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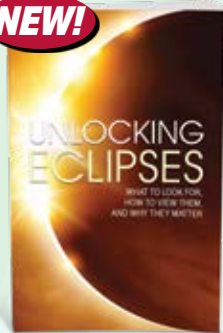
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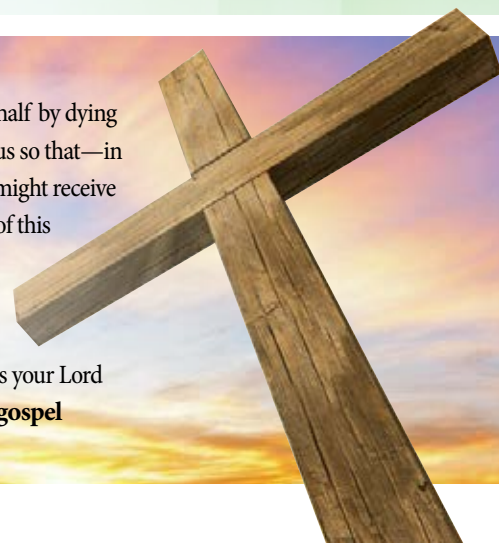
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Dennis Davidson

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(Colossians 1:15-20)

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Front cover: Green anole (*Anolis carolinensis*)  
Image credit: BigStock | samjray105



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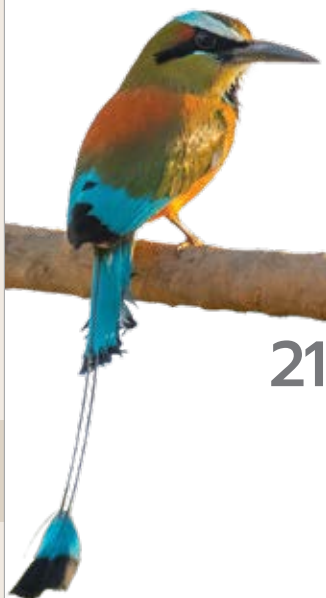
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# WHY BIOLOGY NEEDS A THEORY OF BIOLOGICAL DESIGN

## PART 1

R A N D Y J . G U L I U Z Z A , P . E . , M . D .

### article highlights

- Evolutionary selectionism was developed to explain the design in organisms without the involvement of a Creator.
- Without a viable alternative, selectionism has become the default framework for interpreting biological observations.
- Biology needs an alternative theory that is rational, is evidence-based, and doesn't rely on the mystical personification of nature as a selective agent.
- An engineering-based theory of biological design offers a new framework to investigate biological phenomena.

Anyone who watches American football has observed a predictable inconsistency. When a pass is caught extremely close to the sideline, everyone with the offense immediately makes the arm signal for a completion, while those with the defense signal an incomplete pass. This is a great example of how opposite interpretations of the same observation can be reached by two people with contrary starting positions. It also helps explain the root cause of the creation-evolution controversy.

### The Power of Theory Rests in the Story It Tells

In science, the starting position is a theory. Theories essentially function as long narratives. When they're taught to people, the stories place something akin to labeled cubbyholes in people's minds for them to organize observations. The cubbyholes are arranged in such a way as to fill out different parts of the narrative. People will be *guided* by the labels as they interpret what they see, and then they'll place their newly molded thoughts into the corresponding cubbyholes.

Yet, it's not whether all the cubbyholes are filled but the narrative itself that provides the structure that shapes people's thinking. The narrative always has a goal, and the goal of a theory is to guide people into a particular way of making sense of seemingly



disconnected observations of nature.

We've all heard of the theory of evolution. The worldwide influence of that narrative is undeniable. It powerfully shapes people's view of biology, though it's likely that most people, including evolutionists, couldn't explain its basic assumptions and *how* they shape (i.e., put the labels on the cubbyholes) the interpretations of biological observations. But the take-home message of the evolutionary narrative is clear—the diversity and apparent design of living creatures came about through natural processes without the need for a Creator.

Harvard's legendary evolutionary theorist Ernst Mayr sums up the central importance of a narrative to Darwinism:

Darwin introduced historicity into science. Evolutionary biology, in contrast with physics and chemistry, is a historical science....Laws and experiments are inappropriate techniques for the explication of such events and processes. Instead one constructs a historical narrative, consisting of a tentative reconstruction of the particular scenario that led to the events one is trying to explain....The testing of competing historical narratives became the methods of evolutionary biology, outweighing experimentation.<sup>1</sup>

Mayr then delivers the take-home message:

Natural selection explains the adaptedness and diversity of the world....It no longer requires God as creator or designer....[the] creation, as described in the Bible...was contradicted by almost any aspect of the natural world. Every aspect of the "wonderful design" so admired by the natural theologians could be explained by natural selection.<sup>1</sup>



### Negative Evidence Alone Can't Dislodge Darwin's Narrative

Yet, millions of people—and thousands of scientists—think Darwinian evolution is a nonsensical explanation for the incredible design of creatures. They sense that its atheistic implications are the key to its preservation despite the huge problems that have been highlighted for decades, like failed predictions, counterintuitive explanations, appeals to academic authority, and imagination that is used to fill massive gaps in the evidence.

Since we're dealing with science, why won't contrary evidence dislodge the narrative? There must be other factors involved that enable the theory to persist. And indeed, there are.

First, scientific theories—especially evolution—operate by peculiar rules that make them resistant to dying. The most important rule of evolutionary theory states that any thinking out-

side of the theory is unscientific and must be excluded from scientific narratives. Another rule is that "laymen" aren't capable of determining their own labels for cubbyholes. They must receive what "experts" deliver to them. The rules also say it's alright to place an observation in a cubbyhole, i.e., make it fit a theory, even if (for now) it takes great imagination to do so. The narrator is even allowed to re-label a cubbyhole today the opposite of what it was yesterday.

When someone objects that these rules unfairly protect evolution from falsification, evolutionists simply say, "Science is just self-

correcting." Thus, when faced with contrary findings, the narrative can bend enormously—but not break. The rules allow the narrative to assimilate nearly all observations and to outright exclude competing explanations.

Second, a scientific theory may be in first place, not because it's good, but because it's the only one in the race. It persists because it's the only thing to mentally hold onto. Mutation-selection, it's believed, offers at least some explanation for adaptation and diversity, and a flawed narrative provides more intellectual security than no narrative. Research shows that even scientists are tentative—if not afraid—to let go of one explanatory "handle" until there's another to grab on to.<sup>2</sup> The Darwinian narrative's exclusivity and longevity have enabled it to permeate the thinking of virtually every segment of society.

Because the mutation-selection narrative has been the only game in town for so long, it's the go-to story to explain adaptation for evolutionists and many creationists and Intelligent Design (ID) advocates. For example, if you show nearly anybody a river-dwelling fish with eyes and a cave-dwelling fish of the same kind with no eyes, then the cubbyholes they'll reflexively place their observations into are labeled "random mutations," which caused eye degeneration in the cavefish, and "survival of the fittest," which selected for the eye-loss trait.

Both the full-blown versions of Darwinian mutation-selection and the lighter narrative (that ICR previously taught) are still the same thing. But even evolutionists are increasingly pointing out that Darwinian selection is misleading people into a form of mystical thinking by attributing volition and agency to nature.<sup>3,4</sup>

So, why do many continue to tell the mutation-selection story (i.e., Darwinism)? That's all they've had to go by. No other narrative has been offered. Without a better alternative, many are afraid to let go of Darwinian selectionism. Simply pointing out problems with evolution isn't a replacement narrative.

### Scientific Theory Interprets Observations

Let's take a look at evolution's path to becoming today's dominant biological theory. A theory is a narrative, but that doesn't make it a made-up story, a hunch, or even a commonsense guess. It's a working hypothesis meant to explain the origin of a natural phenomenon or how it works.

This hypothesis becomes the backbone of a tentative framework that's supposed to interpret diverse observations in a way that ties them together and provides an explanation that's reasonable and scientifically plausible (i.e., doesn't appeal to imagination to fill in gaps). It's called a *working* hypothesis because it's used as the lens through which observations are interpreted, it shapes the research questions that are investigated, and it thus sets the research agenda.<sup>5</sup>

So, scientific theories powerfully constrain something of overwhelming importance within science—how observations *are interpreted*. Interpretations are the working-level thoughts that shape a

person's beliefs. Guiding interpretation is perhaps the most important role of theory, but that isn't its central purpose.

## Scientific Theory Answers Big Questions

The main purpose of a theory is to answer the big questions that exist in every field of study. What are the big questions in biology? Perhaps the most apparent is how life began. That's big, but there's something special about creatures. We observe distinctive characteristics that prompt the question: Were creatures *designed* by some being *like us* but greater than us? Questions that contain words like "design" or "engineering" inherently have theological implications.

Evolutionists recognize the big questions in biology and their theological implications as well as anyone. The evolutionary philosopher Peter Godfrey-Smith said:

The apparent design of organisms, and the relations of adaptiveness between organisms and their environments, are the *big questions*, the amazing facts in biology. Explaining these phenomena is the core intellectual mission of evolutionary theory. Natural selection is the key to solving these problems; selection is the *big answer*.<sup>6</sup>

He summoned support from Richard Dawkins, adding:

The first chapter of *The Blind Watchmaker*...is an extended defense of the claim that apparent design in nature poses a uniquely important problem for the scientific worldview, and biology's special task is to solve this problem.<sup>6</sup>

Evolutionists clearly understand the implied theology of this "apparent design" and know they need their own atheistic answers to the big questions. They're confident their construct of natural selection provides these answers.

Harvard's famed geneticist Richard Lewontin describes how evolutionary theory was developed to address the design of creatures as the *most* important question in biology.

Life forms are more than simply multiple and diverse, however. Organisms fit remarkably well into the external world in which they live. They have morphologies, physiologies and behaviors that appear to have been carefully and artfully designed to enable each organism to appropriate the world around it for its own life. It was the marvelous fit of organisms to the environment, much more than the great diversity of forms, that was the chief evidence of a Supreme Designer. Darwin realized that if a naturalistic theory of evolution was to be successful, it would have to explain the apparent perfection of organisms and not simply their variation.<sup>7</sup>

Big questions concerning biological adaptation are related to the apparent design of organisms. Evolutionary theorist Stephen J. Gould asked:

What is the motor of organic change? More specifically, how are life and the earth related? Does the external environment and its alterations set the course of change, or does change arise from some independent and internal dynamic within organisms themselves?<sup>8</sup>

So, some big questions in biology that any theory must answer are:

1. How do we account for the impressive apparent designs of organisms?
2. What explains the purpose observed in biological systems?
3. Can nature function as an agent sufficient unto itself, or is an intelligent agent needed?
4. What controls organisms' responses to their environments?
5. Are there limits to the process of biological adaptation?

## Natural Selection: Darwin's Design-Producing, Creative Force

Given the big questions and their own atheistic bias, Darwinists needed an unconscious creative agent that can sort through random mutations, select the best, and build "designed" organisms. Evolutionary theorist Francis Ayala confirms natural selection was intended to fill this role:

With Darwin's discovery of natural selection, the origin and adaptations of organisms were brought into the realm of science. The adaptive features of organisms could now be explained, like the phenomena of the inanimate world, as the result of natural processes, without recourse to an Intelligent Designer.... Darwin's theory of natural selection accounts for the "design" of organisms, and for their wondrous diversity, as the result of natural processes, the gradual accumulation of spontaneously arisen variations (mutations) sorted out by natural selection.... This was Darwin's fundamental discovery, that there is a process that is creative, although not conscious.<sup>9</sup>

How selectionists devised a narrative that is fundamentally anti-intelligent design but still produces design is the topic of my next article.





## Selectionism Today: The Go-To Answer to Big Questions

Is there currently a rival theory to contest selectionism as the go-to explanation for biological adaptation? Evolutionary selectionists claim their theory answers the big questions—especially about purpose, design, and agency. But they also claim selectionism is a robust framework for scientists to organize their thinking about *all aspects* of the diversity of life and that it's the *best* way to approach biological research. In other words, they believe that without evolutionary theory biologists couldn't do their jobs effectively.

Evolutionists bolster their case by opposing creationists and many ID advocates who declare that creatures didn't evolve but were instead precisely and skillfully engineered. The selectionists assert that these critics have utterly failed to produce an alternative framework to interpret observations and offer "new avenues for research."<sup>10</sup> They underscore the lack of fresh thinking by noting that creation/ID selectionists have themselves accepted mutation-selection—the backbone of the Darwinian anti-design model of adaptation—as their major tenet for designed adaptation.<sup>11</sup>

Are these indictments true? Is selectionism the uncontested framework for interpreting adaptation and diversity? What would you say if an evolutionist asked you to tell him how the research questions being raised and investigative agenda being set *based on* a theory of "engineered creatures" are *different* from those of evolutionists?

Historically, creationists and many ID advocates claim they do have a "theory": intelligent design is the best explanation for observations like irreducible complexity, specified complexity, and fine-tuning in nature. Evolutionary selectionists retort, "What kind of 'theory' is that?" They wouldn't deny various biological complexities or that organisms appear designed, but they would say organisms *only appear* designed because mutation-selection is a powerfully

"creative process" that offers a totally natural explanation for the origin of all biological complexity.<sup>12</sup>


Then they wait for a contrasting theory to contest their explanation.

Design-oriented selectionists respond that natural selection is actually a "conservative process" (some say it's the God-ordained way to weed out the worst mutations from populations) that can cause incredible biological diversity only within specific creature kinds. Evolutionary selectionists disagree. They also still point out that using "conservative" rather than "creative" to describe selectionism still holds it to be a real, adaptive process squarely within Darwinian selectionism, so where's the alternative theory? It isn't an alternative theory if it merely differs in the degree of efficacy of the mutation-selection model. Selectionism remains without a serious challenger.

## Replace Selectionism With a Theory of Biological Design

In sum, evolutionary theory is a narrative that guides people to think that a natural, purposeless process in which nature is personified as a selective, creative agent can answer the biggest question in biology. Namely, how did creatures get their incredible design? The influence of selectionism pervades even creationist and ID domains primarily due to its long persistence as the uncontested explanation of adaptation.

As noted earlier, the real work of theoretical narratives is to guide the interpretation of day-to-day observations. The lack of an alternative theory to selectionism is why evolutionists and creationists have presented essentially the same narrative for the origin of such phenomena as blind cavefish. At the Institute for Creation Research, we sense that the traits that enable some fish (and other creatures) to colonize caves result from those creatures' ability to purposefully track environmental changes due to highly engineered, innate systems. We find it dishonoring to the Lord Jesus to say His mechanism by which creatures adapt today is the purposeless, deadly, clunky, and anti-design mutation-selection process. It's clear that we need our own complete, engineering-based theory and interpretive framework based on what is *opposite* to assumptions of selectionism.

What would make up a theory of biological design (TOBD)? A TOBD needs to be a compelling, engineering-based narrative that can sweep away the cubbyholes of selectionism and offer a better foundation and new labels to use when interpreting observations that will then be placed into new cubbyholes. A TOBD will be far more intuitive, rational, and evidence-based by eliminating both imagination and the personification of nature as a selective agent. Details of a TOBD will be presented in part two on this topic. 

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The tallest sand dunes in North America are found in Great Sand Dunes National Park and Preserve, located on the eastern edge of the San Luis Valley in southern Colorado. The largest of the dunes reaches 700 feet above the valley floor. Visitors to the park have to slog up sand for about an hour just to reach its top!

A satellite's-eye view shows the dunes nestled in a bend of the Sangre de Cristo mountain range. Signage at the park attributes the dunes to the unique wind patterns that cross the San Luis Valley, which extends westward from the dunes around 50 miles until it reaches the San Juan Mountains.<sup>1</sup> But surely there is more to this story. What built these mountains of sand?



*Great Sand Dunes National Park and Preserve, Colorado*

Image credit: Earth Science and Remote Sensing Unit, NASA Johnson Space Center

## GREAT SAND DUNES NATIONAL PARK AND PRESERVE

# COLOSSAL ICE AGE REMNANTS

B R I A N T H O M A S , P H . D .





*Sandhill cranes visit the grassy San Luis Valley. This view looking east shows the great sand dunes in front of Mt. Herard of the Sangre de Cristo Range.*

Image credit: National Park Service

## What It Takes to Make a Dune

A group of Colorado-based geologists offered three requisites for dune formation in a study on the origin of the Great Sand Dunes.<sup>2</sup>

1. An adequate supply of dry, loose sand—the rarest requisite
2. A means to transport the sand, such as wind
3. An obstacle (e.g., a mountain range) for the dune to form against so the sand doesn't keep drifting

The same geologists also listed common factors that keep sand from forming dunes. These include sand mixing with clay particles or any liquid water, both of which hold sand grains down. Rocks can hinder the sand's progression along the ground, as can roots and leaves

### article highlights

- Most of the sand in Great Sand Dunes National Park in southern Colorado originated from a volcanic mountain range 50 miles away. So how did the dunes form?
- Signs of Ice Age glacial activity in the area hint at what produced the sand, and the Sangre de Cristo mountain range would have allowed the sand to pile up against it.
- The dunes must have formed quickly before grass from the adjacent San Luis Valley could grow to stop them.
- A single Ice Age following the Genesis Flood offers a more likely cause for the dunes than the conventional explanation of multiple Ice Ages.





*One of many sand dunes dwarfs two of its climbers.*

Image credit: Bradley Harkness

from even sparse vegetation. Today, the San Luis Valley has plenty of grass and marshes that keep sand from going too far. The conditions, then, must have been different in the past for the sand to have formed these giant dunes.

### Where Did All This Sand Come From?

Geologists analyzed sand grains from the dunes to find the sand's sources. It turns out that about 30% came from the nearby Sangre de Cristo Range.<sup>2</sup> This range comprises an uplifted block, called a horst, of crustal granite and gneiss. About 70% of the sand came from the faraway San Juan Mountains, which are relatively younger and entirely volcanic. Enormous calderas among these mountains mark where supervolcanoes erupted.<sup>3</sup>

Today's slow processes and winds do not grind rock into sand, transport it 50 miles west, and build new dunes with it. Thus, both conventional and catastrophist geologists lean on Ice Age conditions to explain the dunes' origins.

In the past, glaciers scoured some mountain valleys into U-shaped profiles called troughs. Moraines, piles of rock debris that vary from clay and sand to boulders, mark the edges of the glaciers that once bulldozed nearby mountain slopes. Evidence of these indicate



*Hikers wade through Medano Creek upon their return from a dune summit. Today's creek carries more sand away from the dunes than to them.*

Image credit: Pimlico27 via Wikimedia, CC BY-SA 4.0 Deed

that ice once pressed down the San Juan Mountains, which hold the headwaters of the Rio Grande, during the Ice Age. Indeed, "the main Rio Grande glacier was about 60 km [37 mi] long and covered nearly 1000 km<sup>2</sup> [386 mi<sup>2</sup>]."<sup>2</sup> The connected glaciers together formed the western San Juan ice cap.<sup>4</sup> Melting glaciers ground rock into sand and spread that sand across the valley with help from accelerated winds.



*Margerie Glacier, Glacier Bay, Alaska. Glaciers like this covered the San Juan Mountains during the Ice Age.*



## Putting the Pieces Together

So, what pieces do we have for the dune formation puzzle? A vast quantity of sand derived mostly from the volcanic San Juan Mountains via glacial activity, the sand's transportation 50 miles across the San Luis Valley, a backstop mountain range where the sand accumulated, and dunes forming quickly before grass could grow to stop them.

What historical happening can fit these pieces together? Creationists recognize that the world-destroying forces at play during Noah's Flood pushed the Sangre de Cristo Range mountains upward as floodwaters receded.<sup>5</sup> Soon after, magmas beneath the earth blasted through the crust along the Rockies.<sup>6</sup> One volcano after another, including a few supervolcanoes, erupted continuously during and after the Flood.

This contributed to the start of the Ice Age, which needed brief timespans between volcanic eruptions for them to repeatedly pump enough aerosols into the sky to block sunlight and keep ice from melting in the summertime.<sup>7</sup> Conventional geologists don't believe the Flood is historical and insist that long timespans separated past volcanic eruptions, so short timespans don't fit their way of thinking. However, they do agree that because of an Ice Age, glaciers formed in the mountains and grew as ice thickened over time. Eventually, eruptions slowed and ice melted.



*Over a half million people per year visit Great Sand Dunes National Park and Preserve.*

Image credit: Brian Thomas

As the Ice Age ended, glacial meltwater carried and deposited ground-up rock material in a huge fan of sand across the broad San Luis Valley. Strong gales like glacial winds (a type of katabatic wind) blew sand far to the east until it piled against the Sangre de Cristos.<sup>8</sup> Critically, this must have happened after the water table dropped beneath the sand's capillary fringe level for the topmost sand to be dry but before vegetation had time to cap the sand.<sup>9</sup> Soon grass grew, halting dune growth. Ever since, prevailing winds that blow east and intermittent winds that blow west over a saddle in the Sangre de Cristos

have kept the dunes piled high.

This explanation for the Great Sand Dunes requires many precise events to have occurred. Because conventional scientists insist on multiple Ice Ages, they maintain these unlikely events happened multiple times to form the dunes. Each time one of their many Ice Ages occurred, glacial outwash transported sand for miles, the valley's water table sunk low enough for that sand to dry, and strong winds blew—all before grass could grow.

All of this happening once at the end of a single Ice Age is more likely than it happening exactly that way dozens of times. Meanwhile, conventional scientists still struggle to explain how even one Ice Age can happen. The Great Sand Dunes therefore serve as awe-inspiring monuments to a single, recent Ice Age. 🌬️🏜️

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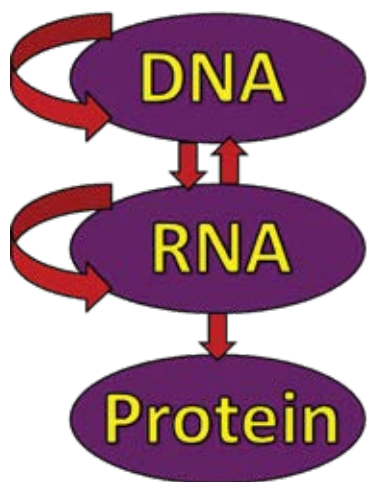
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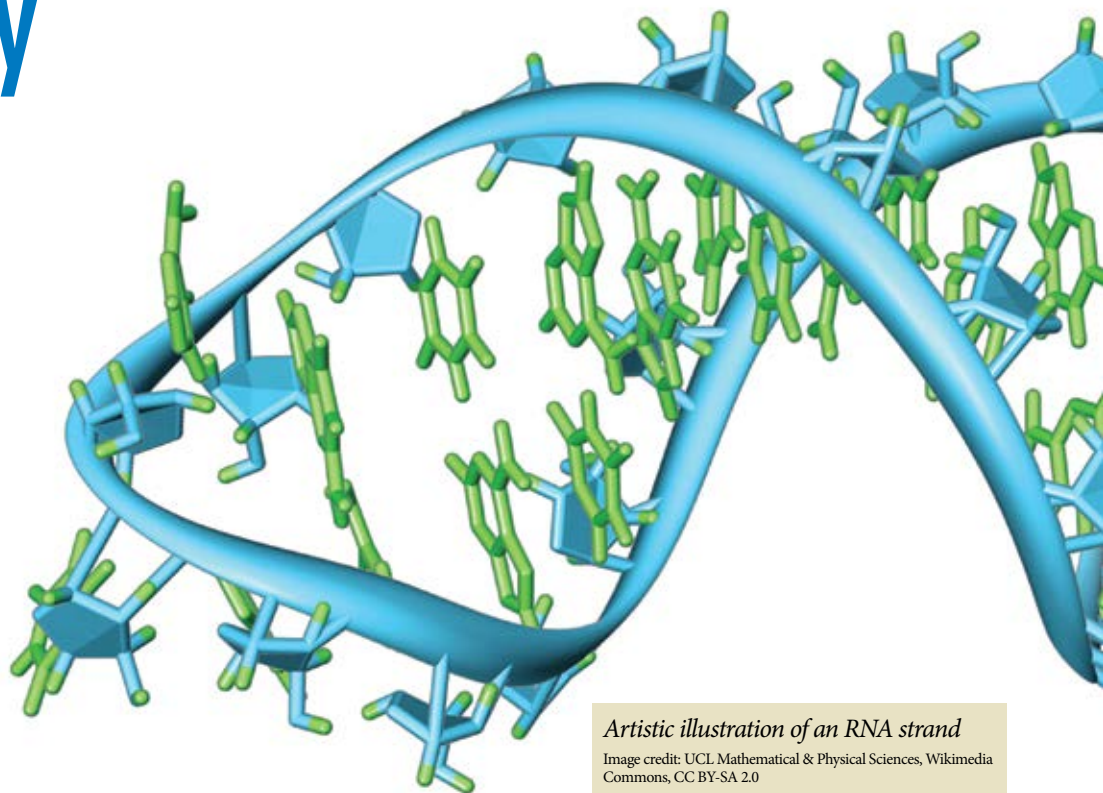
*Brad and Semper Harkness, the author's daughter and her husband, explore the mighty dunes with their canine companions.*

Image credit: Semper Harkness

# RNA Editing Adaptive Genome Modification on the Fly



*Conventional belief about the transference of information between DNA, RNA, and proteins*



*Artistic illustration of an RNA strand*

Image credit: UCL Mathematical & Physical Sciences, Wikimedia Commons, CC BY-SA 2.0

**W**hen the workings of the genome were first being discovered, the central evolutionary dogma of molecular biology claimed that genetic information passes consistently from DNA to RNA to proteins. Today we know that RNA messages can be altered by a variety of mechanisms. New studies in genetics on one of these processes, RNA editing, have revealed an unprecedented level of dynamically adaptive genome complexity that defies the conventional evolutionary paradigm.<sup>1</sup>

All major animal groups from jellyfish to humans use amazing cellular machinery to modify RNA that's transcribed (copied) from both protein-coding and non-coding RNA genes. One of the first RNA-modifying systems that researchers uncovered is alternative splicing, where a single gene can have its modular components added, removed, doubled, or even combined with the products of a completely separate gene.<sup>2</sup> Thus, a single gene can produce a wide



*Marbled jellyfish*

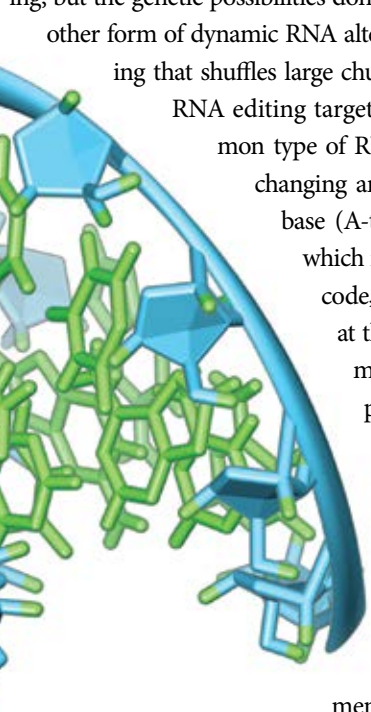
array of RNA variants, including many different protein forms if the RNAs are translated (made into proteins).

Incredible variability can be achieved through alternative splicing



## article highlights

- RNA editing plays a major role in genetic information processing; this genetic recoding ability dynamically expands the biological information capacity of the organism.
- This highly precise and complex process is found in mammals and sea creatures like squid and coral.
- This dynamic mechanism demonstrates remarkable complexity and quick responsiveness in cellular systems at all levels of life.
- The exquisite engineering of living creatures points to the Master Designer of all things—the Lord Jesus Christ.



ing, but the genetic possibilities don't stop there. RNA editing is another form of dynamic RNA alteration. Unlike alternative splicing that shuffles large chunks of DNA sequence around, RNA editing targets single bases. The most common type of RNA editing in animals involves changing an adenosine base to an inosine base (A-to-I editing). The inosine base, which isn't part of the standard genetic code, is interpreted as a guanine base at the ribosome where proteins are made. This type of editing in both protein-coding and non-coding RNAs has been found to have profound effects on gene expression.<sup>1,3,4</sup> Also, the alteration of RNA transcripts coding for proteins creates yet another dynamic system of diversity in the cells' protein complement, which is called a proteome.

The process of RNA editing appears to occur as the gene is copied or transcribed (called co-transcriptional) and also after the messenger RNA (mRNA) is produced (called post-transcriptional).<sup>1</sup> The basic type of mRNA targeted for editing is called an imperfect double-stranded RNA—a single-stranded RNA that has folded back onto itself with some mismatched bases. These targeted RNAs can be protein-coding or long non-coding RNAs.

The modification produced by RNA editing is accomplished by protein machinery called adenosine deaminases acting on RNA (ADAR) enzymes.<sup>1</sup> The various types of ADARs, which are creature specific, edit double-stranded RNA, as noted above. This is most commonly done in non-coding regions of genes (introns) while also editing much fewer sites in coding regions with highly targeted specificity. The RNA editing in introns affects retention of the mRNA in the cell's nucleus and the process of splicing the RNA to create a mature transcript. Incredibly, the RNAs encoding ADAR proteins are themselves also commonly edited as part of complex feedback loops and networked interplay between RNA editing and

other RNA modification systems.

Interestingly, in some creatures RNA editing is widespread among the RNA encoding of proteins involved in neurotransmission and the cellular electrical machinery that regulates cell signaling, such as ion channels in the cell membrane.<sup>1,3</sup> These RNA edits can alter the resulting protein and can also change the splicing pattern of the mRNA when processing the transcript after it's copied. RNA edits in ion channel proteins dynamically modulate the electrophysiological properties of the neuronal cell's synapses and other aspects of their neuronal connections to rapidly adapt to various environmental conditions.<sup>1,3</sup>

Even more amazing from a broader and functional perspective, RNA editing affects transcripts encoding proteins involved in brain patterning for both embryo development and mature brains, neural cell identity and function, and proteins related to DNA repair.<sup>1</sup> Thus, RNA editing is a key factor in cell neuron activity and brain cell network plasticity, which is important for daily functioning in things such as memory consolidation.

While the regulatory pathways that control RNA editing are not well understood, research studies show that RNA editing alters the structure and information content of protein-coding and long non-coding RNAs in response to changing environmental conditions and a creature's past experience.<sup>1</sup> In this respect, ADAR enzyme activity and target selection have been shown to be linked to cell signaling pathways.<sup>1</sup>

In regard to the adaptive, innate immune response of vertebrates, RNA editing has been shown to be involved as part of the built-in algorithm and learning machinery associated with host responses to viral infections. For example, mutations in human ADAR1 are one of the defined genetic causes of Aicardi-Goutières syndrome, an autoinflammatory disorder characterized by spontaneous interferon production (natural defense proteins) and neurological problems.<sup>1</sup> Mutations in human ADAR2 cause a small head and neurological disorders during development, and its deficiency in mice causes seizures and early embryo lethality.<sup>1</sup>

Clearly, RNA editing is key to an organism's ability to develop, grow, and adapt itself in response to its environment and past life experiences. In the next part of this article, I'll list several of the more recent studies that show how important this process is to adaptive response mechanisms.

## RNA Editing in Cephalopods

Until recently, the best-studied cases of RNA editing in animals have been in mammals and flies. It was thought to occur at a fairly low level and to be mostly involved in immune responses.<sup>1</sup> However, a 2015 study concerning squid reported that the majority of proteins studied were affected by RNA editing.<sup>3</sup> In fact, the researchers discovered that A-to-I RNA editing had a pervasive effect on most biochemical pathways in the squid, especially those related to the nervous system. Other reports have demonstrated that RNA editing is crucial



*Caribbean reef squid*

Image credit: Betty Wills, Wikimedia Commons, CC-BY-SA 4.0

to the proper functioning of the nervous system in humans and other mammals, though at a much lower level.<sup>1,5,6</sup>

For years, the squid, with its highly specialized nervous system and large axons (nerve cell fibers), has been a model in studying the physiology of how nervous systems work. Thanks to this study, the importance and role of RNA editing, especially as it relates to the squid's lightning-fast muscle and neurological responses, have been better clarified. In fact, the level of squid RNA editing complexity was truly astounding and had never been seen at this level before. In an interview, lead researcher Dr. Eli Eisenberg stated:

We have demonstrated that RNA editing is a major player in genetic information processing rather than an exception to the rule....The squid's RNA editing dramatically reshaped its entire proteome—the entire set of proteins expressed by a genome, cell, tissue, or organism at a certain time.<sup>7</sup>

In a more recent squid study, the researchers used the molecular motor proteins kinesin and dynein to take a deeper look into the functional results of mRNA recoding through RNA editing.<sup>8</sup> Both kinesin and dynein utilize cellular energy from ATP molecules to move cellular cargo down protein fiber highways called microtubules. The researchers discovered that RNA editing significantly altered both motor proteins and that this varied quite a bit between tissues and was responsive to seawater temperature.

This amazingly complex system is an engineering marvel. It enables the squid to literally recode its active genetic information “on the fly” to allow for rapid adaptive responses to changing environmental conditions. This is especially true in light of all the other intricate cellular information systems with which RNA editing interfaces.

Recent research in octopus highlighted the importance of RNA editing as an adaptive response system to changes in water temperature.<sup>9</sup> In this study, RNA editing was documented in at least 20,000 different sites among the creature's messenger RNAs expressed in neural tissue in response to cold water temperatures (55°F versus 72°F). The massive shift in RNA editing in response to temperature change was observed within hours in the lab, and the effects were verified by catching wild octopi in the ocean and testing their RNA.

The researchers also verified that the massive recoding of RNAs on the fly resulted in a corresponding shift in the overall protein complement (proteome) of the creature. In fact, one altered protein known as a synaptotagmin, which controls a voltage channel in neu-

ral cell membranes, was recoded in the amino acids that actually span the cell membrane. This altered the binding of calcium ions, a key chemical messenger in intercellular electrical communication. Another altered protein was a kinesin motor that moves cellular cargo down specialized protein fiber highways called microtubules, as noted above with squid.

## RNA Editing in Corals

Coral reefs are a key component of ocean ecology, providing homes and habitats for a wide diversity of life. While a head of coral may look like a single organism, it's actually a conglomeration of numerous genetically identical creatures called polyps. These organisms have been thought to represent a primitive form of multicellular animal life. In fact, evolutionary scientists allege that the first



*A diver studies Acropora millepora coral*

Image credit: Michelle Jonker, Wikimedia Commons, CC BY 3.0 Deed

corals evolved over 400 million years ago at the earliest stages of life on Earth. But are corals actually primitive, or are they just another example of highly complex engineering?

A 2017 study on RNA editing in corals contradicted the evolutionary story that life became progressively more complex over eons of time.<sup>10</sup> This type of phenomenon is the same A-to-I editing described above in cephalopods. Its mechanisms are still being analyzed, but like the cephalopods, the editing is known to be involved in adaptation and increasing the post-transcriptional diversity of the genome.

In the coral study, scientists analyzed RNA editing in the species *Acropora millepora*, which is supposedly one of the most basal or primitive animals in the so-called evolutionary tree of life. The researchers focused on reproductive cells, or gametes (sperm and egg), where RNA editing was believed to play an important role. Surprisingly, it was discovered that the RNA editing patterns in the corals resembled those found in mammals. The patterns are largely involved in transposable element sequences that, when transcribed, readily



form double-stranded RNAs that fold back onto themselves. In fact, they found over 500,000 sites in coral transcripts where RNA editing had altered the sequence. The RNA editing levels were especially increased during spawning and in newly released gametes.

So, how did corals at the supposed beginning of animal evolution possess an incredibly controlled, precise, and dynamic phenomenon like RNA editing that's as complex as that found in mammals? This represents a repeating theme in scientific discovery—astonishing levels of complexity in cellular systems at all levels of life. Nothing appears to be primitive or explainable by the slow and random hypothetical evolutionary process of mutation and selection.



California ground squirrel

Image credit: Thomas O'Brien, Wikimedia Commons, CC BY 3.0 Deed

## RNA Editing in Mammals

As far as the adaptive engineering of RNA editing goes, the greatest research progress has been in marine creatures that live in very challenging ocean environments, as noted above with cephalopods and corals. However, a 2018 study in mammals illustrated how this system also works in land creatures.<sup>11</sup>

While cephalopods and corals are ectothermic marine animals whose body temperature mirrors the surrounding temperature, hibernating ground squirrels provide a unique opportunity to investigate RNA editing in a heterothermic mammal, whose body temperature is internally determined. Remarkably, ground squirrels exhibit a unique physiology where body temperature varies over 86°F and can be maintained at a low temperature of 41°F for many days during hibernation and torpor. Torpor is a state of decreased physiological activity associated with hibernation that's characterized by reduced body temperature and slow metabolic rates. Thus, torpor is a highly specialized and adaptive system that enables some animals to maintain physiological activity during periods of reduced food availability in winter.


In this study, researchers profiled the transcriptome (total RNA in a given tissue) in three brain regions at six different physiological states.<sup>11</sup> The goal was to evaluate whether RNA editing is a mecha-

nism that during hibernation facilitates neurological tissue protection in response to cold temperatures. The researchers identified 5,165 RNA sites in 1,205 genes that had dynamically increased RNA editing after the squirrels were subjected to the cold for an extended period. Additionally, the RNA editing was found to positively correlate with increasing cold exposure. The overall conclusion was that RNA editing at low body temperatures provided a dynamic neuroprotective mechanism during torpor in mammalian hibernation.

## Conclusion

RNA editing promotes transcriptome diversity by recoding and expanding the coding capacity of the genome, typically as a controlled response to changed environmental conditions. The most common type of RNA editing is A-to-I editing in which the I is read as a guanine at the ribosomal machinery that translates proteins.

The chief piece of cellular machinery involved in this recoding reaction is an adenosine deaminase, known as the ADAR family of enzymes, that acts on the mRNA. At present, most research has revolved around RNA editing in response to temperature changes associated with cold acclimation. In ectothermic organisms, including *Drosophila* and Cephalopoda, where body temperature mirrors ambient temperature, decreases in environmental temperature lead to increases in A-to-I RNA editing and cause amino acid recoding events that are thought to be adaptive responses to temperature fluctuations. In addition, RNA editing is also being shown to be important in cold acclimation of hibernating mammals.

Evolution pictures living organisms as passive forms being acted on and shaped by outside forces. But the more researchers delve into life's inner workings, the more they find innate, exquisitely engineered systems that enable creatures to adapt and respond to changes around them. Our world declares the wonders of our Creator, the Lord Jesus Christ. 

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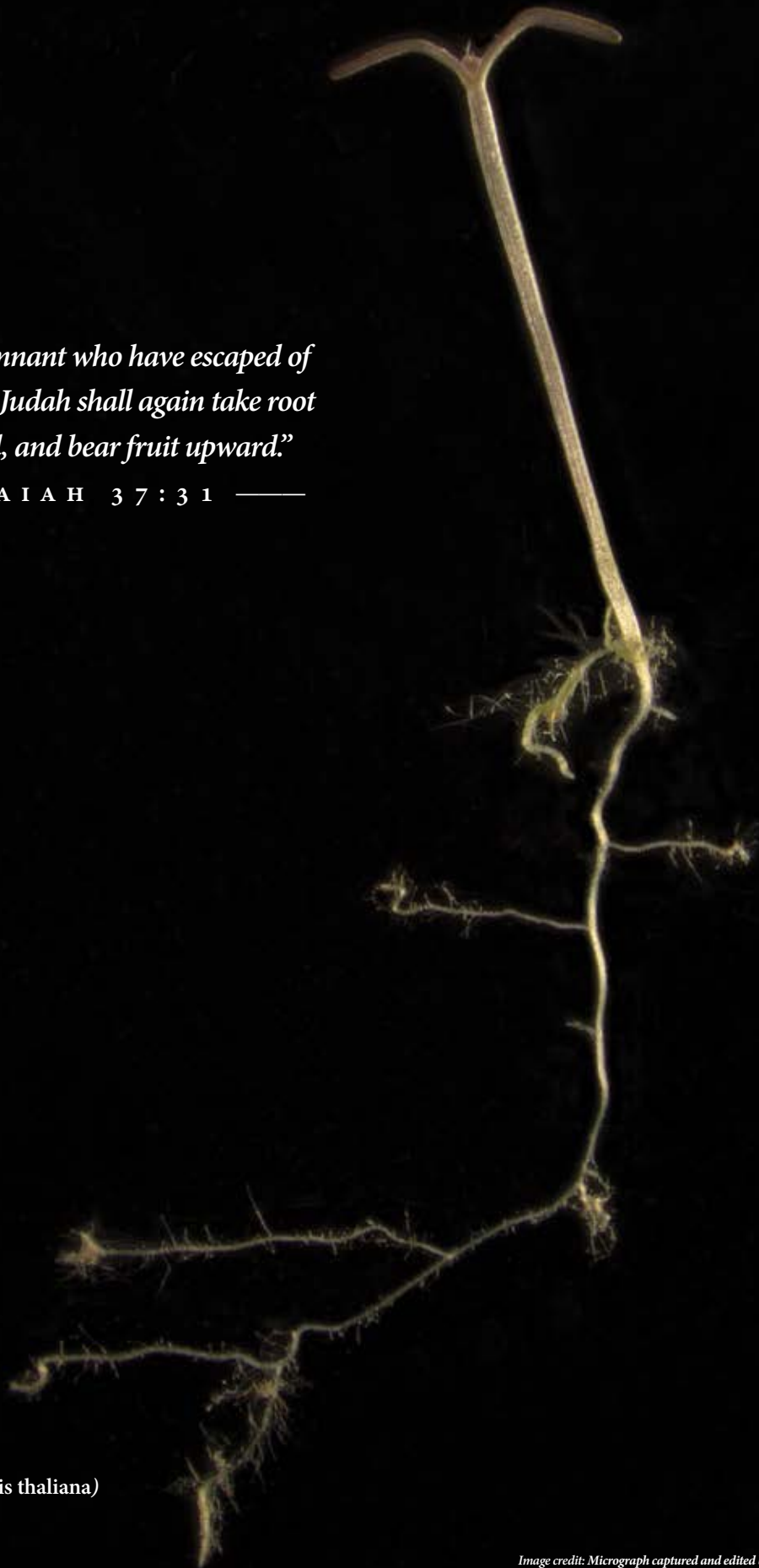
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*“And the remnant who have escaped of  
the house of Judah shall again take root  
downward, and bear fruit upward.”*

—— I S A I A H 3 7 : 3 1 ——



*Thale cress (Arabidopsis thaliana)*

Image credit: Micrograph captured and edited by Michael J. Boyle, Ph.D., The William B. Dean, MD Imaging Center of the Institute for Creation Research



# Dolomite Problem Best Solved by Flood

TIM CLAREY, P.H.D.

## article highlights

- Dolomite rock is found all over the world, but conventional geologists struggle to explain its unique formation in today's oceans.
- A new study found that alternating episodes of fresh and salt water create favorable conditions for dolomite formation.
- Only the Genesis Flood provides a fitting explanation for Earth's dolomite layers. The heavy rainfall of the early Flood mixed with the ocean's salt water allowed for dolomite precipitation.
- The sudden drop off of dolomite content in later Flood rocks can be explained because higher and more extensive salt water levels prevented further mixing with freshwater rain.

Dolomite is a very common sedimentary rock, comprising about 30% of all carbonate rocks.<sup>1,2</sup> Its chemical formula is  $MgCa(CO_3)_2$ , whereas the more common limestone is  $CaCO_3$ . Oddly, ocean water is supersaturated with respect to dolomite, yet it doesn't readily form from typical seawater. After more than 200 years of study, very little is known about how dolomite forms. In the modern world, it has only been found in tiny amounts in a couple locations and under very unusual conditions.<sup>3</sup>

This mystery is further complicated by the fact that dolomite and dolomite-rich rocks are more common in the oldest sedimentary layers and significantly less common in later strata. As one study concluded:

This lack of knowledge has been termed the *dolomite problem*, which can be expressed as follows: at present, large quantities of dolomite do not seem to form in nature under the geochemical conditions of the past sedimentary cycles.<sup>4</sup>

Studies have shown that the dolomite-to-calcite ratio is highest at 3:1 in pre-Sauk Megasequence rocks (pre- and earliest Flood). It decreases dramatically to 1:80 in late Zuni Megasequence rocks (highest point of Flood), and there's essentially zero dolomite found in post-Flood rocks (Ice Age and modern).<sup>5</sup>

Over the years, geologists have proposed numerous models to explain the formation of dolomite.<sup>6</sup> But none can adequately account for the thick, continuous deposits observed in the early Flood rocks.

A recent study has shed new light on this topic.<sup>1</sup> The collaborating scientists found that magnesium and calcite can randomly attach



Dolomite formations, Finnmark, Norway


on the surface of a growing dolomite crystal. However, this creates a partially disordered surface that hinders further crystal growth, stopping further deposition of dolomite.

Their breakthrough discovery was that the disordered regions are more easily dissolved than the ordered regions. They concluded, "If the solution is instead cycled between supersaturation and undersaturation [fresher water], then both dissolution and reprecipitation processes can be activated iteratively." They added, "Excess freshwater [rainwater] would lead to dolomite undersaturation, dissolving the more-soluble, disordered surface regions." In other words, fresher water dissolves away the disordered atoms, allowing more dolomite production.

Repetitive cycles of fresh water alternating with ocean water seem to be the key. Lots of rainfall is the secret ingredient. This may not fully resolve the dolomite problem, but it's a start.

What would create a condition where fresh water was frequently cycling with seawater on a global scale? The Flood described in Genesis. Recall the initial 40-day period of heavy rainfall and the repetitive, tsunami-like waves crashing across the continents from plate movement.<sup>7</sup> This would have created better conditions for fresh and ocean water fluctuations, providing the chemistry needed to make dolomite.

As the floodwater rose higher, there would have been less mixing with fresh water as the oceans covered more land, preventing dolomite production. By the time the Zuni Megasequence (high-water point) was deposited,<sup>7</sup> there would have been very little mixing since the ocean water entirely covered the earth. This could explain the dramatic drop-off of dolomite production in later Flood rocks. Today there remains little opportunity to create the chemistry fluctuations needed to produce dolomite.

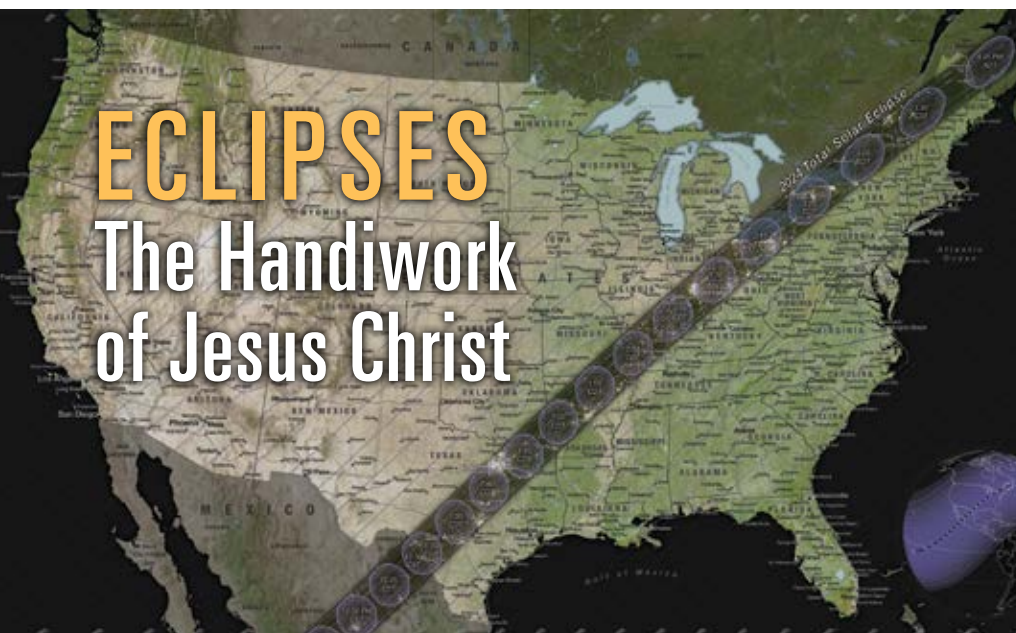
Evolutionary scientists may still be baffled, but Genesis provides the best answer for the dolomite problem. 

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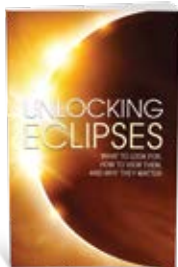




Many remarkable events have occurred over the past 50+ years of the Institute for Creation Research's ministry, but one of the most exciting is happening this year. On Monday, April 8, 2024, a total solar eclipse will be visible from North America. This incredible phenomenon occurs when the moon is located perfectly between the sun and Earth, casting its shadow on the surface of our planet. The path of totality, about 115 miles wide, will stretch from Mexico, through Texas over the Dallas/Fort Worth area, up to Maine, and across parts of eastern Canada. The next one in the continental U.S. won't take place until 2044, so this breathtaking occurrence is certainly rare—though not random.

At ICR, we seek to proclaim how celestial sights like eclipses point to the marvelous workmanship of our Lord Jesus Christ. The magnificent alignment of the sun and moon is an infinitely small reflection of God's eternal glory—present even before the stars were put in place. Sadly, the foolish wisdom of our present age has corrupted the biblical explanation of the universe's origins clearly described in the book of Genesis.

Interestingly, the sun and moon are mentioned over 200 times in the Bible. They capture the attention of both young and old, believers and unbelievers alike, even today. As a result of this continued interest, ICR has sought to provide information about these incredible marvels that's both scientific and rooted in God's Word.




Recently, we published a booklet titled *Unlocking Eclipses: What to Look For, How to View Them, and Why They Matter*. This insightful resource presents all the

details your family will need to prepare for eclipse day. You can purchase a copy at the ICR Discovery Center or at [ICR.org/store](https://www.icr.org/store).

In addition, on Saturday, April 6, 2024, ICR will host a large event in the Dallas, Texas, area to commemorate the Great American Solar Eclipse. In partnership with the Day4 Astronomy club, this family-friendly celebration will feature presentations from ICR scientists and guest speakers, including NASA astronauts and amateur astronomers, as well as games and activities

for kids of all ages. We'd love for you to join us at this fun-filled day of exploring our solar system and discovering the truth about the God who engineered it all. The details about this event are still being finalized, so mark your calendar and please check back at [ICR.org/Eclipse2024](https://www.icr.org/Eclipse2024) to learn more. If you have any questions about the event, call 214.615.8325 or email [events@ICR.org](mailto:events@ICR.org).

We're excited about this once-in-a-lifetime solar eclipse, and we hope you are, too. I encourage you to share with others not only the biblical significance of this stunning display but also how it reflects the most blessed gift ever received by those who, in faith and repentance, love the Creator and Savior of the universe—the Lord Jesus Christ. In Him, our God has “given to us all things that pertain to life and godliness” (2 Peter 1:3) and has allowed us to witness the magnificent wonders of His creation, like eclipses.

For over 50 years, ICR has impacted the lives of many. My dad was one of them, studying the geology of Noah's Flood in the late 1960s after a meeting with Dr. Henry Morris. Because of your prayers and financial support, I'm grateful to say that ICR reaches more people than ever before. Thank you for helping us share the truth of biblical creation. 

*Dr. Morse is Director of Donor Relations at the Institute for Creation Research and earned his D.Min. from The Master's Seminary.*



## UPCOMING MEET AND GREET EVENT

Free event • registration required  
• limited seating

March 10—Kimberly Christian Church, Kimberly, ID

For more information, email [ICRmeetandgreet@icr.org](mailto:ICRmeetandgreet@icr.org)

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# Motmot's Beauty Displays God's Gracious Design

Beauty is God's good gift. Whatever is truly good and beautiful comes from God (James 1:17), whose own beauty is beyond words. King David longed to know God's magnificent beauty, saying:

One thing have I desired of the LORD, that will I seek after, that I may dwell in the house of the LORD all the days of my life, to behold the beauty of the LORD, and to enquire in His temple. (Psalm 27:4)<sup>1</sup>

Because ultimate beauty belongs to God, it's not surprising that His creation—even in its fallen condition—exhibits many examples of beauty, one of which is a bird called the turquoise-browed motmot (*Eumomota superciliosa*). This

Neotropical forest bird's plumage combines emerald green, cyan-to-indigo blue, and brownish russet, and the wings have a black outline when outspread. It has a decurved (curved downward) bill that it uses to snag insects or pick fruit, and it has conspicuous, turquoise-colored eyebrows. But the motmot's real claim to fame is its two extra-long racket-tail feathers that are used for balance and wagtail signaling.<sup>2</sup>

Scanning electron microscopy shows that these unusual tail feathers are a beautiful work of bioengineering, even at the microscopic level—so much so that even evolutionists sometimes forget themselves and admit that these purposeful, pendulum-like tailfeathers give “evidence” of developmental “design.”

The racketed shape of the motmot's tail is attained when weakly attached barbs fall off, and the barbs along the wire appear to be weakly attached due to a combination of a reduced structural attachment and a lack of structurally enhancing melanin in the proximal rami of the barbs. Data provided in this [Journal of Avian Biology] paper provide evidence that certain barbs are designed to fall off, and that the shape of the motmot's tail is pre-determined at the time of development.<sup>2</sup>

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Blue-crowned motmot. Many species of motmots have racketed tails.

## article highlights

- Beauty is one of God's many gifts to us, and we see it throughout creation. One example is the motmot, a spectacular bird from Central and South America.
- The motmot's racketed tail helps it balance and serves as a signaling device. Its tail feathers are designed to fall off, giving it its unique shape and function.
- These beautiful birds live near the ruin of Chichén Itzá, an area where the Mayans once practiced human sacrifice. Even in our fallen world the beauty of Christ's handiwork is on full display.



Ziggurat-like temple known as El Castillo at Chichén Itzá, Mexico

Meanwhile, the Lord Jesus Christ—

our Creator—delivers beauty in our world, even though Earth is marred by Adam's sin and the consequential ugliness that sin produces. For example, I saw this spectacularly beautiful bird in 1998 at Chichén Itzá, a site once used as a Mayan center of horrific human sacrifice and cannibalism.<sup>3</sup>

In some of the most dangerous places on Earth there are some of the most beautiful animals. These include the turquoise-browed motmot that, for years, has dwelt conspicuously near the *cenote* (limestone-dominated sinkhole-well) area of Chichén Itzá in Mexico's Yucatan Peninsula. Even in places where the fallenness of mankind is evident—and sometimes dominant—the “good-yet-groaning” beauty of God's artistic creation is still there to admire and appreciate, for those with eyes to see.<sup>4</sup>

Turquoise-browed motmots were created beautiful because all true beauty is created by our Lord Jesus Christ (Ecclesiastes 3:11). In fact, our God is beautiful, and His work in the turquoise-browed motmot not only reflects our Creator's beauty and creativity but also His gracious character as He preserves such hidden-in-plain-view beauty, even in our fallen world. 🙏

## References

1. Interestingly, David's verb translated “enquire” is an infinite form of *bāqar*, a verb that connotes serious, discovery-seeking research, not unlike the empirical and forensic research by which ICR scientists strive to learn from and honor the Lord. Wigram, G. V. 2001. *The Englishman's Hebrew Concordance to the Old Testament*, 3rd ed. Peabody, MA: Hendrickson (originally published 1874), 265, showing Aramaic equivalent in Ezra 4:15, 19; 5:17; 6:1; and 7:14. Regarding ICR's research mission priorities, see Guliuzza, R. J. 2023. Continuous Environmental Tracking: An Engineering-Based Model of Adaptation. *Acts & Facts* 52 (6): 22–23.
2. “The distinctive racket-tipped...long central tail feathers...terminate in blue-and-black rackets that appear to hang, unattached below the body of the bird. The apparent detachment occurs because the feather shafts proximal to each racket-tip (wires) are devoid of barbs. Although barbs originally grow along the wires, the barbs are later lost to give the tail feathers their racketed shape.” Quoting Murphy, T. G. 2007. Lack of Melanized Keratin and Barbs that Fall Off: How the Racketed Tail of the Turquoise-browed Motmot *Eumomota superciliosa* Is Formed. *Journal of Avian Biology* 38 (2): 139–143. See also Peterson, R. T. and E. L. Chalif. 1973. *A Field Guide to Mexican Birds*. Boston, MA: Houghton Mifflin, 113 and plate 22. Emphasis added.
3. The Chichen Itza excursion was facilitated by the Norwegian Cruise Lines' *Norwegian Star* when this writer served aboard that cruise ship as guest lecturer naturalist-historian.
4. Johnson, J. J. S. Jungle Biodiversity Discoveries in Perilous Times. *Creation Science Update*. Posted on ICR.org June 12, 2020. See also Eidsmoe, J. 1998. *Columbus and Cortez, Conquerors for Christ*. Green Forest, AR: New Leaf Press, chapter 5.

Dr. Johnson is Associate Professor of Apologetics and Chief Academic Officer at the Institute for Creation Research.





I was beyond thrilled to see a kids [December 2023] edition of *Acts & Facts* in our mailbox! I had long been thinking of how cool it would be for our kids (in elementary school) to get similar content as we are getting through the regular *Acts & Facts* publication! They've loved the kids page in *Acts & Facts* and were so excited to see an entire edition just for kids! Our daughter had just been asking

about the Ice Age, so the content lined up so well. God is so good! Thank you so much for putting this edition together. We hope this is one of many more to come!

— B. C.

**Editor's note:** If you missed getting the 2022 and 2023 *Acts & Facts* kids editions, PDFs of them are available at [ICR.org/CreationKids](https://www.icr.org/CreationKids). You'll also find the individual issues' Creation Kids pages there.



Must do in Dallas! My family had a great experience at the ICR [Discovery Center]. Material is a nice mix of stuff for older and younger kids. Truly one of the highlights of our Texas vacation. I would definitely recommend you take the time to visit if you are in the area. Really need a few hours to see everything.

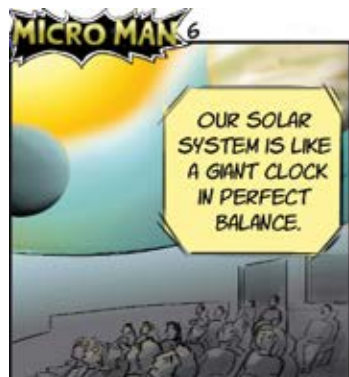
— D. M.

Highly recommend. Incredible learning experience that was fun and interactive. The exhibits were well done and in depth. Enjoyable for all ages. The planetarium movies were great as well.

— R. D.

Wonderful place to learn more about Scripture and creation. We loved it! I learned a lot! Such a nice staff, and the exhibits are interactive and informative. The Ice Age portion was my favorite!

— J. D.



Written by Michael Stamp. Illustrated by Lori Fausak.



research (blind cavefish experiment).

— C. L.

Adults without kids, go to the end first! High-quality technology exhibits portray creation science. Very attractive for kids. As an adult, I was glad to get to the very last area, where they refute carbon dating results, ice core dating, natural selection creating new species, etc. I also loved the wall showing that dinosaurs have been shown in art and in literature around the world as recently as Marco Polo.

— M. R.



Marco Polo mosaic, Palazzo Tursi in Genoa, Italy

Wow, this museum is fantastic! The exhibits are interactive, interesting, and visually stunning. The lectures provide the latest research (and its significance) in [a] compelling, comprehensive manner.

The planetarium is likewise educational and professional. When guests travel to North Texas, this is the museum we will be visiting with them!

— S. B.



Have a comment?

Email [Editor@ICR.org](mailto:Editor@ICR.org) or write to

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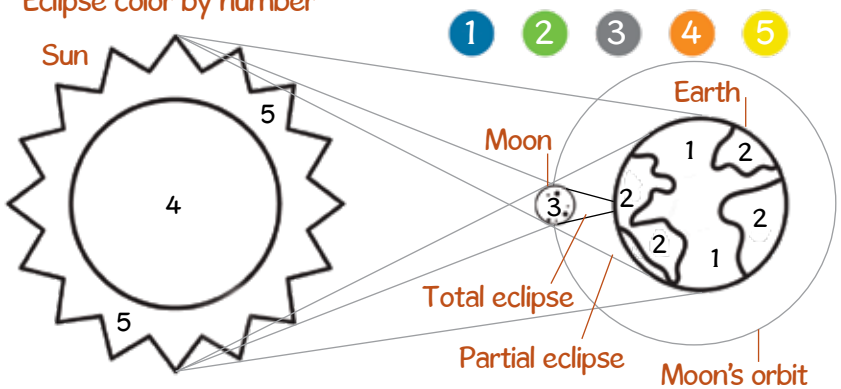
Our Creator placed Earth in the exact location for us to witness an incredible celestial display—a solar eclipse! This happens when the moon travels between the sun and our planet. Its shadow crosses Earth and darkens the regions along its path. In a total eclipse, it looks like nighttime in the middle of the day! Did you also know...

- ✓ The Bible says God created all objects in outer space on Day 4 of the creation week.
- ✓ There are four types of solar eclipses: total, annular, partial, and hybrid.
- ✓ The moon is about 400 times smaller than the sun, but it's also around 400 times closer to Earth. This allows it to completely block the sun.

## Did you know?

On April 8, 2024, a total solar eclipse will be visible from parts of North America. The path of totality will stretch from Mexico, through Texas, up to Maine, and into eastern Canada. The continental United States won't get another one until 2044!

## Eclipse color by number

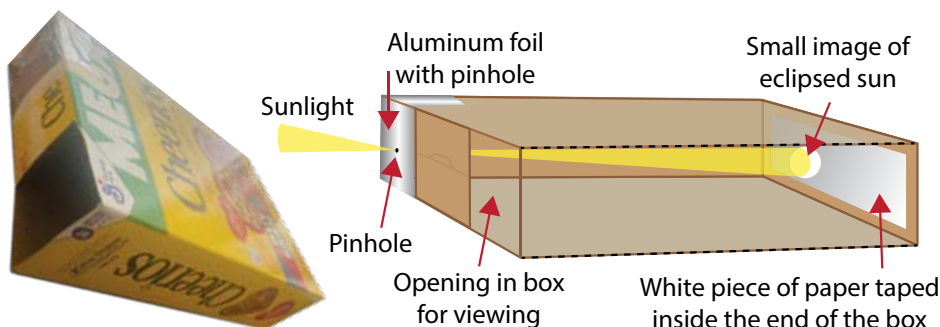


## Make your own eclipse!

Supplies: flashlight, golf ball or ping pong ball, and globe or larger ball

Set up the globe and golf ball on a tabletop. Turn the lights off. Shine the flashlight on the globe, and place the golf ball between the light and the globe. The shadow of the globe is just like the moon's shadow on the earth during an eclipse!

Make your own eclipse viewing box. Supplies: empty cereal box, aluminum foil, paper, tape, pushpin, and scissors



With your back to the eclipse, look into the box to see an image of the eclipsed sun. When viewing a solar eclipse, it's important to *never* look directly at the sun. Always wear specialized glasses or use a pinhole projector.

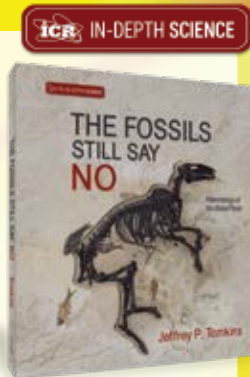
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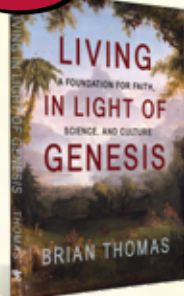
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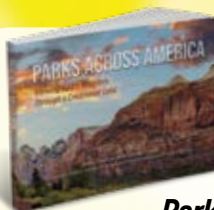
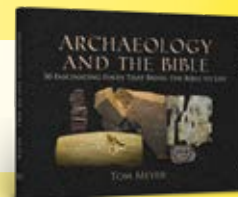
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