendix A demonstrates that the expression in Equation 1 describes not the creation of a simple point charge but rather the outward propagation of a shell of charge. He does not seem to notice the contradiction between this result and the rest of his paper.

To calculate the true field of a varying point charge, we should instead begin with a time-dependent charge density $\rho(\mathbf{r},t)$; we can then calculate the resulting time-dependent potential $V(\mathbf{r},t)$, the gradient of which yields the electric field $\mathbf{E}(\mathbf{r},t)$. Alternatively, one could use Jefimenko's equations (see, e.g., Griffiths, 1999), which directly link the electric and magnetic fields to the charge configuration $\rho(\mathbf{r},t)$ and current density $\mathbf{J}(\mathbf{r},t)$. It is this approach which we here take. Jefimenko's equation for the electric field is

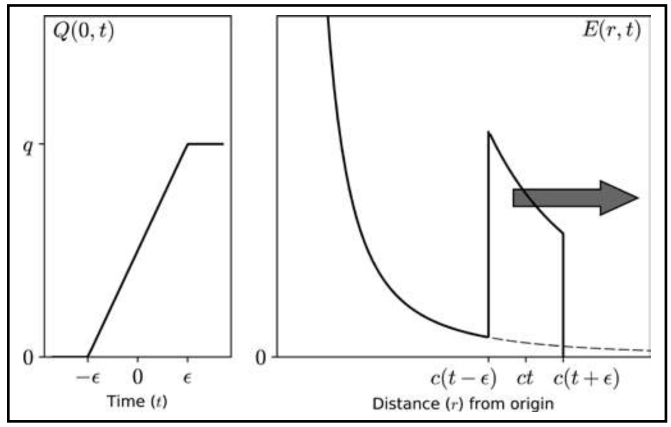

Figure 1. Left panel: The rise of a point charge at the origin (Equation 4); to avoid discontinuities, we assume a linear rise from 0 to q over a time period of 2ϵ. Right panel: The magnitude E (Equation 5) of the electric field at a given time t, as a function of distance from the origin. The dashed line shows the electric field of a static charge; as time increases, the "spike" about $r=ct$ propagates to the right and diminishes in size so that the field approaches the static limit. Compare this—the true field configuration—with Equation 1, which is assumed by Akridge (1979) and lacks the spike.

$$\mathbf{E}(\mathbf{r},t) = \frac{1}{4\pi\epsilon_0}\int\left(\frac{\rho(\mathbf{r}',t_r)}{|\mathbf{r}-\mathbf{r}'|^3}(\mathbf{r}-\mathbf{r}') + \frac{\dot{\rho}(\mathbf{r}',t_r)}{c|\mathbf{r}-\mathbf{r}'|^2}(\mathbf{r}-\mathbf{r}') - \frac{\dot{\mathbf{J}}(\mathbf{r}',t_r)}{c^2|\mathbf{r}-\mathbf{r}'|}\right)d^3r', \tag{2}$$

where the retarded time $t_r=t-|\mathbf{r}-\mathbf{r}'|/c$ enforces the finite propagation speed of disturbances in the field. The corresponding equation for the magnetic field is

$$\mathbf{B}(\mathbf{r},t) = \frac{\mu_0}{4\pi}\int\left(\frac{\mathbf{J}(\mathbf{r}',t_r)}{|\mathbf{r}-\mathbf{r}'|^2} + \frac{\dot{\mathbf{J}}(\mathbf{r}',t_r)}{c|\mathbf{r}-\mathbf{r}'|}\right) \times \frac{\mathbf{r}-\mathbf{r}'}{|\mathbf{r}-\mathbf{r}'|}d^3r', \tag{3}$$

where μ_0 is the permeability of free space.

So let us begin by modeling the creation of a point charge q at the origin. We shall work in the rest-frame of the charge so that the current density **J**—and thus, by Equation 3, the magnetic field—vanishes. (See below for additional discussion of currents and magnetic fields in this situation.) We shall also avoid unnecessary discontinuities by positing that the creation of the charge occurs, in a linear fashion, over the time span $-\epsilon<t<\epsilon$; later, if we wish, we can consider the limit as ϵ approaches zero. Thus, the time-dependent charge distribution giving rise to the electric field is (see Figure 1)

$$\rho(\mathbf{r},t) = \begin{cases} 0 & \text{if } t \leq -\epsilon \\ \frac{q}{2}\left(\frac{t}{\epsilon}+1\right)\delta_D(\mathbf{r}) & \text{if } -\epsilon < t < \epsilon \\ q \cdot \delta_D(\mathbf{r}) & \text{if } t \geq \epsilon, \end{cases} \tag{4}$$

where $\delta_D(\mathbf{r})$ is the three-dimensional Dirac delta function (see Appendix A). Next, application of Equation 2 to the distribution in Equation 4 yields (see Appendix B for details) the following electric field:

$$\mathbf{E}(\mathbf{r},t) = \begin{cases} \dfrac{q \cdot \hat{\mathbf{r}}}{4\pi\epsilon_0 r^2} & \text{if } r \le c(t-\epsilon) \\ \dfrac{q \cdot \hat{\mathbf{r}}}{8\pi\epsilon_0 r^2} \cdot \dfrac{t+\epsilon}{\epsilon} & \text{if } c(t-\epsilon) < r < c(t+\epsilon) \\ 0 & \text{if } r \ge c(t+\epsilon). \end{cases} \tag{5}$$

If we now compare Equation 5 to the (incorrect) prescription of Equation 1, we see that the essential difference is a "spike" in the field (see Figure 1) produced during the charge creation. It is this spike (from the $\dot{\rho}$ term in Equation 2, and absent in Akridge's analysis) which maintains conservation of energy once the charge has been created.

We can explicitly verify energy conservation by calculating the total electromagnetic energy

$$U(t) = \frac{1}{2}\int \left(\epsilon_0 E(\mathbf{r},t)^2 + \frac{1}{\mu_0} B(\mathbf{r},t)^2\right) d^3r \tag{6}$$

at all times $t \ge \epsilon$. In this frame there is no magnetic field $\mathbf{B}$, and thus we need integrate only over E^2; the details of the calculation appear in Appendix B, and the result is a constant energy

$$U(t) = \frac{q^2}{(2\epsilon)8\pi\epsilon_0 c} + \frac{q^2}{8\pi\epsilon_0 r_0}, \tag{7}$$

where r_0 is the lower limit of integration. (A positive lower limit is necessary to avoid divergence, just as in the standard calculation of the energy of a point charge.)

It is evident that time does not appear in Equation 7; hence, after the charge has been created (i.e., for $t \ge \epsilon$), the energy of its field is constant. Thus the expanding electric field does not violate energy conservation, and therefore instantaneous field-creation throughout the universe is not required. Akridge's argument is hence without merit.

Analysis

The second of the two terms in Equation 7 is no surprise—it is the standard expression for the energy of a static charge. The first term, then, is in some way the result of charge creation over a time span of length 2ϵ. The more gradual the charge creation, the less significant the term becomes, whereas it becomes infinite in the limit $\epsilon \to 0$. It is thus worthwhile to consider this term more closely.

One feature of Maxwell's equations is that they impose local charge conservation automatically; the standard derivation of this result begins with Maxwell's modification of Ampere's Law (Equation A.5) and takes the divergence:

$$\nabla \times \mathbf{B} - \mu_0\epsilon_0 \frac{\partial \mathbf{E}}{\partial t} = \mu_0 \mathbf{J} \tag{8}$$

$$\nabla \cdot (\nabla \times \mathbf{B}) - \mu_0\epsilon_0 \frac{\partial}{\partial t} \nabla \cdot \mathbf{E} = \mu_0 \nabla \cdot \mathbf{J} \tag{9}$$

Since the divergence of a curl vanishes, we conclude from Gauss's Law (Equation A.2) that

$$-\frac{\partial}{\partial t}\rho = \nabla \cdot \mathbf{J}; \tag{10}$$

that is, an increase (or decrease) of charge at any point must be accomplished by a flow of current into (or out of) that point. This statement clearly contradicts our postulated scenario, in which there exists a positive $(\partial/\partial t)\rho$ with no corresponding current $\mathbf{J}$. Thus, we (along with Akridge) are actually applying Maxwell's equations to a situation in which they manifestly do not hold; it is therefore no wonder that we obtain an unexpected term in Equation 7.

Consideration of the magnetic field produces the same conclusion. By symmetry considerations, the field $\mathbf{B}$ must point in a radial direction; however, the vector field $d\mathbf{E}/dt$ is also strictly radial, and it must be orthogonal to $\mathbf{B}$ (by Equation A.5). Thus $\mathbf{B}$ must vanish, as we have already concluded on the basis of Equation 3. On the other hand, the Maxwell-Ampere law (Equation A.5) requires that a growing charge (with no magnetic field) *must* be accompanied by a current—and yet the only charge in the Universe (in our toy model) is at rest, meaning that there can be no current.[1] Indeed, this contradiction simply restates the continuity issue of the preceding paragraph, and the conclusion is the same—both we and Akridge have been applying Maxwell's equations to a situation in which they do not hold.

We could instead have "created" (or rather, accumulated) the charge by means of a current flowing in from infinity: for

1 It is of course also true that charged elementary fermions possess an intrinsic magnetic moment due to their spin. Inclusion of this quantum mechanical effect would be an interesting study but would not alter the conclusions of this paragraph.

instance, one could postulate (to maintain spherical symmetry) that $\mathbf{J}(\mathbf{r},t)=-q\hat{\mathbf{r}}/8\pi\epsilon r^2$ during the time $-\epsilon<t<\epsilon$, so that $\nabla \cdot \mathbf{J}$ gives us $\dot{\rho}(\mathbf{r},t)$ matching Equation 4 (for all times t and points $\mathbf{r}$). For this scenario, the reader can verify (after rather tedious integration) that the anomalous term in Equation 7 disappears, although Equation 5 changes significantly due to the simultaneous currents filling all of space. Interestingly, in this case also the magnetic field turns out to vanish, with the $\mathbf{J}$ and $d\mathbf{E}/dt$ terms in Equation A.5 cancelling out—and thus we remain consistent with Maxwell's Equations.

If on the other hand one wishes to model charge creation *per se* (without recourse to any such currents), then there are at least two options. First, it is possible that when God spoke charge into existence, He chose not to maintain local charge conservation. Indeed, since God ceased His creative work after Day 6, we cannot assume that today's conservation laws (describing His ongoing work of providence) necessarily apply to His work of creation. In such a case, modeling the event would require a self-consistent formulation of electrodynamics without local charge conservation. It is unclear what form such a theory would take: on the quantum level, one could perhaps introduce appropriate operators for creation/annihilation of charge, while taking care to account for gauge invariance, particle spin, etc.; on the classical level, one could perhaps adapt Maxwell's equations to a non-trivial topology and model the introduction of charge through some sort of wormhole. In either case, the work required is well beyond the expertise and inclination of the author. Nor would the utility of such a theory (or its amenability to empirical test) be at all clear.

The second option (perhaps preferable on aesthetic grounds) is that when God first spoke charge into existence, He did so using a process similar to that by which He upholds the universe today—namely, by always producing equally- and oppositely-charged pairs of particles. Two examples are pair production ($\gamma \rightarrow e^- + e^+$) and beta decay ($n \rightarrow e^- + p^+ + \overline{\nu}_e$). Since the Universe is (to our knowledge) electrically neutral, it is probable that *global* charge conservation has existed from the beginning, and thus it is not unreasonable to suppose that local charge conservation has held true as well.

Neither option, however, requires in-transit light-creation. If God utilized some sort of pair production consistent with Maxwell's Laws, then those laws insure both energy conservation and the propagation of field disturbances at the speed of light. If God utilized some other sort of method, then He would have been free either to create light in transit or not.

Conclusions

Akridge (1979) argues that conservation of energy requires instantaneous creation of universe-wide electric fields whenever electric charge is created; he thus concludes that light from distant stars was created in transit. We have demonstrated that this argument is fundamentally flawed, on both *a priori* and electrodynamical grounds. In particular, Akridge employs an incorrect prescription for the time-dependent electric field; in contrast, the correct prescription satisfies energy conservation automatically.

However, we should note that this argument, with its flaws, provides our community an opportunity for self-reflection. Given the intervening four decades and the relative obscurity of the argument, we have the rare advantage of being able to perform this self-reflection with minimal risk of personal offense. What conclusions, then, can we draw from this incident in the history of creationism?

We first note that Akridge's argument seems never to have gained much traction within creationary circles. Indeed, apart from the two mentions noted above, the argument seems to have languished in relative obscurity. If this fact indicates skepticism among the CRS membership concerning the argument's merits, then we have demonstrated that the unease was well-warranted. It seems likely that many members sensed its problematic nature, and thus our history gives us a positive example of caution in handling arguments that do not "sound" plausible, even if we are unable immediately to pinpoint the precise nature of that implausibility.

However, we must also note that the argument did pass peer review and appeared in *CRSQ*, arguably the flagship journal of creation science. On the one hand, we should make full allowance for the acute difficulty of finding willing and qualified reviewers during the early decades of the Creation Research Society. On the other hand, it seems unlikely that the CRS at that time included absolutely *no* members conversant enough with electrodynamics to pinpoint these flaws. In any case, and for whatever reason, neither the reviewer(s) nor anyone within the 1979 membership seems to have pointed them out.

To take note of this failure is not to suggest that individual creationists are somehow responsible for other creationists' errors, much less errors decades in the past. Nor is today's organization to be blamed for a forty-year old misstep. Nevertheless, the error under discussion is by no means minor: the argument proceeds from an unambiguously false electrodynamic premise, and peer review is intended to detect precisely this type of error. Thus, remembering the aphorism about those who forget history, it is worthwhile to consider—not what went wrong in 1979, but rather how we could prevent (or at least quickly redress) a similar error today.

The answer must ultimately involve our organizational responsibility to self-regulate, a responsibility which inheres in no one member exclusively but in the community as a whole. What then falls to each of us (as members of the community) is to thoughtfully consider, evaluate, and interact with the articles and arguments which lie within our own individual areas of expertise. Sometimes doing so is straightforward. At other times, it can be difficult to critique ideas which one feels *ought* to be true. Nevertheless, "the first to present his case seems right until another comes forward and questions him" (Proverbs 17:19)—and we, rather than unbelievers, should be the first to raise such questions in a rigorous and yet constructive fashion.

Indeed, this is precisely what CRS *has* been doing for over five decades, and during that time there has been significant refinement in the quality (and scope) of creationary argumentation in virtually all areas. We can be grateful for this growth in the caliber of the science published in *CRSQ*, and we can be even more grateful that, in the process, the organization has remained faithful to Scripture. Both of these blessings are the fruit of the selfless work of many CRS members and, especially, of the grace of God. But repeated reminders—of the importance of excellent science, accurate exegesis, and doctrinal fidelity—are wholesome, and the author hopes that this examination of Akridge (1979) can serve as another such reminder. Our faith in God's Word will always incur ridicule from the unbelieving world, but we surely do not wish to invite such ridicule by our own failure to engage in critical thinking. In addition, we have a much greater motive for accurate argumentation, namely, the account we must each give to our Creator and Redeemer: "we make it our aim to please Him, for we must all appear before the judgment seat of Christ" (2 Corinthians 5:9–10), and "each one's work will become manifest … what sort of work each one has done" (1 Corinthians 3:13).

Thus it is incumbent upon us as a community—authors, readers, and reviewers (each within his own area of expertise)—to subject our ideas to searching critique by carefully examining their assumptions and implications. To borrow biblical language, the more diligently we judge ourselves, the less likely it is that we shall be judged wanting. Thus, the flaws in this argument from a previous generation can serve as a wholesome stimulus for us today (including this author) to thoughtfully weigh the positions we take in defense of the biblical record—and to critique our own arguments as carefully as we critique others'.

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Appendix A
Maxwell's Equations and the Dirac Delta

This appendix provides a brief review of Maxwell's equations and the Dirac delta function, employing SI units throughout. For a more comprehensive explanation, one can consult any standard electrodynamics text; the exposition of Griffiths (1999) is particularly lucid.

Electric and magnetic fields exert force on electric charges. The Lorentz force law describes this effect by specifying the force exerted on a small test charge q with velocity $\mathbf{v}$ by electric and magnetic fields $\mathbf{E}$ and $\mathbf{B}$, respectively:

$$\mathbf{F}=q(\mathbf{E}+\mathbf{v}\times\mathbf{B}). \tag{A.1}$$

Note that these fields, like the resulting force, are vector quantities (in the mathematical sense).

Whereas the Lorentz force law describes the effect of fields on charges, Maxwell's Equations describe the fields generated by the charges. Specifically, given a charge density ρ and a current density $\mathbf{J}$, one can write Maxwell's Equations as follows:

$$\nabla \cdot \mathbf{E} = \frac{1}{\epsilon_0}\rho \tag{A.2}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \tag{A.3}$$

$$\nabla \cdot \mathbf{B} = 0 \tag{A.4}$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t}. \tag{A.5}$$

In these equations, ϵ_0 (the permittivity of free space) is 8.85×10^{-12} $C^2/N{\cdot}m^2$, and (the permeability of free space) is $4\pi \times 10^{-7}$ N/A^2. The four equations A.2–A.5, together with the Lorentz force law (A.1), constitute the foundation of classical electromagnetic theory. From these equations, one can derive the following expression for the energy U of an electromagnetic field:

$$U(t) = \frac{1}{2}\int\left(\epsilon_0 E(\mathbf{r},t)^2 + \frac{1}{\mu_0}B(\mathbf{r},t)^2\right)d^3r. \tag{A.6}$$

Next, the so-called Dirac delta function facilitates the application of Equations A.2–A.5 to point charges. The Dirac delta is not, strictly speaking, a function but rather a distribution (or, alternatively, a measure). One can visualize it as an infinitely narrow and infinitely tall spike at the origin. Thus one can write (suggestively)

$$\delta_D(x) = \begin{cases} 0 & \text{if } x \neq 0 \\ \infty & \text{if } x = 0. \end{cases} \tag{A.7}$$

so that (precisely)

$$\int_{-\infty}^{\infty} \delta_D(x)\, dx = 1. \tag{A.8}$$

Note that Equation A.7 requires Equation A.8 (or, better, Equation A.9 below) to render its meaning precise. One can also consider the Dirac delta to be the limit of Gaussian probability distributions with mean 0 and standard deviation approaching zero (as in Figure 2).

The key property of a delta function is its ability to pick out one value from an integrand, so that for any function *f(x)* we have

$$\int_{-\infty}^{\infty} f(x)\delta_D(x-c)\, dx = f(c). \tag{A.9}$$

The three-dimensional Dirac delta function is simply the product of one-dimensional deltas:

$$\delta_D(\mathbf{r}) = \delta_D(x)\cdot\delta_D(y)\cdot\delta_D(z), \tag{A.10}$$

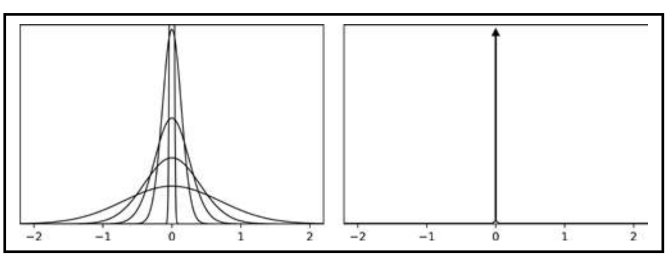

Figure 2. The left-hand panel shows a series of Gaussian functions (of unit area) converging to the Dirac delta, depicted in the right-hand panel. The Dirac delta "function" is zero everywhere except at the origin, where its value is infinite.

so that

$$\int f(\mathbf{r})\delta_D(\mathbf{r}-\mathbf{r}_0)\, d^3r = f(\mathbf{r}_0). \tag{A.11}$$

Appendix B
Deriving Equations 5 and 7

This appendix provides the derivation of Equation 5 from the charge distribution of Equation 4; it then provides the derivation of Equation 7 from Equation 5.

Recall that the electric field for any configuration of charges and currents is given by the first of Jefimenko's equations (Equation 2), which we reproduce here:

$$\mathbf{E}(\mathbf{r},t) = \frac{1}{4\pi\epsilon_0}\int\left(\frac{\rho(\mathbf{r}',t_r)}{|\mathbf{r}-\mathbf{r}'|^3}(\mathbf{r}-\mathbf{r}') + \frac{\dot{\rho}(\mathbf{r}',t_r)}{c|\mathbf{r}-\mathbf{r}'|^2}(\mathbf{r}-\mathbf{r}') - \frac{\mathbf{J}(\mathbf{r}',t_r)}{c^2|\mathbf{r}-\mathbf{r}'|}\right)d^3r', \tag{B.1}$$

In our scenario, the current density **J** vanishes, and Equation 4 gives the charge density:

$$\rho(\mathbf{r},t) = \begin{cases} 0 & \text{if } t \leq -\epsilon \\ \frac{q}{2}\left(\frac{t}{\epsilon}+1\right)\delta_D(\mathbf{r}) & \text{if } -\epsilon < t < \epsilon \\ q\cdot\delta_D(\mathbf{r}) & \text{if } t \geq \epsilon, \end{cases} \tag{B.2}$$

Taking the time derivative, we obtain

$$\dot{\rho}(\mathbf{r},t) = \begin{cases} \frac{q}{2\epsilon}\delta_D(\mathbf{r}) & \text{if } -\epsilon < t < \epsilon \\ 0 & \text{otherwise.} \end{cases} \tag{B.3}$$

We now must calculate two integrals, one involving ρ and the other involving $\dot{\rho}$, with both integrands evaluated at retarded time $t_r = t - |\mathbf{r} - \mathbf{r}'|/c$. The Dirac delta function makes the integration straightforward and enforces the condition $\mathbf{r}'=0$, so that $t_r = t - r/c$. Thus we have

$$\int d^3r' \frac{\rho(\mathbf{r}', t_r)}{|\mathbf{r} - \mathbf{r}'|^3}(\mathbf{r} - \mathbf{r}') = C \cdot \frac{\hat{\mathbf{r}}}{r^2},$$

$$\text{where } C = \begin{cases} 0 & \text{if } r \geq c(t+\epsilon) \\ \dfrac{q}{2}\left(\dfrac{1}{\epsilon}\left(t - \dfrac{r}{c}\right) + 1\right) & \text{if } c(t-\epsilon) < r < c(t+\epsilon) \\ q & \text{if } r \leq c(t-\epsilon), \end{cases} \tag{B.4}$$

and

$$\int d^3r' \frac{\dot{\rho}(\mathbf{r}', t_r)}{c|\mathbf{r} - \mathbf{r}'|^2}(\mathbf{r} - \mathbf{r}') = D \cdot \frac{\hat{\mathbf{r}}}{cr},$$

$$\text{where } D = \begin{cases} \dfrac{q}{2\epsilon} & \text{if } c(t-\epsilon) < r < c(t+\epsilon) \\ 0 & \text{otherwise.} \end{cases} \tag{B.5}$$

With these integrals in hand, we can evaluate Equation B.1 as a function of distance at any particular time t. First, at distances $r \geq c(t+\epsilon)$, there has not yet been enough time for the effect of the charge at the origin to propagate out to r, and we have

$$\mathbf{E}(\mathbf{r}, t) = 0 \text{ for } r \geq c(t+\epsilon). \tag{B.6}$$

Next, if $c(t-\epsilon) < r < c(t+\epsilon)$, then the electric field at point $\mathbf{r}$ feels the effect of the growing charge and is in the "spike" portion of Figure 1:

$$\mathbf{E}(\mathbf{r}, t) = \frac{\hat{\mathbf{r}}q}{4\pi\epsilon_0}\left(\frac{1}{2r^2}\left(\frac{1}{\epsilon}\left(t - \frac{r}{c}\right) + 1\right) + \frac{1}{2\epsilon cr}\right) \tag{B.7}$$

$$= \frac{\hat{\mathbf{r}}q}{8\pi\epsilon_0 r^2} \cdot \frac{t+\epsilon}{\epsilon}, \text{ for } c(t-\epsilon) < r < c(t+\epsilon). \tag{B.8}$$

Finally, if $r \leq c(t-\epsilon)$, the field is that expected for a static charge:

$$\mathbf{E}(\mathbf{r}, t) = \frac{\hat{\mathbf{r}}}{4\pi\epsilon_0}\frac{q}{r^2} \text{ if } r \leq c(t-\epsilon). \tag{B.9}$$

Together, Equations B.6, B.8, and B.9 yield Equation 5:

$$\mathbf{E}(\mathbf{r}, t) = \begin{cases} \dfrac{q \cdot \hat{\mathbf{r}}}{4\pi\epsilon_0 r^2} & \text{if } r \leq c(t-\epsilon) \\ \dfrac{q \cdot \hat{\mathbf{r}}}{8\pi\epsilon_0 r^2} \cdot \dfrac{t+\epsilon}{\epsilon} & \text{if } c(t-\epsilon) < r < c(t+\epsilon) \\ 0 & \text{if } r \geq c(t+\epsilon). \end{cases} \tag{B.10}$$

This expression for $\mathbf{E}(\mathbf{r},t)$—along with the fact that the magnetic field vanishes by symmetry—allows us to calculate the net electromagnetic energy at any time t via Equation 6:

$$U(t) = \frac{1}{2}\int \left(\epsilon_0 E(\mathbf{r}, t)^2 + \frac{1}{\mu_0}B(\mathbf{r}, t)^2\right) d^3r \tag{B.11}$$

Proceeding, we have

$$U(t) = \frac{1}{2}\int \epsilon_0 E(\mathbf{r}, t)^2\, d^3r = 2\pi\epsilon_0 \int E(r, t)^2\, r^2 dr \tag{B.12}$$

$$= 2\pi\epsilon_0 q^2 \left\{ \frac{(t+\epsilon)^2}{64\pi^2\epsilon_0^2\epsilon^2} \int_{c(t-\epsilon)}^{c(t+\epsilon)} \frac{dr}{r^2} \right.$$

$$\left. + \frac{1}{16\pi^2\epsilon_0^2} \int_{r_0}^{c(t-\epsilon)} \frac{dr}{r^2} \right\} \tag{B.13}$$

where r_0 is an arbitrary (positive) lower limit required for convergence of the integral. Continuing,

$$U(t) = \frac{q^2(t+\epsilon)^2}{32\pi\epsilon_0\epsilon^2}\left(\frac{1}{c(t-\epsilon)} - \frac{1}{c(t+\epsilon)}\right)$$

$$+ \frac{q^2}{8\pi\epsilon_0}\left(\frac{1}{r_0} - \frac{1}{c(t-\epsilon)}\right) \tag{B.14}$$

$$= \frac{q^2(t+\epsilon)}{16\pi\epsilon_0\epsilon c(t-\epsilon)} + \frac{q^2(c(t-\epsilon)-r_0)}{8\pi\epsilon_0 r_0 c(t-\epsilon)} \tag{B.15}$$

$$= q^2 \frac{r_0 + 2\epsilon c}{16\pi\epsilon_0\epsilon c r_0} \tag{B.16}$$

$$= \frac{q^2}{16\pi\epsilon_0\epsilon c} + \frac{q^2}{8\pi\epsilon_0 r_0}, \tag{B.17}$$

as in Equation 7.

Letters to the Editor

The policy of the editorial staff of CRSQ *is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the* CRSQ *editorial staff or the Creation Research Society.*

Which came first, the fact or the Creator? Why is presuppositionalism a better apologetic than evidentialism?

The defining point between classical/evidentialist apologetics and presuppositionalism is that the classical approach begins at the very same point that the non-believer does (i.e. an atheist who wants to prove evolution). Both approaches presuppose the power of the human mind to put facts together to form a worldview. The evidentialist believes in the power of the human mind to interpret direct evidence, at least in part. In a sense, both man and God add something to the equation. This means that man alone is capable of adding something independently by his own rational thinking. True, the presuppositionalist does use (God-given) rationality, linguistics, and logical arguments. But the evidentialist must admit that it was God who gave man these capabilities to begin with, to interpret God's facts in God's way, and not independently.[1] Everything begins and ends with the Word of God; Jesus is the Alpha and the Omega, the First and the Last (Revelation 22:13). This is not a narrow argument, because we simply are obedient in accepting God's Word as truth and not questioning it.

Although a good apologetics method allows us to be more effective in our witness, one's apologetics method is not a salvation issue.

Finite man grapples with the infinite reality of God. But can he not draw the obvious conclusion that man must be informed of total and complete truth? That is what God's self-revelation is all about. Man is fully passive in this, because the truth is infinite (since God is too) and since we are finite, we will never reach full, infinite truth.

This is akin to the question *which came first, the chicken or the egg*? This question could be re-phrased in the following way: which came first, the fact, or the Creator who created the fact? And who also arranges all facts into a meaningful, holistic worldview structure? Obviously, God came first. Jesus says, "He that is not with me is against me: and he that gathers not with me scatters" (Luke 11:23). It can't be true that atheism is half correct or that half the evidence supports Christianity. All facts support Christianity. We may not know the answer to a specific question, but we know that there is an answer.

How does presuppositionalism view facts? Facts are not neutral. We don't live in a neutral universe. Facts must be interpreted according to our worldview.[2] Archaeologists don't uncover dinosaur bones with tags on them saying how old they are. Worldviews may be in constant flux, but since truth exists, one particular worldview (the Christian one) must, by necessary means bear down on the truth (John 16:13).

An evidentialist Christian may claim that he is only going where the facts lead him, but subconsciously he is trying to assemble the facts into a holistic interpretation which fits the Bible. The presuppositionalist simply admits these presuppositions candidly and openly.

In this sense, all non-believers are fools (Psalm 14:1) because they believe a lie. They are fools because in their heart they have said there is no God. This includes Hindus, whose gods are idols. What man is not in active denial of God? We are all Adam's fallen seed and as such we all take part in the rebellion, even hypocrites sitting in the pews. The epistemic advantage to the presuppositional approach is simply that the mind of the Christian is illuminated by the Holy Spirit, who guides him unto all truth (John 16:13). Just like vine branches, we Christians cannot do anything without Jesus (John 15:5).

The situation is not any different for the non-believer. Let us examine the case of the disciples after the resurrection in Luke 24. The disciples were Jewish people who grew up with the Scriptures. They should have known that the Scriptures attest to the life, suffering, and resurrection of Jesus Christ, the Messiah. Jesus told the disciples about His coming suffering and death before it was to happen (Luke 13:33; Matthew 16:21; Mark 8:31). Still, the angels had to ask the women at the tomb why they searched for the living among the dead (verse 5). In verse 25–27, Jesus had to explain to the two travelers on the road to Emmaus how the events in Jerusalem during His crucifixion were a fulfillment to Scripture. It is not until verse 31 that the eyes (the understanding) of the two disciples were opened so as to understand the Scriptures.

Furthermore, in John 20:24–32 we read: "Now Thomas, one of the twelve, called the Twin, was not with them when Jesus came. So the other disciples told him, 'We have seen the Lord.' But he said to them, '*Unless I see in his hands* *the mark of the nails, and place my finger into the mark of the nails, and place my hand into his side, I will never believe.'* Eight days later, his disciples were inside again, and Thomas was with them. Although the doors were locked, Jesus came and stood among them and said, 'Peace be with you.' Then he said to Thomas, 'Put your finger here, and see my hands; and put out your hand, and place it in my side. **Do not disbelieve, but believe**.' Thomas answered him, 'My Lord and my God!' Jesus said to him, 'Have you believed because you have seen me? *Blessed are those who have not seen and yet have believed*.' Now Jesus did many other signs in the presence of the disciples, which are not written in this book; *but these are written so that you may believe that Jesus is the Christ, the Son of God, and that by believing you may have life in his name*."

This is the epistemic advantage of presuppositionalism over evidentialism! It is as if though the apostle Thomas is playing the role of an evidentialist philosopher, in that he will only believe in Jesus if he can reach into His side and feel the print of the nails. Jesus shows compassion on Him and allows him to do so, but still admonishes him *not to be faithless, but believing*. Blessed are those who see evidence for God, but blessed also are those who believe in God's Word. The last verse in chapter 20 describes how the Bible, the Word of God, was written for us to believe even though we were not present to be witness to those events.

"Trust in the Lord with all thine heart; and lean not unto thine own understanding." (Proverbs 3:5)

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Endnotes

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Climate Change and the Extinction of Evolution

With each new catastrophe—earthquake or eruption, flood or famine—a crack is created in the dam holding back the placid lake of uniformitarian thinking. Climate change is playing a big role in the increase of these catastrophes. Climate change is also showing us the falsity of the idea that natural selection is linear and results in evolution as we witness the reversal of supposed speciation. Both of these pillars of evolutionary thinking—uniformitarianism, which provides the geologic time necessary, and natural selection, which provides the biological mechanism—are crumbling ideas as the earth wears out as a garment (Isaiah 51:6). Evolutionary thinking is at the mercy of human experience and is doomed as we observe these changes that are occurring with ever increasing frequency and severity.

Born and raised in the bliss and scientific simplicity of 150 years ago, the theory of evolution has been greatly weakened by recent catastrophic events. The eruption of Mt. St. Helens in 1980 brought about a renaissance in research into catastrophic processes. Events of this magnitude while less frequent, and while providing a great field of study for scientists, do not impact the common person's life as much as other catastrophes have. The earthquake leading to a tsunami that killed over 200,000 people in 2004 in Indonesia was far more impactful to the thinking of many people. All over the world earthquakes in various places (Matthew 24:7) are causing dams to crumble with the resultant flooding providing small-scale examples of geologic processes. Seeing these catastrophes happen in their own home towns, people can visualize how greater catastrophic events can form larger features like the Grand Canyon. These observations strip away the power of uniformitarian thinking, that bliss of ignorance. While some of these are natural disasters, others are driven by climate change.

Climate change, and warming oceans in particular, are driving increasing precipitation in some areas and drought and famines in others as weather patterns change. Flooding from storm events has altered the course of rivers, carved canyons, caused mudslides, and other geologic processes that we can witness occurring catastrophically and rapidly. In addition to impacting uniformitarian thinking, climate change is also impacting what we thought we understood about natural selection. Natural selection, as commonly understood, simply described a way of causing a specie to adapt to changes in its environment resulting in a linear evolution into a new specie. What we are seeing now is that natural selection is much more fluid and reversable.

This reversibility is very poignantly demonstrated by the puzzling Pizzly Bear. As the earth warms, and the artic region warms at about double the rate, the Polar Bear's natural habitat out on the ice flows is diminishing. The Polar Bear was well adapted to an icy environment with its pigment-free fur and other adaptations. The historic view of natural selection would say that the Polar Bear has evolved into a separate species in order to survive. However, now we are seeing Pizzly Bears in areas that have historically been icy Polar Bear habitats. These white-brown mottled crosses between Grizzlies and Polar Bears are clear evidence of inter-breed-ability. These two bears do not represent separately evolved species, but rather one Pizzly specie that has been able to adapt to different environments fluidly and reversibly. As climate patterns change and oceans warm and rise, even Darwin's famous Galapagos Finches will be affected. Changes in an animal specie is one thing, but like Mt. St. Helens, these changes do not impact the common person as much as something like disease.

We see a similar fluidity and adaptation of diseases in response to vaccines. One of the greatest triumphs of the 20th century was the near eradication of several severe infectious diseases through the use of vaccines. Today however, we are seeing a resurgence in these same infectious diseases from vaccine-resistant strains. These strains have always been present in the total population of these viruses, but were in the minority. The use of vaccines suppressed the more common strains allowing the old minority to become the new, vaccine-resistant majority. What will people be thinking when their bodies are once again covered by loathsome sores (Revelation 16:2)?

Is it possible to conclude that the idea of evolution will not be able to remain in the minds of those who are experiencing the crumbling pillars of uniformitarianism and natural selection in the world around them? How can uniformitarian scientists continue to justify their position in the face of such coming catastrophes? I posit that while some may stubbornly cling to these ideas, for the majority of the population they will come to a new reality. In the face of these catastrophes, people often turn to a power higher than themselves. A paradigm shift will occur in the population as a whole, which never fully bought into evolutionary theory anyway. In a way, the idea of evolution was set up to fail from the beginning. As the apex of evolution, humans would have the right to harvest the earth's resources any way chosen, regardless of the consequences. Along with the growing acceptance of the idea of evolution came the industrialization and consumerism that has resulted in the climate change we are now experiencing. Today, climate change appears to be leading us toward the extinction of the idea of evolution.

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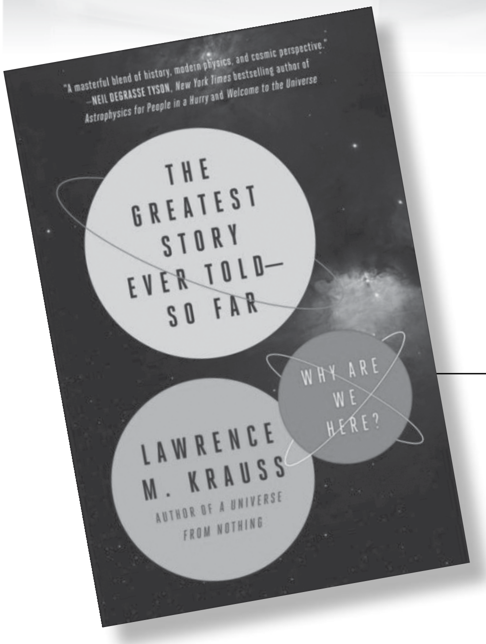

The Greatest Story Ever Told—So Far: Why Are We Here?

by Lawrence Krauss

Atria Books, New York, 2017
322 pages, $27.00

The title pretty much says it all. The author, theoretical physicist Lawrence Krauss, director of the Origins Project at Arizona State University (https://interplanetary.asu.edu/), mockingly seeks to supplant in the popular mind "The Greatest Story Ever Told"—the Bible and the Resurrection of Jesus Christ—with the story of modern physics and our "understanding [of] the fundamental forces of nature" (p. 188). But this story sees "…no obvious plan or purpose to the world we find ourselves living in. Our existence…appears to be a curious accident" (p. 4). For Krauss, "the pinnacle of the human story did not conclude with a prophet's sacrifice two thousand years ago…" (p. 2).

If all of this sounds blasphemous, that is the plan. Krauss revels in shock impact. He once said to accompanying laughter from the audience, "Forget Jesus. The stars died so you could be born" (Krauss, 2013). Richard Dawkins loved Krauss's comment so much that he repeated it in his semi-autobiographical book, *Brief Candle in the Dark: My Life in Science*, where there is also a photo of Dawkins and Krauss during the filming of *The Unbelievers* (Dawkins, 2015, p. 259, photo opposite p. 121).

Krauss's goal is to tell "the story of science's quest to uncover the hidden realities underlying the world of our experience" (p. 1), and, in telling it, Krauss is generally quite effusive about the state of theoretical physics. This differs markedly from how fellow theoretical physicist Sabine Hossenfelder views much of her field today: "Someone needs to talk to me out of my growing suspicion that theoretical physicists are collectively delusional, unable or unwilling to recognize their unscientific procedures" (Hossenfelder, 2018, p. 95; Melnick, 2018). Regarding supersymmetry and the Large Hadron Collider (LHC), Krauss admits, "…many of us thought that the LHC had a much greater chance of discovering supersymmetry than it did of discovering the Higgs. It didn't turn out that way…The situation is already beginning to look uncomfortable…But the situation is not yet hopeless" (p. 285). He says that discovering the Higgs boson "has beautifully capped more than two millennia of intellectual effort by brave and determined philosophers, mathematicians, and scientists to uncover the hidden tapestry that underlies our existence" (p. 288). With respect to dark matter, "Around the world a half dozen beautiful experiments are now going on…So far nothing has been seen, however" (p. 286). Krauss completed this book in Christopher Hitchens' former guesthouse. "I cannot think of a more inspiring place to have finished" writing it, he says, and he describes Hitchens' screed, *God Is Not Great: How Religion Poisons Everything*, as a "masterpiece" (pp. 305, 308). However, another observer dismissed Hitchens' book as "an intellectually shoddy and factually inaccurate rush-job, written with blithe ignorance of what his antagonists actually believe" (Oppenheimer, 2007, 2011).

Most troubling, Krauss delights in a practice that Stephen Jay Gould also engaged in, abusing the words of Scripture for evolutionary or atheistic ends. Krauss takes this perverse practice to a new level. He opens one chapter by citing Hebrews 10:35, *"Therefore do not throw away your confidence, which has a great reward"* about the confidence of

Christian believers in heaven (p. 83). Krauss twists this to a discussion of the confidence of leading physicists in their new theories. The verse *"For you are a mist that appears for a little time and then vanishes"* (James 4:14), reflects on the fleeting nature of life (p. 97). Krauss tries to use it to describe the annihilation of fleeting virtual particles. Later, he cites John 6:12, the miracle of the loaves and the fishes, *"Gather up the fragments that remain, that nothing be lost."* This he relates to symmetry-breaking and finding the Higgs boson (pp. 201–207). Chapter 20 opens with Matthew 5:39, where Jesus says: *"If anyone slaps you on the right cheek, turn to him the other also"* (p. 249). Krauss is not concerned with loving one's enemies. Instead, he focuses on the word *slap* in the verse and appears to equate it with *spanking the vacuum* in order to excite Higgs particles (p. 256).

All of this is maddening, but we need to think apologetically and missiologically and to pray for people like author Krauss, a Jewish anti-theist. I have been studying his work and that of other well-known Jewish atheists, anti-theists, and militantly secular scientists – mostly physicists - for several years. In my next book on Jewish atheism and secularism, I place Krauss into what I refer as the 'low-brow' atheist/anti-theist set, a group that often employs shock, name-calling, and sloganeering in its polemics. Many in this group seem to be in a 'mutual admiration society' with Richard Dawkins. But they are definitely in a different category from certain other Jewish atheist physicists such as Nobel Prize winners Steven Weinberg and the late Murray Gell-Mann, whose atheism, though just as misguided, is expressed at a higher intellectual level than the low-brow set.

Reading this book gives the reader an overview of the achievements of modern physics, but sadly, only within the context of extreme hostility to religion, and especially the Christian faith. For Krauss and others like him, there is no hope for mankind outside of those achievements. As believers, we can rejoice that His Story remains the Greatest Story that will ever be.

The reviewer is a missionary to Jewish people with Life in Messiah International and Friends of Russian Jewry, Inc., and is the International Coordinator for the Lausanne Consultation on Jewish Evangelism (LCJE), which is part of the greater Lausanne Movement.

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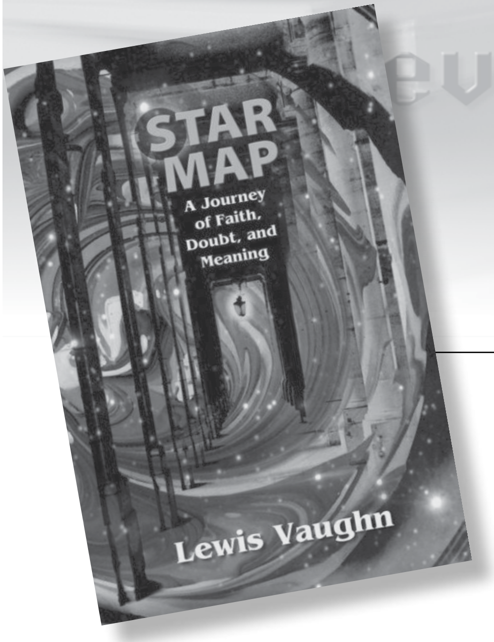

Star Map: A Journey of Faith, Doubt, and Meaning

by Lewis Vaughn

Freethought House,
Minneapolis-St. Paul, 2017,
240 pages, $19.95

I have always been interested in why people who profess to be Christians reject their faith and become atheists, partly because that also was my journey. I have read many accounts of ex-"Christians" and notice a common path to atheism is exposure and acceptance of evolution. One of my latest books, *Evolution is the Doorway to Atheism* (Bergman, 2019), covers 55 cases involving "Christians" who lost their faith after learning about, and becoming convinced, that the explanation for the existence of life is evolution. Thus no need exists for God, and therefore He does not exist. Author Vaughn's acceptance of evolution occurred as a student in a Catholic college. The publishers' description of the *Star Map* book is as follows:

> Lewis Vaughn's journey transforms him from a young Christian fundamentalist to a disillusioned agnostic to an atheist seeker of meaning in a godless world. Along the way he stumbles on the strongest empirical argument against the reliability of faith as a source of knowledge, and sees that life does indeed have meaning without religion. In the end, he never regains the faith he lost, but finds something better.

That something better is atheism. Vaughn's background includes family problems associated with an alcoholic stepfather and also being molested when he was around 14 by an older man. Upon conversion, in his own words, he became a born-again Christian attending a megachurch in Dayton, Ohio, pastored by Henry Allen "Harry" Ironsides. Things went well for him for some time. He believed the Bible was literally true, accepting creation (p. 75). His pastor taught early in 1969 that man would never set foot on the moon because, as Ironsides proclaimed, God "has fixed all the bounds of the earth" (p. 125). This prediction was soon proven false when Neil Armstrong landed on the moon on July 9, 1969.

Vaughn's church group read through the Bible, although there was little background in apologetics. He was disturbed by some of what he read (p. 136). Research shows that those who learn Bible stories without the historical background, explanation, and supporting evidence are more likely to leave Christianity, and this happened to Lewis Vaughn.

Vaughn attended a Catholic college, the University of Dayton, and studied science and philosophy. He also learned anti-Christian and anti-Catholic myths. In his words, the church pounced with holy ferocity on "Galileo, Copernicus, Bruno, Kepler, Newton, Halley, and countless other scientists" (p. 176).

Vaughn became a heretic, believing that "faith was a shot in the dark" (p. 177). He also once thought that design was a strong argument for God's existence, but college studies destroyed that argument (pp. 189–190). Vaughn decided that we are nothing more than beings a little higher than the apes (pp. 187–198).

What I find amazing is that he is grossly ignorant about the problems with evolution and church history as well, yet he is now the author of many successful college textbooks, which include *Philosophy: The Quest for Truth*, *Bioethics*, *The Power of Critical Thinking*, and *Philosophy Here and Now*, all published by Oxford University Press.

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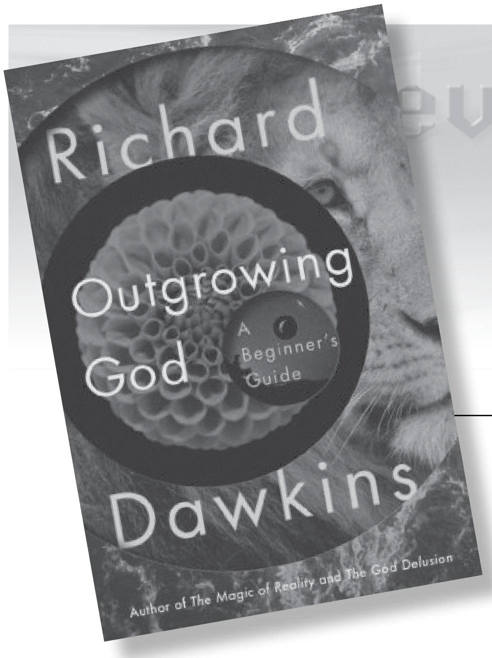

Outgrowing God: A Beginner's Guide

by Richard Dawkins

Random House, New York, 2019, 294 pages, $27.00

Oxford University Professor Emeritus Richard Dawkins has produced another best seller in his attempt to convince the world of evolution. His 2006 book *The God Delusion* sold millions of copies and has been translated into 35 languages. Both *The God Delusion* and *Outgrowing God* have four main points:

1. The Creationist explanation for the origin of life is falsified by evolution, which is proven by evidence equal to that of the earth's shape.
2. The Bible is a false and immoral book.
3. If there is a God as described in Christianity, the evil and suffering now existing in the world would not exist.
4. Atheists can be good, moral, and happy people.

In *Outgrowing God*, Dawkins focuses on the evidence for evolution and against creation and Intelligent Design. He writes of his "clinging" to belief in God until about age 15, because he was deeply impressed by the beauty and complexity of living things. "I finally gave up on the very idea of any gods when I learned about evolution and the true explanation why living things looked designed" (pp. 141–142).

Dawkins concludes, "…evolution is a definite fact: we are cousins of chimpanzees, slightly more distant cousins of monkeys, very much more distant cousins of fish…" (p. 14). He adds, "Everything about an animal or plant, every detail of every one, looks overwhelmingly as though somebody designed and created it. And through the centuries people have—wrongly—given the credit to God" (p. 160).

Dawkins explains evolution is "ultimately caused by random mutations." Normal gene frequency changes will not produce evolution because, Dawkins argues, "most mutant genes, in fact, make things worse. But some [changes]… happen to make things better" and these few changes are what drives evolution (pp. 176, 222).

Dawkins' evidence for evolution includes breeding, and he notes that over 400 dog breeds have come from the wolf-kind, ranging from Great Danes and Irish Wolfhounds, to dogs as small as Chihuahuas and Yorkies. As another example, horse breeders have produced carthorses and medieval horses which are much larger than wild horses, along with small Shetland ponies and Flabellas. Finally, from wild cabbage, breeders have produced kale, broccoli, kohlrabi, cauliflower, and brussel sprouts (p. 178).

The problem evolution faces is that clear limits exist in breeding. One of the best examples is that in breeding racing horses over the past century, we are now very close to the absolute speed limit possible without genetic modification. Gains are now only a fractional second.

To evolve bacteria into humans requires billions of new genes. The problem is that many new traits today are produced, not by new genes as claimed, but by the damaging or breaking of existing genes. As Michael Behe learned from the study of dog mutations, to get a dog with curly hair, you break a gene involved in hair growth. To get a dog with a short muzzle like a Pekingese, you break one or more of the genes involved in facial shape development (Olasky, 2019, pp. 40–42).

Behe found one of the favorite examples of evolution, brown bears to white polar bears, was also an example of breaking genes—17 in this case. The genes broken include one involved in making pigment, another involved in metabolism, and yet another that allows it to store higher levels of fat. Thus, evolution, by breaking genes, hinders the Darwinist assumption of evolution by mutations of existing genes to produce new and better genes.

Dawkins realizes that evolution is the doorway to atheism, and that is a focus of this book. The main reason people give for believing in the Creator of life is the evidence of the beauty of creation. Darwin himself realized this and realized that to convert the world to his view, he needed a another creation theory, the survival-of-the-fittest law.

The more fit forms of life culled the weaker, less fit.

Most of the claims Dawkins cites to prove evolution are refuted in peer-reviewed, scientific literature. Dawkins ignores information that does not agree with his worldview, a problem called conformation bias. One of many examples includes the human body organs which he cites as examples of poor design, such as the recurrent laryngeal nerve which takes a long way around to get to its goal, the larynx (pp. 166–167). In 1858, *Gray's Anatomy* explained why the recurrent laryngeal nerve had to take the long route to the larynx:

> As the recurrent nerve hooks around the subclavian artery or aorta, it gives off several cardiac filaments to the deep part of the cardiac plexus. As it ascends in the neck it gives off branches, more numerous on the left than on the right side, to the mucous membrane and muscular coat of the esophagus; branches to the mucous membrane and muscular fibers of the trachea; and some pharyngeal filaments to the Constrictor pharyngis inferior" (Gray, 1918, p. 912).

All of Dawkins' other examples of poor and useless design have also been refuted (Bergman, 2019).

Dawkins' end goal is clear: The historic evidence for God comes from creation, and now that evolution has explained everything, we have no need for God. The problem is that empirical science does not support evolution, and many evolutionists are either oblivious to this fact or choose to ignore it.

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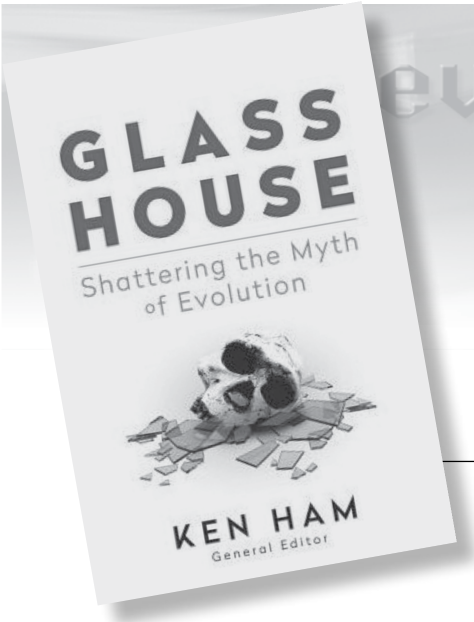

Glass House: Shattering the Myth of Evolution

edited by Ken Ham and Bodie Hodge

Master Books, Green Forest, AR, 2019, 320 pages, $17.00

Fourteen writers contributed to this book, the majority of whom are associated with Answers in Genesis. The 28 chapters are mainly a review of classic creationist challenges to evolution including living fossils such as the coelacanth, vestigial organs, the 1952 Miller-Urey origin of life experiment, whale evolution, peppered moth coloring, horse evolution, homology, Lucy, embryological recapitulation and more. If the reader is new to creation topics or needs a refresher, this book is a good place to start.

The historical definition of science contrasts with today's prevalent naturalism (p. 36). It is concluded that evolution is "a model, hypothesis, idea, belief, or a worldview—it is not a theory… evolution has mountains of evidence against it" (p. 10). Book chapters further discuss operational-historical science categories, the limits of mutation and natural selection, alleged dinosaur-bird evolution, and missing links in general.

Some of the book discussions raise questions and may encourage further study, and I will mention seven specifics. First, creationist astronomer Jason Lisle is credited with discovering a new planet (p. 66). For those interested, a google search fills in the details. Second, "science in the United States is losing out to other nations since our science education system now limits science in the classroom exclusively to the religion of secular humanism" (p. 50). One might respond that many other nations go far beyond the U.S. in promoting educational secularism. Also, the book statement bypasses the impact of nearly 11 million homeschool, private and charter school students, 18 percent of all elementary–high school students. Third, rock layers are said to have formed at Mount St. Helens (p. 54). Have sediments indeed hardened to rock, other than the igneous volcanic rock layers which accompany the debris sediments? Fourth, David Menton concludes that feathered dinosaurs never existed (p. 227). However, there is mixed evidence on this topic of possible dinosaur insulation. Fifth, "The age of the earth is one of the most important issues facing the church today" (p. 94). It would be interesting to hear pastor evaluations of this statement as they deal with the whirlwind of cultural change.

For the sixth specific book statement, there is the serious charge that the evolution worldview is responsible for 778 million wartime deaths (p. 300), and this is aside from the ongoing worldwide abortion tragedy. Sin certainly is the root cause of suffering and death, but is the evolution worldview the common denominator? Finally, here one more book comment on the lighter side. Dozens of creation scientists, both past and present, are honored throughout the chapters. This is all good, but one might ask why every listed person is male, except for AIG's well-deserved Georgia Purdom. It is time to gender-balance the rich history of pioneer creation scientists, and one might begin with Caroline Herschel (1750–1848), Maria Mitchell (1818–1889) and Henrietta Swan Leavitt (1868–1921).

The paperback book has scattered black and white figures; no index is provided.

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Instructions to Authors

Submission

Electronic submissions of all manuscripts and graphics are preferred and should be sent to the editor of the *Creation Research Society Quarterly* in Word, WordPerfect, or Star-Office/Open Office (see the inside front cover for address). Printed copies also are accepted. If submitting a printed copy, an original plus two copies of each manuscript should be sent to the editor. The manuscript and copies will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. If submitting a manuscript electronically, a printed copy is not necessary unless specifically requested by the *Quarterly* editor. Manuscripts containing more than 35 pages (double-spaced and including references, tables, and figure legends) are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, www.creationresearch.org).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor (CRSQeditor@creationresearch.org) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Star-Office/Open Office), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

1. Title page. This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.

2. Abstract page. This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 100 and 250 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.

3. Introduction. The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.

4. Body of the text. Two types of headings are typically used by the *CRSQ*. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.", "ibid.", "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the *CRSQ* or consult the Society's web site for specific examples as well as a more detailed explanation of manuscript preparation. Frequently-used terms can be abbreviated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide gel electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms "microevolution" and "macroevolution," authors should clearly define how they are specifically using these terms. Use of the term "creationism" should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

5. Summary. A summary paragraph(s) is often useful for readers. The summary should provide the reader an overview of the material just presented, and often helps the reader to summarize the salient points and conclusions the author has made throughout the text.

6. References. Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current *CRSQ* style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to *CRSQ* is acceptable.) The examples below cover the most common types of references:

Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.

Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

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Walker, T.B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with *14-point type* to insure proper appearance in the columns of the *CRSQ*.

8. Figures. All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do not embed figures in the text. Each figure should contain a legend that provides sufficient description to enable the reader to understand the basic concepts of the figure without needing to refer to the text. Legends should be on a separate page from the figure. All figures and drawings should be of high quality (hand-drawn illustrations and lettering should be professionally done). Images are to be a minimum resolution of 300 dpi at 100% size. Patterns, not shading, should be used to distinguish areas within graphs or other figures. Unacceptable illustrations will result in rejection of the manuscript. Authors are also strongly encouraged to submit an electronic version (.cdr, .cpt, .gif, .jpg, and .tif formats) of all figures in individual files that are separate from the electronic file containing the text and tables.

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Submission of letters regarding topics relevant to the Society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article's original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published. Following this period, individuals who desire to write additional responses/comments (particularly critical comments) regarding a specific *Quarterly* article are encouraged to submit their own articles to the *Quarterly* for review and publication.

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Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (2000 words), and one response (1000 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor's discretion, but suggestions of topics are welcome.

Book Reviews:

All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer's analysis of the book's content, clarity, and relevance to the creation issue.

Creation Research Society Membership/Subscription Application and Renewal Form

The membership/subscription categories are defined below:

1. **Voting Member** ....Those having at least an earned master's degree in a recognized area of science.
2. **Sustaining Member** ....Those without an advanced degree in science, but who are interested in and support the work of the Society.
3. **Student Member** ....Those who are enrolled full time in high schools, undergraduate colleges, or postgraduate science programs (e.g., MS, PhD, MD, and DVM). Those holding post-doctoral positions are not eligible. A graduate student with a MS degree may request voting member status while enrolled as a student member.
4. **Senior Member** ....Voting or sustaining members who are age 65 or older.
5. **Life Member** ....A special category for voting and sustaining members, entitling them to a lifetime membership in the Society.
6. **Subscriber** ....Libraries, churches, schools, etc., and individuals who do not subscribe to the Statement of Belief.

All members (categories 1–5 above) must subscribe to the Statement of Belief as defined on the next page.

Please complete the lower portion of this form and mail it with payment to CRS Membership Secretary, 6801 N. Highway 89, Chino Valley, AZ 86323, or fax for credit card payment to (928) 636-1153. Applications may also be completed online at creationresearch.org.

This is a ❏ new ❏ renewal application for the subscription year beginning Summer ❏ 2018 ❏ __________. *(Please type or print legibly.)*

Name ______________________ Address ______________________

City ______________ State ________ Postal/Zip code ____________ Country ______________

Phone (optional) ______________________ Email ______________________

Degree ______________________ Field ______________________

Year granted ______________ Institution ______________________

Presently associated with ______________________

I have read and subscribe to the CRS Statement of Belief. Signature ______________________

For foreign orders, including Canadian, payment must be made in U.S. dollars by a check drawn on a U.S. bank, international money order, or credit card. *Please do not send cash.*

Indicate applicable category	*Indicate payment*			
	Paper**			
❏ Voting ❏ Sustaining	USA	Canada Mexico	Other countries	**Paper-less‡**
❏ Regular [per year]	❏ $43	❏ $63	❏ $80	❏ $33
❏ Senior [per year]	❏ $38	❏ $58	❏ $75	❏ $28
❏ Life member	❏ $500	❏ $500	❏ $500	❏ $500
❏ Student* [per year]	❏ $38	❏ $58	❏ $75	❏ $28
❏ Subscriber [per year]	❏ $46	❏ $66	❏ $83	❏ $36

* Student members are required to complete the bottom portion of this form.
NOTE: Student members may qualify for the *Future Leaders Sponsorship* program.
See the CRS website at www.creationresearch.org for details.
** Rates for the paper option include postage for First Class Mail International

‡ **PAPERLESS option:** You may opt out of receiving paper copies of the CRS periodicals (*CRS Quarterly* and *Creation Matters*). By choosing this option you may register for access to the Premium Area of the website, where you may view or download electronic (PDF) versions of these publications. Of course, regular members and subscribers may also have access to the Premium Area. Only members, however, will have access to the Members Exclusive Area of the website.

Member/Subscriber	$______ per year
	x _____ years
SUBTOTAL	$__________
Optional contribution	+ $__________
Life membership	+ $__________
TOTAL	$__________

❏ Visa ❏ MasterCard ❏ Discover
❏ American Express ❏ Check/money order
Card number ______________________
Expiration date (mo/yr) ______________________
Phone number (_______) ______________________
Signature ______________________

Student Members **are required to complete the following:**

School or institution now attending ______________________

____

Your current student status: ❏ high school; ❏ undergraduate;
graduate program ❏ MS ❏ PhD; ❏ other ______________

Year you expect to graduate or complete your degree ____________

Major, if college or graduate student ______________________

Signature ______________________

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nonmembers and subscribers (libraries, schools, churches, etc.) – $25.00 + S/H

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23	☐	☐	☐	☐
24	☐	☐	☐	☐
25	☐	☐	☐	☐
26	☐	☐	☐	☐
27	☐	☐	☐	☐
28	☐	☐	☐	☐
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30	☐	☐	☐	☐
31	☐	☐	☐	☐
32	☐	☐	☐	☐
33	☐	☐	☐	☐

Volume	Number 1	2	3	4
34	☐	☐	☐	☐
35	☐	☐	☐	☐
36	☐	☐	☐	☐
37	☐	☐	☐	☐
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42	☐	☐	☐	☐
43	☐	☐	☐	☐
44	☐	☐	☐	☐

Volume	Number 1	2	3	4
45	☐	☐	☐	☐
46	☐	☐	☐	☐
47	☐	☐	☐	☐
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51	☐	☐	☐	☐
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53	☐	☐	☐	☐
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55	☐	☐	☐	☐
56	☐	☐		

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Make check or money order payable to Creation Research Society. Please do not send cash. For foreign orders, including Canadian, please use a check in U.S. funds drawn on a U.S. bank, an international money order, or a credit card.

(Please type or print legibly)

Name ________________________________ Address ____

City ____________________________ State ________ Zip ______________ Country________________________

❏ Visa ❏ MasterCard ❏ Discover ❏ American Express Card number ____

Expiration date (mo/yr) ______________ Signature____

Mail to: Creation Research Society, 6801 N. Highway 89, Chino Valley, AZ 86323, USA

Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* is a peer-reviewed technical journal. It has been gradually enlarged and modified, and is currently recognized as one of the outstanding publications in the field. In 1996 the *CRSQ* was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

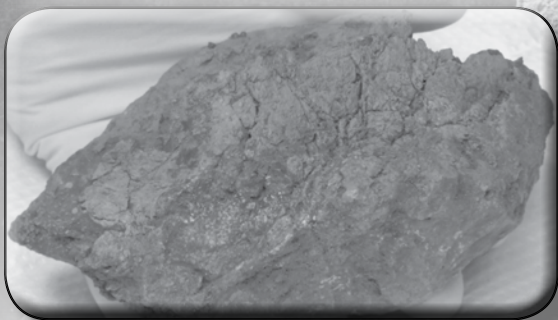
Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. *All members of the Society subscribe to the following statement of belief:*

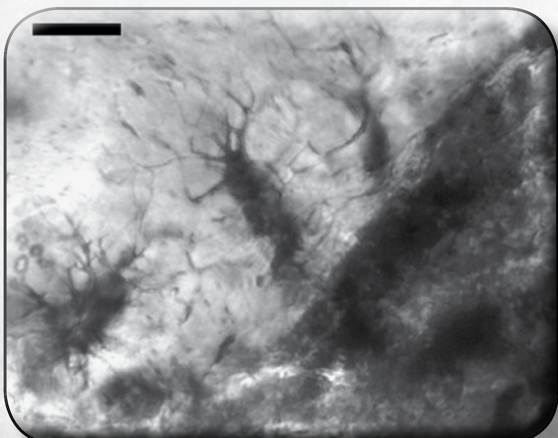
1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

iDINO II

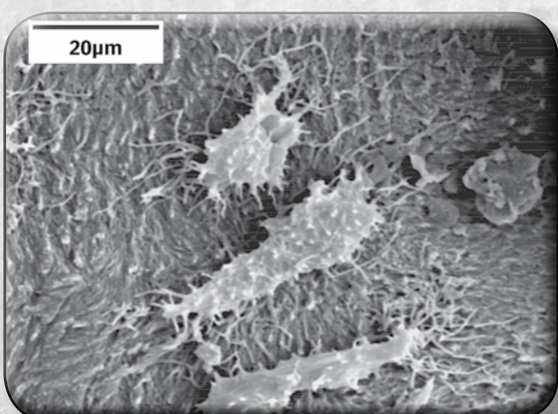
Investigation of Dinosaur Intact Natural Osteo-tissue



A fragment of the *Triceratops* brow horn. Fragments, such as this one, still contain tissue and cells.



Microscopic examination of tissue extracted from a *Triceratops* horn reveals bone cells still present.



Electron microscope picture of intact bone cells still in tissue extracted from a *Triceratops* horn.

How can pliable, stretchable tissue survive inside dinosaur fossils for over 65 million years?

How can this tissue still contain intact cells and even dinosaur proteins?

How can this fragile biological material survive for so long?

The answer to these questions directly challenges the current, evolutionary-biased, geologic timescale.

The Creation Research Society began its iDINO research initiative for the purpose of studying soft tissue in dinosaur fossils. The first phase of the project detected pliable, unfossilized tissue in a brow horn of a *Triceratops*. Within this tissue were intact osteocytes (bone cells). Some results from the iDINO project have been published in a technical microscopy journal and presented at an international microscopy conference. The Spring 2015 issue of the *Creation Research Society Quarterly* also features a special report of the iDINO project. Plus, to further spread the important information about soft tissue, the Society is developing a video (Echoes of the Jurassic).

The **second phase** of the project (iDINO II) will look more extensively at the process of tissue preservation. Evolutionists have offered various theories of how this tissue could survive for millions of years. iDINO II will methodically investigate these preservation claims, assessing their plausibility.

The iDINO results have already provided a strong challenge to the evolutionary worldview. More extensive and detailed examination may provide even stronger evidence that the age of dinosaur fossils is far less than 65 million years. To this end, the Society continues to seek those willing to fund this project with either one-time gifts or monthly donations.

For more information contact us at (928) 636-1153 or crsvarc@crsvarc.com.

Also visit http://tinyurl.com/nphm2c4 for project updates and details.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