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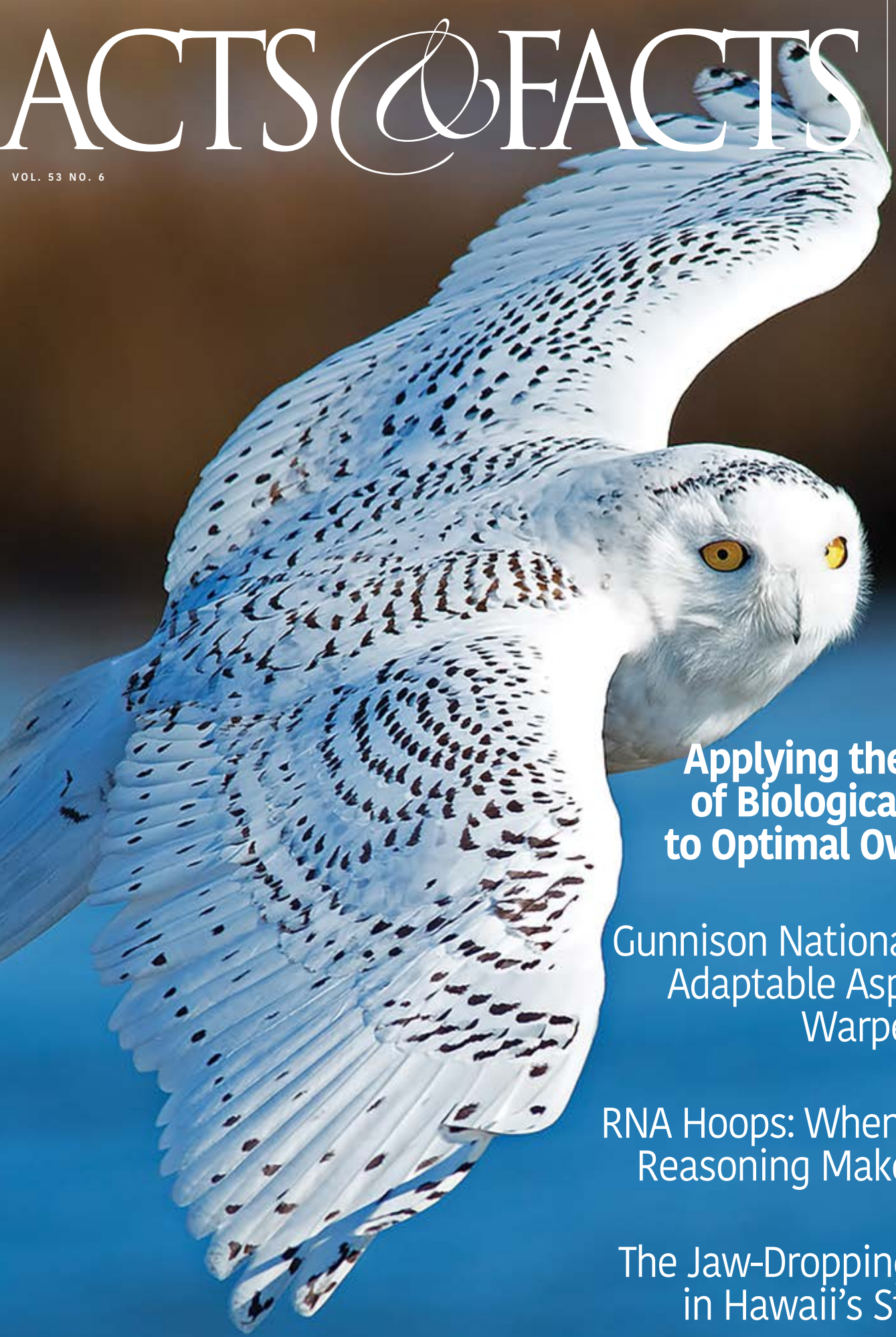

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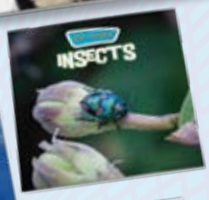

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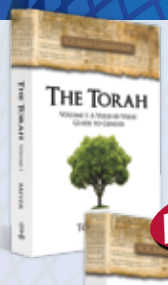

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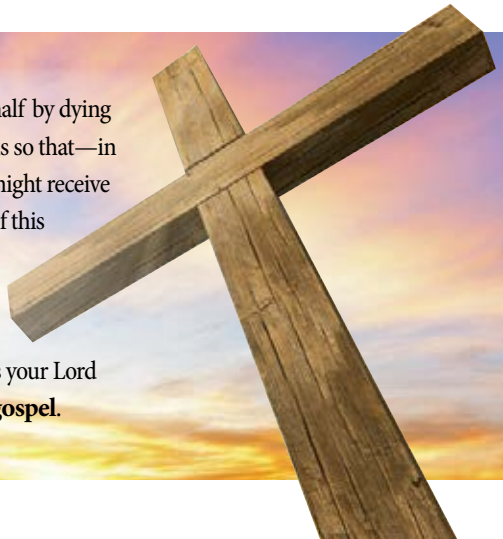

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DESIGNER
Dennis Davidson

[Jesus Christ] is the image of the invisible God, the firstborn over all creation. For by Him all things were created that are in heaven and that are on earth, visible and invisible, whether thrones or dominions or principalities or powers. All things were created through Him and for Him. And He is before all things, and in Him all things consist. And He is the head of the body, the church, who is the beginning, the firstborn from the dead, that in all things He may have the preeminence. For it pleased the Father that in Him all the fullness should dwell, and by Him to reconcile all things to Himself, by Him, whether things on earth or things in heaven, having made peace through the blood of His cross.
(Colossians 1:15–20)

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All Scripture quotations are from the New King James Version unless otherwise indicated.

Front cover: Snowy owl in flight
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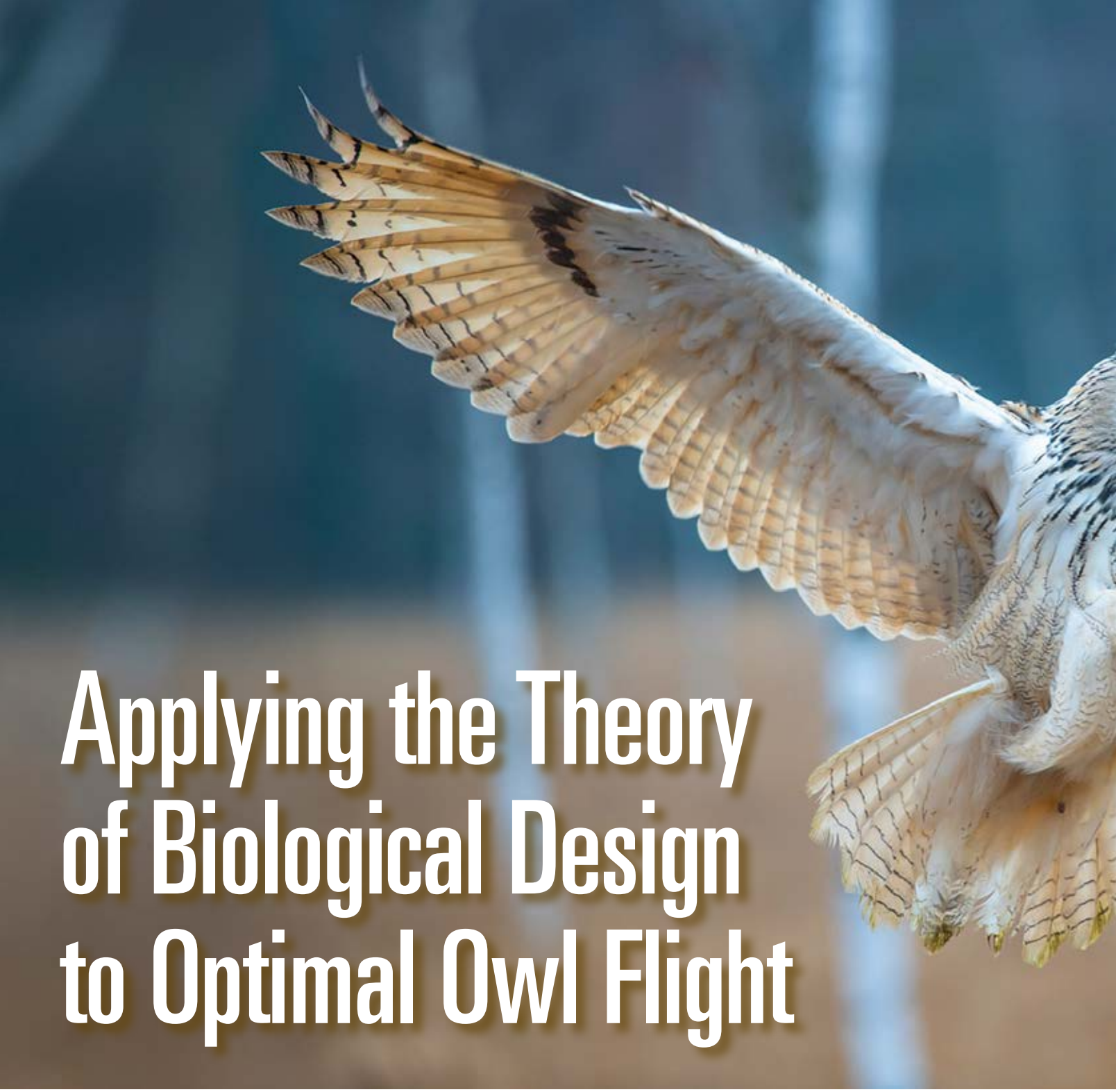

Applying the Theory of Biological Design to Optimal Owl Flight

RANDY J. GULIUZZA, P.E., M.D., AND AARON T. GULIUZZA, P.E.

If the greatest writers had been well-versed in fields of science, then history might have also remembered them as eminent scientific theorists. Hallmarks of excellent writing like simplicity, soundness, wit, and intrigue wrapped in a lucid style make for an engaging story, which, time has revealed, is the backbone of powerful scientific theories. Influential theories can change a perspective about some simple observation that's then extrapolated into a compelling narrative that radically transforms the way people think about life.

Splendid Narratives Filled with Silly Science

Evolutionary biologist Richard Dawkins is the best example of a popular science writer who has conveyed a widely influential

Eagle owl

theory—namely, his "selfish gene" theory of evolution. The science journal *Nature* applauded Dawkins' landmark 1976 book *The Selfish Gene* on the thirtieth anniversary of its publication. He wasn't lauded for making a discovery. Instead, his "landmark work" was narrating "a vivid and systematic picture of biological evolution wholly 'from the point of view of the gene' and explor[ing] the wider implications of this approach."[1]

Can simply changing a "point of view" be powerful? Absolutely. Great Britain's Royal Society conducted a public poll in 2017 to identify "the most inspiring science books of all time."[2] *The Selfish Gene* was deemed the most inspiring science book *ever*, "followed by Bill Bryson's 2003 book *A Short History of Nearly Everything* in second place, and Charles Darwin's 1859 classic *On the Origin of Species* in third place…with many commenting on how [*The Selfish Gene*] had changed their perspective of the world."[2]

It's notable that Darwin and Dawkins hold up an organism and basically say, "Starting today, think about creatures from a new perspective in light of the following story." Both present a profoundly diminished view of creatures compared to the high esteem in which they were previously held. The *Origin of Species* began depicting creatures as never-ending works-in-progress that nature cobbles together in a clunky, purposeless process. They're passive modeling clay whose random genetic mistakes are sorted through by the vicissitudes of nature.[3] Dawkins adds,

> We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes. This is a truth which still fills me with astonishment....One of my hopes is that I may have some success in astonishing others.[1]

In spite of the hype, selfish-gene theory and selectionism don't help us understand the *operation* of creatures any better. Neither has offered noteworthy testable predictions, a useful way to characterize biological function, or guided research toward valuable discoveries. This article will demonstrate how we can do far better by applying a powerfully contrasting perspective of creatures within the new theory of biological design (TOBD).

article highlights

- Powerful scientific theories are compelling narratives that change the way people think.
- Creatures are internally directed, with traits that are complete, innate, and engineered.
- Creatures' traits are the real causal change agents, and a theory of biological design (TOBD) uses this as a starting point.
- Optimized engineering principles are at work in creatures like owls, whose wings are designed to be silent while still providing maneuverability.
- We see such directed precision engineering inside all creatures. Evolution needs to be replaced by a TOBD that showcases the abundant evidence of Christ's creative handiwork.

A Changed Perspective with a Theory of Biological Design

Clearly, the way we think about creatures is extremely important. The radically different approach of a TOBD is long overdue. The essential change in view is that it is organism-focused. Causal explanations are framed according to engineering practice.

Organism-focused (or internalism) means that *all* of an organism's capabilities are determined by innate, engineered, and up-front traits. *These exist in organisms prior to any environmental exposures.* These capabilities should be the principle focus of research and dis-

cussion. Traits—not exposures—determine capabilities. Causal explanations should credit these traits with a creature's successful resolutions of environmental challenges.

An engineering-based approach fosters testable predictions. Some are: purpose is expected at every level of investigation, biological functions can be reversed engineered, and *identifiable* control systems will govern 100% of an organism's operations. It expects to find corresponding features between human-engineered contrivances and those in creatures that perform similar functions. Engineered outcomes like efficiency, optimization, robustness, etc. should be widely evident. Biological functions will be most accurately explained by models developed using engineering principles. These principles should guide research since they're essential for making correct cause-and-effect associations.

In sound scientific theories, assumptions often also function as expectations (i.e., testable predictions). The assumptions detailed above flow from the engineering discipline and are scientifically plausible.

A TOBD *hypothesizes* that the most likely reason creatures look engineered is that they are engineered. In other words, a TOBD is neither a conclusion nor an inference to the best explanation. A TOBD rejects selectionism's inherent mystical narrative gloss and personifications. The ability to confirm the TOBD's hypothesis and assumptions by observation/testing makes it scientifically superior to both selfish-gene theory and selectionism.

As an example, let's apply a TOBD to a really challenging biological activity like the silent flight that owls can accomplish. One goal of engineers is optimization. So, if owls were engineered for silent flight, then

1. Do we find optimization?
2. If so, can it be explained by drawing on engineering principles from disciplines like fluid mechanics, material science, acoustics, and aerodynamics?
3. Do we see corresponding features between an owl's traits and human-engineered devices?
4. Do engineering principles help us better understand biology?

Owl Wing Acoustics: Feathers Optimally Engineered for Silence

Is owl flight optimized for silence? It seems so. Owl researchers stated,

> As the flight of owls is so silent that the available microphones are at their limits…it will be a challenge for the future to develop a set-up in which absolute noise production of owl flight can be measured.[4]

They added that an owl could glide 10 feet from a human and not be heard. The system appears to be optimized to the limits of physical sound detection. Owls use other sophisticated avionics in flight that rely on their hearing, thus they may not be able to hear their own flight.

Air flowing over wings acts like a fluid such as water flowing over fins or around a rudder. To account for an owl's silent flight, fluid mechanic engineers study the interactions of fluids and structures that explain sound production from turbulent or laminar (uniform) air flowing over a wing. Their experiments demonstrate that sounds produced by feathers can be reduced with any one of three aerodynamic features: leading edge serrations, velvety feathers, and trailing edge "fringe."[5]

Owls are the only birds known to have functional leading edge serrations. A serration is a precisely curved, comb-like projection on the feather (see Figure 1). Since a TOBD assumes purpose that can be reverse engineered at every level of biology, the search for the aerodynamic purpose of leading edge serrations serves as a guide for identifying the engineering principles that are predicted to explain how the serrations work.

Figure 1. *Leading edge serrations are bent, comb-like structures that function as closely spaced co-rotating vortex generators*

Aeroacoustics is a fluids-engineering subspecialty that studies the noise fluids make. Researchers have learned that air flowing close to a wing, known as a boundary layer, is initially very smooth. But the smooth layer of air eventually starts to break away from the wing. The result is flow separation and eventually separation bubbles (Figure 2). The separation bubbles cause an area of low pressure behind the wing that tends to pull the wing back in a phenomenon called drag. The bubbles also create sound.[6] Flow separation occurs more prevalently the steeper the angle of the wing is relative to the ground (a high angle of attack) and at low airspeeds.

Fluids engineers have discovered that adding structures known as vortex generators to the leading edge of an aircraft wing, wind turbine blade, or submarine plane greatly reduces flow separation, bubbles, drag, and noise.[7] These engineers also research the optimal shape, positioning, and numbers of vortex generators for specific applications. They've used these to improve the angle of attack that an aircraft can fly before stalling.[7,8]

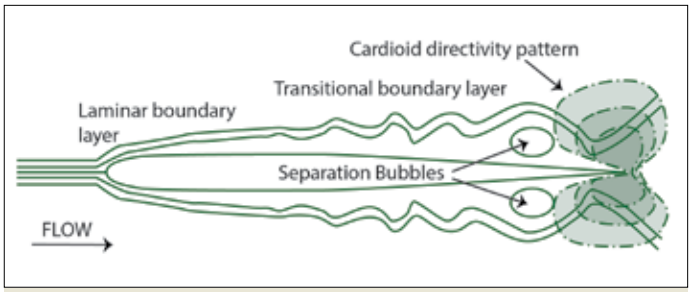

Figure 2. *Boundary separation occurs when laminar air becomes more turbulent and separates from the airfoil, causing drag, separation bubbles, and noise at the wing's trailing edge. The wing in this illustration is horizontal with the ground. Placing the leading edge of the wing higher than the trailing edge leads to a higher angle of attack and more boundary separation and separation bubbles.*

Adapted from Figure 1 in reference 6.

Flying at low speeds and high angles of attack characterizes owl flight. Owl leading edge serrations operate by the same principles as human-engineered vortex generators. The serrations swirl the boundary layer of air, preventing boundary layer separation and minimizing emitted noise. Engineers describe these leading edge serrations "as a set of closely spaced co-rotating vortex generators that reduce the flight noise emitted by the owl."[9] This confirms a TOBD prediction of finding corresponding features between human-engineered devices and those in creatures that perform similar functions.

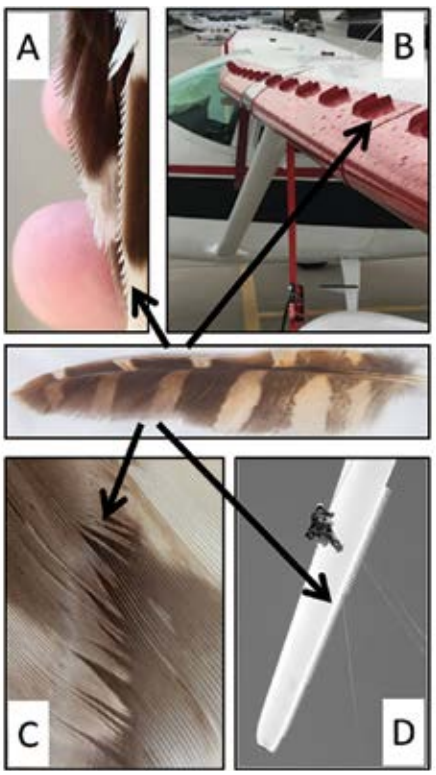

Figure 3. *Images of corollary features between (A) owl leading edge serrations, (B) airplane wing leading edge vortex generators, (C) owl trailing edge fringe, and (D) wind turbine blade trailing edge serrations*

Image credit: Aaron Guliuzza

Trailing edge "fringe" also helps keep the boundary layer of air close to the wing by channeling the air into streamlined paths at the point where the airflow leaves the wing, reducing sound.[10] Engineers use trailing edge serrations on wings where noise is a problem, such as with drones and wind turbine blades as seen in Figure 3.

Feathers themselves are semirigid, and their movements on the wing create another source of noise. Velvety feathers midway along the main wing surface reduce the sound produced by the friction of each feather sliding over the next (Figure 4).[4]

Figure 4. *Velvety top of an owl flight feather*

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Owl Wing Aerodynamics: Optimally Engineered for Slow, Stalled, Silent Flight

The main characteristic of an optimized solution is that it is the best balance of many competing needs. In a kind of trade-off, any one particular need may not be optimized for its highest efficiency, but the combination of how everything works together is the best possible arrangement given all constraints. Aircraft noise can be audible for thousands of feet, and even the best engineers struggle to find the optimal solution between quietness and economic efficiency (Figure 5).

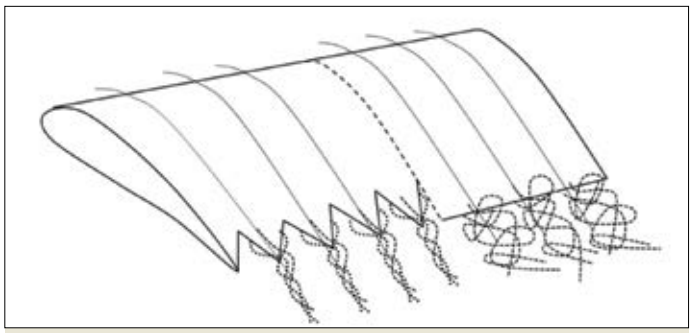
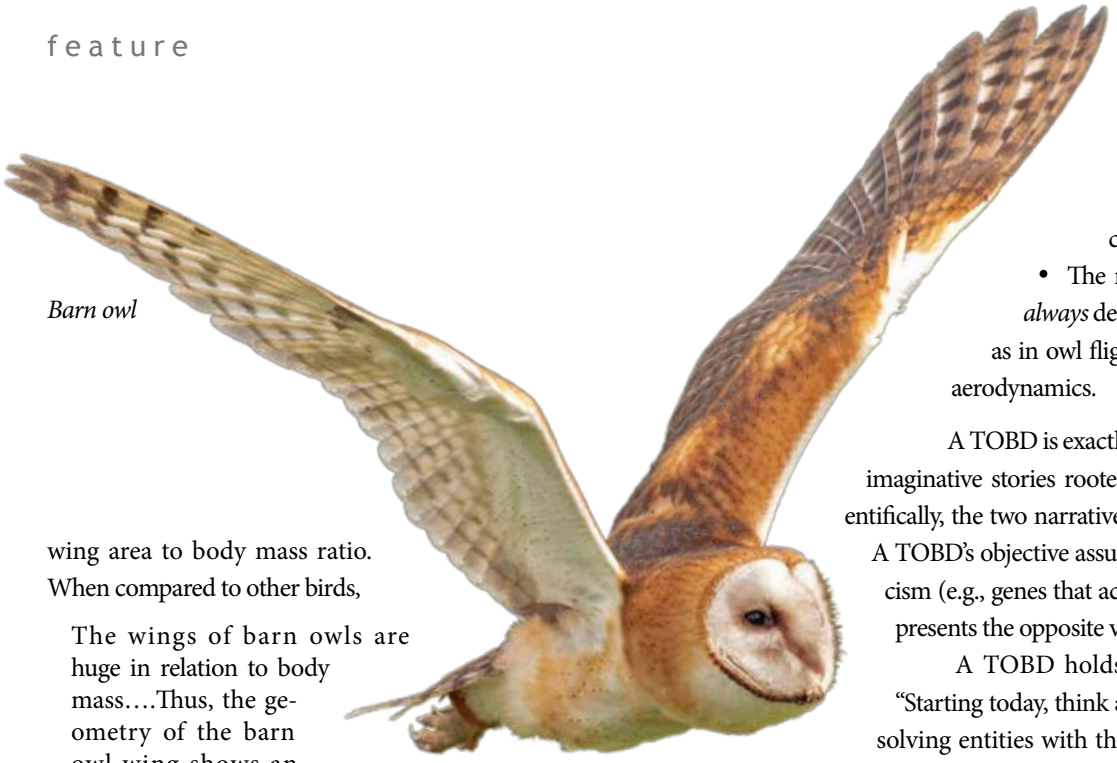


Figure 5. *Rendering of airflow over serrated versus straight trailing edge features. The streamlined flow of air will produce less sound. Engineers use computational fluid dynamics software to help optimize the design of trailing edge sound-reducing features.*

Figure 11.11 in reference 11, used in accordance with federal copyright (fair use doctrine) law. Usage by ICR does not imply endorsement of copyright holder.

Does this mean the optimization of the owl's sound-reducing features produces flight inefficiencies elsewhere? Not at all. The genius engineering of leading edge serrations, velvety feathers along the main wing surface, and trailing edge fringe *enhances* the flight characteristic that owls specialize in—controlled, stalled flight.[4]

This optimum balance for super-slow flight is a function of the



Barn owl

wing area to body mass ratio. When compared to other birds,

> The wings of barn owls are huge in relation to body mass….Thus, the geometry of the barn owl wing shows an indirect adaptation towards silent flight by being optimized for low flight velocities….A major disadvantage of low flight velocities is the increased influence of induced drag, which negatively affects the flight performance. The general shape of owl wings is suited to reducing this influence, either by an overall elliptical shape, which is especially prominent for barn owls, or by the expression of slotted wings due to feather emarginations [notched margins].[4]

Aerospace engineers call wing shape design "planform." They can specify elliptical, rectangular, tapered, pointed, swept, or hybrid designs. Owls have elliptical wings. Why? Aerospace engineers describe elliptical as "the ideal subsonic planform since it provides for a minimum of induced drag for a given aspect ratio….The elliptical wing provides the best coefficients of lift before reaching an incipient stall."[12]

Splendid Narrative, Solid Science, and a True View of Creatures

Scientific theories are narratives that can change a point of view about natural phenomena. This can be powerful. Without ever leveling a direct attack against God, Darwin's devalued view of God's living handiwork led to a cheapened view of Him…and widespread disbelief in His work in creation.[13] Little wonder Harvard's esteemed evolutionary theorist Stephen Jay Gould said, "Darwinian natural selection presents the most contrary position imaginable" to beliefs of "an omnipotent and benevolent creator who loves us most of all."[14]

A theory of biological design presents a radically different way to look at creatures. Its essential changes in perspective are:

- A TOBD is organism-focused, not environment-centered.
- Causal explanations become engineering-based.
- It takes an engineer's approach to research that's characterized by objectivity, clarity, and precision.
- The narrative is compelling because it *always* describes breathtaking engineering—as in owl flight that's optimized for silence and aerodynamics.

A TOBD is exactly what biology needs to reverse the imaginative stories rooted in Darwinian selectionism. Scientifically, the two narratives are not even in the same league. A TOBD's objective assumptions counter evolution's mysticism (e.g., genes that act like selfish agents—seriously?). It presents the opposite view of creatures to selectionism.

A TOBD holds up living organisms and says, "Starting today, think about creatures as active, problem-solving entities with the innate capability to solve many challenges and fill the earth." Organisms are neither fixer-uppers nor unending works-in-progress. They are already complete and have been from the beginning.

At ICR, we believe that worship should be the normal response to science. Biology isn't a mess; it's a masterpiece. That high view of creatures leads to an exalted view of the Lord Jesus Christ, who made owls. "The beast of the field shall honour me, the dragons and the owls" (Isaiah 43:20, KJV).

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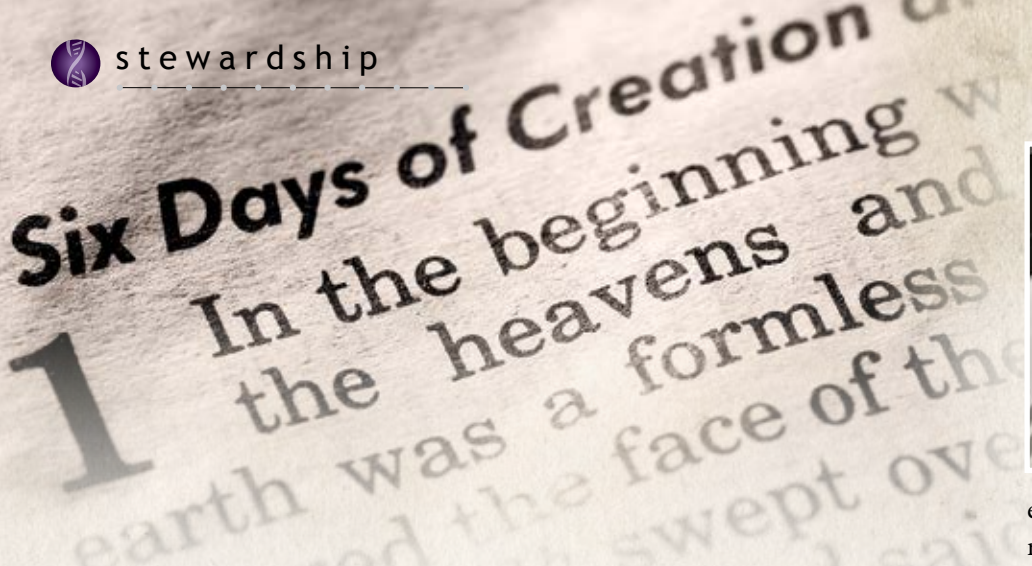
Dr. Guliuzza is president of the Institute for Creation Research. He earned his doctor of medicine from the University of Minnesota, his master of public health from Harvard University, and received an honorary doctor of divinity from Southern California Seminary. He served in the U.S. Air Force as 28th Bomb Wing flight surgeon and chief of aerospace medicine. Dr. Guliuzza is also a registered professional engineer and holds a B.A. in theology from Moody Bible Institute. Aaron Guliuzza is an industrial engineer with Molded Fiber Glass Companies who oversees production of composite wind turbine blades and parts for the Chevrolet Corvette. He is a registered professional engineer and holds a B.S. in industrial engineering from South Dakota School of Mines and Technology.

JAMES GADBERRY



A Journey to the Truth of Creation

I recently had lunch with the chief academic officer of a local Christian university. As we connected over our meal, I could see his excitement about ICR's research and our Discovery Center. He was intrigued by the opportunity to bring his staff and faculty for a visit.

Our discussion continued into a conversation about "thousands versus millions" of years of Earth history. At this, his expression changed from enraptured to a blank stare. At first, I was confused by his sudden indifference. He wasn't disagreeing with anything I said. He was familiar enough with all that ICR does, and all signs pointed to him being a proponent of biblically based creationism.

I wasn't sure how to proceed. I wanted to "step on the gas" and directly ask, "Are you a creationist or an evolutionist?" A strong sense told me to tread wisely and graciously, so I calmly asked, "Do you believe Genesis 1's account of creation, or do you subscribe to the idea of deep time?" His response left me perplexed: "I am still in my creation journey."

Thankfully, we later welcomed the university's staff and faculty to ICR. They heard from ICR researchers and left ecstatic about ICR's research and how it glorifies Christ, our Lord and Creator. Still, I pondered the idea of a creation journey.

Before my time serving on ICR's staff, I spent 10 years as a pastor for a large church. I taught, evangelized, and discipled. But if I am transparent with you, I spent an extremely small amount of time in Genesis 1, sometimes visiting once a year on January 1 in my generic yearly Bible devotion. For the occasional wedding ceremony I presided over, I might touch on the Genesis 2:18 statement: "It is not good for man to be alone." I took the Bible at its word without giving the Bible's account of creation much attention. Thoughtless of me, I know.

I remember my first time seeing the ICR Discovery Center. I had visited countless ministries before, and the excellence is what first stood out to me. I thought, "Are these walls made from quarried stone?" "Their bathroom sink is a nod to the Grand Canyon that would shame any modern art exhibit." "Wow, these ICR people sure are serious about God's creation."

After this visit and exposure to ICR's creation evidence, I don't believe I slept that night. I was completely reengaged in my Bible, not only in the Genesis account of creation but in who our Creator is—Jesus. I was zealous again. But at the same time, I was furious that I had ministered for so many years without this faith-affirming scientific account that the Bible says what it means and means what it says.

My creation journey continues every day. I find myself unlearning false scientific teachings and gaining daily faith-affirming insights into what, how, and why God engineered our world the way He did. I am so very grateful for the almost 55 years of ICR's excellence in scientific representation for the truth of creation.

When Moses asked God if he could see His glory, God let Moses see where He had been (Exodus 33:18–23). In the same way, ICR research continues to glorify our Creator and His handiwork by showing believers God's hand in creation, and it certainly is glorious.

Thank you for supporting ICR with your prayers and financial gifts. Not a precious penny goes to waste. Together, we are making a difference in the body of Christ.

Mr. Gadberry is interim director of development and donor relations at the Institute for Creation Research.

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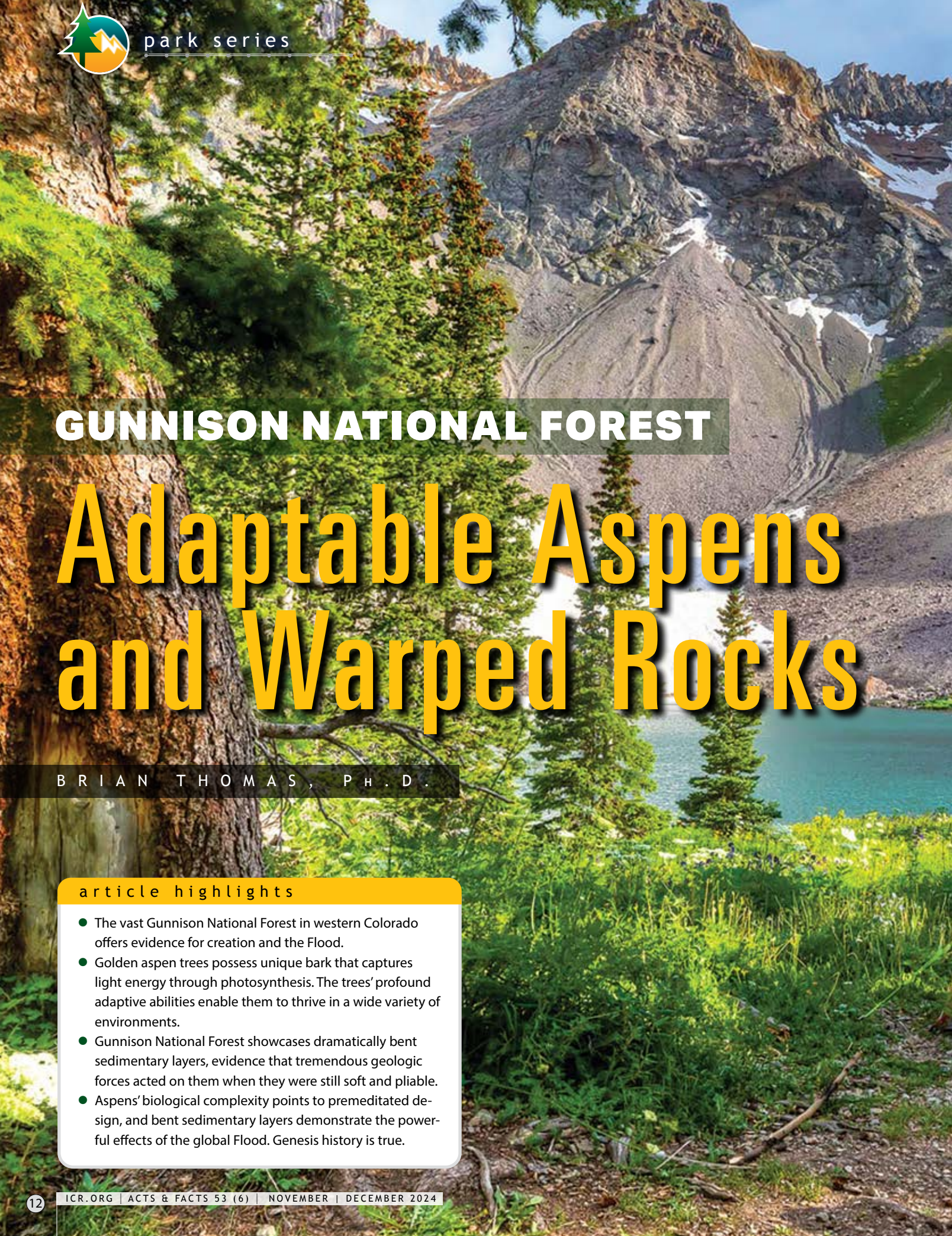

GUNNISON NATIONAL FOREST

Adaptable Aspens and Warped Rocks

BRIAN THOMAS, PH.D.

article highlights

- The vast Gunnison National Forest in western Colorado offers evidence for creation and the Flood.
- Golden aspen trees possess unique bark that captures light energy through photosynthesis. The trees' profound adaptive abilities enable them to thrive in a wide variety of environments.
- Gunnison National Forest showcases dramatically bent sedimentary layers, evidence that tremendous geologic forces acted on them when they were still soft and pliable.
- Aspens' biological complexity points to premeditated design, and bent sedimentary layers demonstrate the powerful effects of the global Flood. Genesis history is true.

Image credit: Brian Thomas

Gunnison National Forest's 1.67-million-plus acres showcase stunning views of the Colorado Rocky Mountains. The Continental Divide forms its eastern border, and other parks nestle against its many sides. Among myriad wonders are particular trees and rock exposures that point thoughtful visitors to two key biblical events.

Quaking Aspens

Many consider the quaking aspen of North America, *Populus tremuloides*, their favorite tree for its pillar-like, off-white trunks, leaves that flutter or "quake" in the slightest breeze, and fantastically golden fall foliage. Two clearly seen engineered aspects of aspen biology point to creation.

Every decision a human inventor makes during design and construction balances competing needs and demands. Consider a pen. Someone decided its size—suitable for human hands—and its long-lasting but inexpensive material. The inventor(s) selected the right chemical mixture for an ink that would flow at just the right rate, stay visible on paper, and conserve cost.

All this handiwork reveals that engineering decisions were made to achieve the final result. The same applies to what we see in the world, which includes aspens. The Creator "established the world by His wisdom" during the first key biblical event—creation (Jeremiah 10:12).

Aspen leaves turn golden yellow in the fall
Image credit: Brian Thomas

Gunnison National Forest and surrounding areas offer scenic campgrounds
Image credit: USDA

Consider the remarkable bark of the aspen tree. Most trees have thick, protective bark. Not the aspen. As is the case with all strategies and structures, disadvantages balance advantages. On one hand, the aspen's growth strategy uses bark thin enough for elk and insects to eat, possibly weakening the tree. On the other hand, cells in its thin bark perform photosynthesis.[1] Even after its leaves have dropped for the winter, an aspen receives an off-season metabolic boost that counters the need to repair bark damaged by hungry animals.

Not only does photosynthetic bark point to creation, but engineered propagation strategies also point to it. Aspens are dioecious, making either male or female flowers. Once pollinated, their flowers grow in small clusters called catkins to produce genetically different offspring while holding the aspen's identity as a "tree that yields fruit, whose seed is in itself according to its kind" (Genesis 1:12). Aspen seeds are tiny and tufted so wind can carry them great distances.

This strategy for sexual reproduction ensures that future generations can receive genetic benefits, especially including trait adjustments from recombined alleles.[2] Biologists attribute the success of aspens in pioneering huge swaths of landscape from Canada to Mexico to their expansive genetic toolbox. One recent study found 1,000 genome adjustments just in relation to temperature and water fluctuations.[3] Aspens give us a golden example of engineered adaptation.

Aspens also propagate through shoots that rise from extended lateral roots. Eventually, thousands of "trees," each called a ramet, can share the same root system. Together, they make up a clonal patch called a genet. This strategy enables an entire genet to share resources like water and to efficiently pioneer new places or rebound from natural disasters.[4] And the genet keeps growing even if animals eat a few shoots.

How do aspens know when it's a good time for a lateral root to send up a shoot? When light detectors in the bark sense full sun, e.g., at the edge of a grove, they signal appropriate root cells to grow a shoot poised perfectly to pioneer sunlit spaces. Someone must have programmed that information into their cells. Aspens use that programming to continuously track their environment for light intensity, process that input, and deploy an output that suits the detected situation. Who deserves the credit for this growth strategy? Not the creature but its Creator, "His Son…through whom also He made the worlds" (Hebrews 1:2).

A trail through a stand of aspens near Crested Butte
Image credit: Brian Thomas

Taylor Park Reservoir

While these two aspects of engineered biology—photosynthetic bark and growth strategies—reflect creation, nearby rocks point to Noah's Flood. Workers in 1937 blasted rock to build a dam and form Taylor Park Reservoir in eastern Gunnison National Forest. The paved road to the park rises up the Taylor River valley and over the dam. Travelers can now see what was long hidden: bent strata. Some great forces turned these once-flat rocks into a colossal "N" shape. These sedimentary layers are thick and extensive. How and when did they form and bend?

Conventional thought attributes this to long eons of slow folding. The now-bent layers have age assignments of 400 and more million years,[5] while mountain-building (thus rock-bending) forces supposedly occurred on the order of 60 million years ago. That would have given the sediments plenty of time to harden, or lithify. Once lithified, they would have cracked and splintered under such pressures instead of bending. We see no such shattering of rock here or at other locations that expose bent strata.

These sediments must have behaved plastically and been moldable, not yet lithified, in order to fold as they did. If mere months elapsed between when the deposits

Taylor Dam
Image credit: WaterArchives.org, CC BY-SA 4.0, Wikimedia Commons

Taylor Park Reservoir, with the dam shown bottom left. Construction revealed an N-shaped rock fold that challenges mainstream age assignments.
Image credit: Brian Thomas

formed and when mountain-building activity bent them, then these bends delete hundreds of millions of supposed years in their development.

This is what we should expect from Noah's global Flood. The ICR Flood model posits that multiple extensive sedimentary layers were deposited during the Flood year.[6] Catastrophic plate tectonics made an entirely new seafloor and rapidly moved the continents around. Colliding plates and thickened crust forced those sediments up to form the Rocky Mountains along with most other mountains.

Since Scripture teaches the Flood was worldwide and recent, rock folds from early Flood layers (conventionally called Paleozoic) should occur all over. Images here show just that. Such extraordinary power spread so widely matches a global flood—the second key biblical event that Gunnison National Forest points to.

Like in many other parks covered in this "park series" of articles, the engineered biology and catastrophic geology in Gunnison National Forest testify to the truth of Genesis history. We really do live on a created, then flooded, earth.

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Rock folds at Carbon Canyon, Arizona, tell the same tale: this whole rock stack was still wet when bent. It was deposited early in the Flood and folded later that year.
Image credit: Brian Thomas

Bent strata at a beach in Pembrokeshire, Wales
Image credit: Brian Thomas

JEFFREY P. TOMKINS, PH.D.

RNA Hoops
When Circular Reasoning Makes Sense

If the regulatory picture of the genome were not complicated enough, over the past decade scientists have discovered another level of Darwinian-defying biocomplexity involving a whole new class of molecules in the form of RNA hoops or circles.[1,2] In fact, the findings were so startling that one researcher commented that the molecules form "a hidden, parallel universe" in which many new types and functions remain to be discovered.[3] What are these remarkable RNA molecules?

article highlights

- Recent discoveries regarding circular RNA (circRNA) show it serves a variety of regulatory functions and adds a separate level of genetic information and complexity.
- Evolutionists initially thought circRNA was a type of genetic accident, but it's been found to be intricate, multilevel, gene-regulating code.
- It appears circRNAs are also important features of adaptive neurology and healthy cellular function.
- The genetic code contains multiple overlapping layers of information, a level of design complexity that only our all-knowing, all-powerful Creator could have produced.

The Growing List of Non-Coding RNAs

Early in the molecular biology revolution of the 1970s, researchers discovered a class of functional molecules in the genome called non-coding RNAs, meaning they do not provide a template for making proteins. The first identified forms of these molecules, transfer RNAs and ribosomal RNAs, are involved in manufacturing proteins. Now scientists have added many more categories of non-coding RNA to the mix. Some are very short, and others are quite long. Many of these new types of RNA are regulatory in nature and are known to be key players in controlling how genes are expressed and controlled in the cell.

The latest addition to this startling array of RNA molecules is truly astounding. Most non-coding RNAs are linear and then fold

into specific shapes, and others are integrated into various protein structures. However, this newly characterized type forms loops and circles and is encoded with DNA information that in many cases actually overlaps with protein-coding genes. Thus, it represents a completely separate layer of information overlaid in the same code with genes.

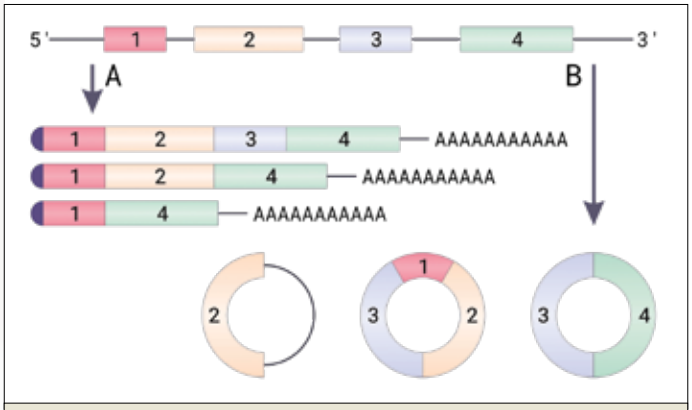
Amazingly, many other types of regulatory RNA are also coded into the same DNA space on chromosomes as the protein-coding genes themselves are. It is now clear that individual genes actually contain many different levels of genetic information, a phenomenon that gradual, neo-Darwinian evolution (random mutation and "selection") simply cannot account for.

Background

In the genomes of most plants and animals, genes are coded in pieces. The coding regions are called exons, and the coding sequence is interrupted by non-coding regions called introns. As a copy of a gene is being made, the resulting RNA transcripts typically undergo splicing to remove introns and fuse together the exons to form mature linear RNA transcripts known as messenger RNAs (mRNAs).

Splicing is a highly regulated process that may generate multiple mature mRNAs (isoforms) from a given gene in a process known as alternative splicing.[4] This transcript diversity is accomplished by omitting some exons or even doubling some, but the same linear order of sequences is always maintained in the original gene. The various transcript isoforms can exhibit different functions, cellular destinations, or regulatory roles. In humans, over 95% of known genes have alternatively spliced isoforms.

Circular RNAs (circRNAs) are generated by a specific type of splicing called back-splicing in which the leading end (5' terminus) of an unspliced pre-mRNA of an upstream exon is non-colinearly spliced with the trailing end (3' terminus) of a downstream exon, forming a covalently closed loop.[5–8] Upstream and downstream refer to the relative direction in which RNA transcription takes place. After they are produced, circRNAs are mostly found in the cell's cytoplasm outside the nucleus. Because they are circular molecules instead of a regular linear mRNA produced from the same gene, they are more resistant to degradation by RNA enzymes called RNases.



Circular RNA (circRNA) biogenesis from pre-mRNA via backsplicing event

Image credit: Helixitta, CC BY-SA 4.0, Wikimedia Commons

The existence of circRNAs in mammals was first reported in 1979. The circular molecules were directly observed in the cytoplasm of cultured human cancer cells by electron microscopy.[9] However, due to technological limitations, only a few specific circRNAs were characterized over the next several decades, and the potential functions of circRNAs remained unclear.[5]

With the development of new DNA-sequencing technologies in the early twenty-first century and new techniques in the study of DNA sequence-related data (bioinformatics), scientists have demonstrated that the expression of circRNAs in mammals is a common biological phenomenon that shows tissue and cell specificity.[5–8] In fact, the expression level of some circRNAs can be higher than that of the regular linear mRNAs of the genes from which they are derived.

Initial Groundbreaking Discoveries

While numerous circular RNAs have been discovered in the past decade, it's worth noting several initial discoveries that kicked off this whole field of groundbreaking research. These first research papers helped elucidate the basic mechanisms behind how circRNAs are produced and how they specifically function to regulate gene activity.

In the first two studies, researchers discovered that circRNAs from back-spliced exons can serve a wide variety of regulatory functions. One study showed that they can function as microRNA sponges.[1] In a previous article, I discussed the importance of microRNAs. These crucial genetic regulatory molecules control mRNAs in the cell. They can also be heritable and play a key role in epigenentics.[10] So, some types of circRNAs can have dozens of target sites for microRNAs and will act like sponges by binding them up and regulating microRNA activity in the cell.

In a different study, researchers demonstrated that another class of circRNAs, also generated from exons, contain numerous binding sites for a type of regulatory protein called RNA-binding proteins, or RBPs.[2] Diverse RBPs recognize, bind, and regulate hundreds of mRNA transcripts and form extensive regulatory networks that help maintain cell homeostasis and function.[11] Thus, various types of circRNAs act as binding decoys or targets for RBPs as a means to regulate RBP activity. One should recognize these interlocking, RNA-based cellular machinery as highly complex, engineered systems of checks and balances that robustly fine-tune genetic activity within the cell.

Not Junk DNA After All

Another study published about the same time as the two circular RNA studies mentioned above described a third class of circRNAs from entirely unexpected regions of genes.[12] These circRNAs are formed from the intron regions inside a gene that were once thought to be junk DNA. As noted above, exons are the regions in the genetic code that remain in the final coding RNA transcript, while introns are the gene regions that are spliced out.

When scientists first discovered large numbers of spliced-out intron fragments, they were baffled since they originally believed that the fragments served no function and should have been degraded by the cell machinery. Now it is known that introns contain many different types of regulatory signals and features that regulate gene function. And like exons, they can be circularized, too.

In these newly identified circular intronic RNAs (ciRNA), the introns are excised from the initial gene transcript into smaller RNA molecules to form circles that enhance the gene's transcription. The researchers proved this when they were able to "perturb" the action of ciRNAs in cells by inhibiting their function and observing the effect on gene expression. The scientists also found that the ciRNAs promote gene function by associating with the transcription machinery that copies DNA into RNA (RNA polymerase II). Interestingly, these ciRNAs were expressed in particular cell types, further emphasizing that they are specifically controlled and highly functional.[12]

In contrast to the previously discovered circRNA composed of spliced-gene exons and functioning primarily as microRNA (miRNA) sponges in the cell cytoplasm, ciRNAs act as transcription enhancers in the nucleus.[3] In fact, ciRNAs are primarily localized to the nucleus, which contains the cell's genomic DNA, where they enhance gene expression.

Researchers have actually found a wide variety of regulatory RNA molecules encoded in gene introns, including small nucleolar RNAs (snoRNA), miRNA, and various types of long non-coding RNAs (lncRNA).[1] And now scientists can add ciRNAs to the ever-growing list of functional DNA found in introns, creating a picture of complexity in the cell that will certainly increase with time. Clearly, the intron regions that reside inside genes and cover about 20% of the entire human genome are as functionally important to the cell as the protein-coding regions (exons) that cover less than 5% of the genome.[1]

Recent Circular RNA Research

While our understanding of the regulatory control of circRNAs in gene expression, miRNA binding, and protein binding keeps expanding with new research, other aspects of the inherent coding capacity of these molecules continue to emerge. Two things are especially worthy of note. The first is that these circRNAs themselves can be recoded dynamically to alter their function. In a previous article, I reviewed how transcribed linear RNAs from genes can be recoded dynamically on the fly by changing an adenosine base to an inosine base (A-to-I editing).[13] 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. As it turns out, A-to-I editing also occurs in circRNAs.

This leads to the next important recent finding: circRNAs can code for proteins.[7,8] Indeed, a 2022 study showed that not only are circRNAs dynamically recoded, but the A-to-I editing also results in the addition of a translational start codon and an entry point for a ribosome to begin translation (protein production).[14]

Other research demonstrates how circRNAs function in adaptive neurology. The brain's neural network is composed of neuronal cells, the elongated portion of the nerve cell (axons), and the extracellular junctions of the axons among cells (synapses) that work together to transmit bioelectrical signals across the synapses. Interestingly, a large number of circRNAs are consistently found to be upregulated (increase in gene RNA production) during neuron cell development (neurogenesis), and some circRNAs are also found to be enriched in synapses.[6]

These neurologically connected circDNAs have been found in the brains of nematodes (small worms), pigs, mice, and humans.[7] Since neurological function is closely related to behavioral traits

and is also associated with rapid adaptive responses, it is logical to postulate that circRNAs are important molecular systems related to creature adaptation.

Recent research also shows that circRNAs can be encapsulated in lipid-bound capsules called vesicles and exported out of the cell.[6] Initial studies describing this mechanism speculated that it functions as a clearance mechanism to remove overly abundant circRNAs from the cell. However, follow-up research showed that these exported circRNAs remain intact and can be taken up by other recipient cells as a way to facilitate cell-to-cell communication.[6]

Another line of research related to human health emphasizes the importance of circRNAs in cell biology.[6] To date, aberrant levels of cellular circRNAs have been implicated in a variety of diseases, including diabetes, chronic inflammatory disease, and cancer. Incredibly, dramatic shifts in circRNA levels have also been connected to aging.[6]

This research makes it clear that circRNAs are important features of healthy cellular function. At the time of this writing, over 100,000 different circRNAs have been discovered, but they remain very understudied compared to other systems and features of gene expression.[6]

Conclusion

In their anti-design mindset, evolutionary scientists first thought that circRNAs were genetic accidents or experimental artifacts. However, these errant hypotheses have been dismantled as discoveries progressed to reveal complex cellular design and control systems that simply boggle the mind. After over a decade of research, it is now certain that circRNAs are important functional components of gene regulation and protein production. Indeed, the field of circRNA research has revealed many different categories of circRNAs that exhibit control over gene expression in the nucleus, protein production in the cytoplasm, and intercellular communication in the body.

After the initial wave of discoveries for circRNA functionality, prominent molecular biologist Erik Sontheimer exclaimed, "You just wonder when these surprises are going to stop."[3] The ensuing decade of circRNA research since Sontheimer made this comment has not only revealed many more crucial functions of circRNAs but has also shown that they are invaluable regulatory mechanisms within and between cells, governing a broad range of gene expression and protein production activity.

These circRNAs embedded inside both the coding and noncoding segments of genes continue to reveal the amazing complexity of the genetic code that exists in multiple overlapping layers of information. This code complexity utterly defies the Darwinian myth that accidental mutations and an impersonal, mythical selective agent (natural selection) magically created them. Instead, the complexity of this multilayered code and cellular control systems speaks loudly of design by the omnipotent and omniscient Creator, the Lord Jesus Christ.

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BRIAN THOMAS, PH.D.

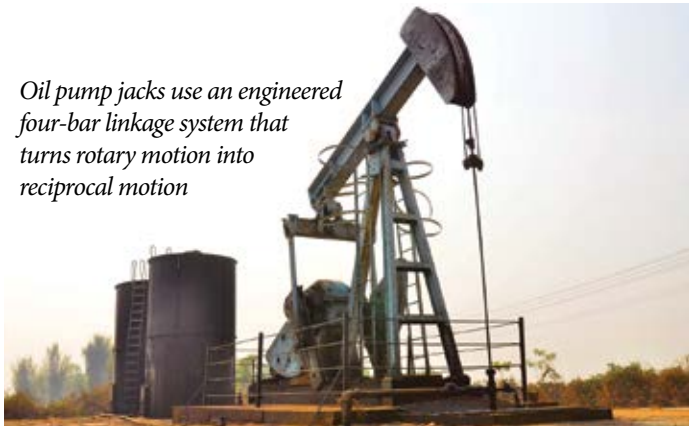
Rhinecanthus rectangulus, *the Hawaiian state fish humuhumunukunukuāpua'a*

The Jaw-Dropping Design in Hawaii's State Fish

Hawaiians call their state fish the humuhumunukunukuāpua'a, or humuhumu for short, and snorkelers marvel at its wild paint job as it flits beneath basalt reefs. Scientifically named *Rhinecanthus rectangulus*, it is one of a variety of triggerfish that are named for a "trigger" used to lock the dorsal spine in an "up" position. Two aspects of the wonderful humuhumu reveal its Creator's handiwork.

The first clearly created humuhumu aspect is the linkage mechanisms in its jaw. Man-made tools like crank rockers and oil derricks use linkage mechanisms to transmit motion and force. Within the humuhumu's big, triangular head, flexible cartilage links bony levers and support bars. These mechanisms transfer power from jaw muscles to teeth, allowing triggerfish to chomp invertebrates like lobsters, spiny sea urchins, and snails.

Many animals use all sorts of clever all-or-nothing linkage mechanisms that showcase creation.[1] "Linkage mechanisms enable animal joints to perform highly sophisticated and optimised motions" and to "achieve extreme levels of compactness in joints."[2] The humuhumu's linkage mechanisms mean that it can use muscles far



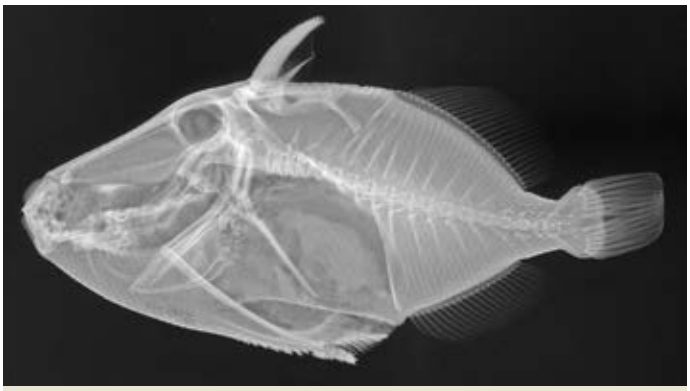
Oil pump jacks use an engineered four-bar linkage system that turns rotary motion into reciprocal motion

article highlights

- Hawaii's humuhumu fish chomps its meals using a powerful jaw with unique all-or-nothing lever mechanisms.
- The jaw's four-bar linkage system is irreducibly complex and could not have evolved step by step.
- We see our Creator's design throughout creation. In this case, it's located in the humuhumu fish's four-bar mechanisms.

behind the jaw to open and close it, thus keeping the streamlined body shape needed for swimming.

The humuhumu's bone-cartilage linkages required all-at-once assembly in the beginning. They refute notions of bit-by-bit evolution over eons. To understand exactly why, it helps to first consider man-made linkages. The humuhumu jaw structure has four-bar linkages. From an evolutionary perspective, some triggerfish ancestors would have evolved one-bar, then two-bar, and up to the multiple four-bar linkages the fish now have. How could this work?



Rhinecanthus rectangulus *X-ray reveals skeletal frameworks that include critical linkages*

Image credit: Sandra Raredon/Smithsonian Institution, public domain

Let's say a new bar (i.e., a bone) somehow evolved. Linked anywhere onto an already-useful linkage mechanism, it would just get in the way. Evolution would have to disassemble the first linkage mechanism and then somehow reconnect the components into a new arrangement with the new bar. This would have left the imaginary triggerfish ancestors with no working jaws! Unable to eat, they would have died.

One evolutionary expert wrote, "Patterns of gain, loss, and functional modification of the key levers and linkages in these diverse fishes are almost entirely unexplored."[3] Evolutionary "patterns" remain unexplored because there were none. The Lord Jesus made the first triggerfish fully intact and functional.

A diagram of major triggerfish skeletal linkages. Although small adjustments to various bone lengths have occurred as these fish diversified into species, the irreducible jaw structures that include four-bar linkage mechanisms remain in all named species of this created kind.

Image credit: Jim Zarbaugh, based on Figure 5 in reference 4

A second humuhumu aspect that points to the Creator is the adaptability of its linkage mechanisms. The humuhumu belongs to the triggerfish family Balistidae. Some triggerfish have shorter snouts with taller heads. Each variation balances pros, like increased mechanical advantage when biting, with cons, like increased drag when swimming. Such tweaks to the head shape help various triggerfish to specialize on different foods they eat. For example, the titan triggerfish *Balistoides viridescens* jaw is strong enough to bite through rocky coral.

Balistoides viridescens' *jaws are strong enough to bite through coral, sea urchins, and mollusks. Divers fear this territorial fish's bite.*

Image credit: Leonard Low, CC BY 2.0

One in-depth study concluded that once the first basic triggerfish evolved, the "triggerfish lineage [has] since oscillated within these morphological maximums of skull morphospace."[4] Oscillations mean that over many generations triggerfish skulls have lengthened, shortened, and then lengthened again. Because the skull adjusts with all parts in concert and without going outside lethal "maximums," we can be confident this process happens through internal programming.

Human engineers can only dream of designing oscillating architecture. It looks like the Lord Jesus, by whose will the Balistidae "exist and were created,"[5] equipped this fish kind with the ability to tweak its own irreducible four-bar architecture across generations.[6]

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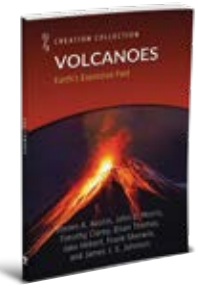

[ICR's Creation Collection] are just perfect books, perfect chapter length, perfect book size, well-written, and the concepts are well-explained, though I wouldn't call them dumbed-down. Thank you for making these wonderful volumes available so reasonably!

— J. C.

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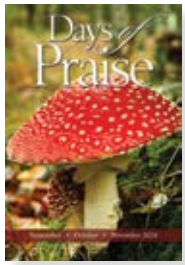


I just need to let you know how thankful I am for ICR and especially the *Days of Praise* devotional. It's so essential and foundational that we remain connected to the truth of origins. ICR has been quietly yet firmly interjecting those truths into cultures for decades. The intelligent and faith-filled content is very helpful.

— I. G.

I just finished reading Dr. Guliuzza's part 4 article on "Why Biology Needs a Theory of Biological Design" [in the September/October 2024 *Acts & Facts*]. **I can only imagine the progress that could be made in biological research if scientists were to start from a foundation of biological design instead of evolution.** It will take some courageous secular scientists to admit that TOBD makes more sense than the naturalistic view and start working from that premise. I am praying that many will and eventually the nonsense of evolution will end up on the trash heap of history, as other misguided scientific "theories" have.

— W. W.

I just signed up to receive your free magazine publication [*Acts & Facts*] and want to thank you! **My daughter is a teacher at the juvenile detention center, and my plan is to read these magazines and forward them to my daughter for the kids who are incarcerated.** I have no doubt the magazine will pique their interest and provide them with divine truth about creation and that God has a plan for them as well. Seeds I pray will bring forth righteous fruit! Thank you for offering these free.

— T. W.

[After reading the recent *Acts & Facts* Impact articles by Jeffrey Tomkins,] **I am exceedingly impressed with the marvelously intricate design of the human cell and all of its components; an obvious testament to the brilliant design of our sovereign Creator God.** Well done, Dr. Tomkins!

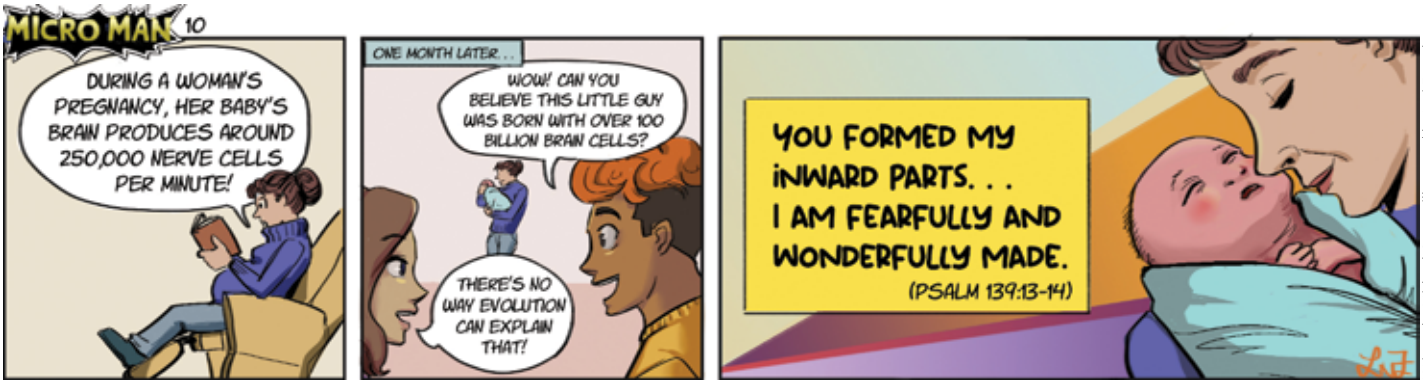
— A. Q.

I would like to thank you for the…podcasts on "Darwin, Hitler, and the Holocaust" [*The Creation Podcast* episodes 76, 77, and 78]. Recently…I have time to see some of the podcasts and, because my husband being Jewish, found them particularly useful though not easy to share. Given the climate of our news and our late events, it is a good thing to present the moral background of Darwinism and that which is born thereof…albeit a not-often-traced line of development.

— P. W.

Editor's note: You can see these and other *The Creation Podcast* episodes at **ICR.org/podcasts.**

Have a comment?
Email Editor@ICR.org or write to
Editor, P. O. Box 59029, Dallas, TX 75229.
Unfortunately, ICR is unable to respond to all correspondence or accept unsolicited manuscripts, books, email attachments, or other materials.



Written by Michael Stamp, illustrated by Lori Fausak

Creation Kids

Owls

ICR INSTITUTE FOR CREATION RESEARCH

Guess hoot? Owls are a very special kind of bird. While some fly during the day, many owls are nocturnal, or most active at night. These mysterious animals are known for their intense eyes, sharp talons, and powerful sense of hearing. Their silent wings have even inspired human designs for things like airplanes, cars, and wind turbines. Did you also know...

Eurasian Eagle Owl

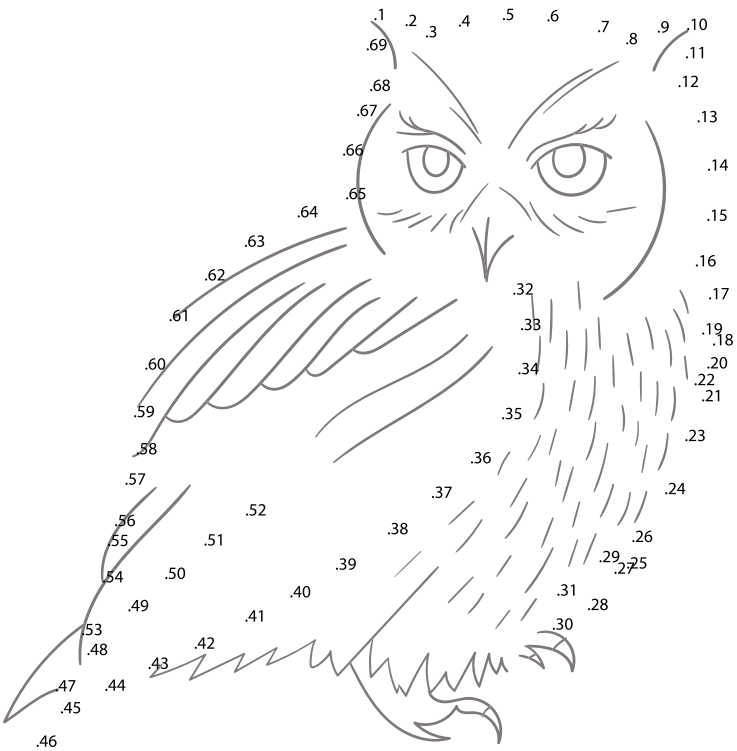
- There are about 250 owl species around the world. Owls are on every continent except Antarctica.
- Owls make a variety of sounds, from deep hoots to chirps, whistles, and screams.
- Most owls swallow their food whole. Later, they spit up the parts they can't digest in what's called a pellet. Many other birds do this, too.
- While owls usually live alone, a group is known as a parliament. This name was made popular by C. S. Lewis in *The Chronicles of Narnia*.

Fill in the Blanks

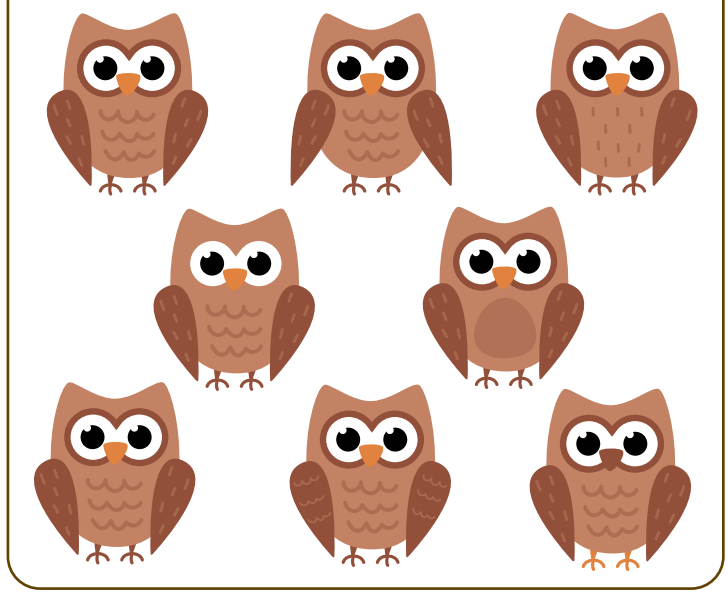
"Look at the birds of the _____, for they neither sow nor _____ nor gather into _____; yet your heavenly Father _____ them. Are you not of more value than they?" (Matthew 6:26)

Fill in the Blanks answers: air, reap, barns, feeds

Connect the dots and color what you find.



Circle the two owls that are the same.



BY SYDNEY WALTERS AND SUSAN WINDSOR

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Randy Guliuzza, P.E., M.D.

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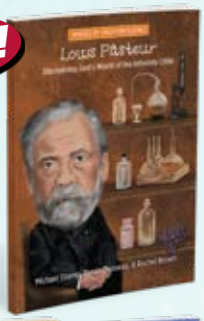

Louis Pasteur knew living creatures don't come from nonliving things but instead point to the handiwork of their Creator. This new book in ICR's Heroes of Creation Science series shows how his discoveries changed the fields of medicine, microbiology, and more.

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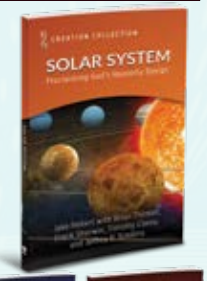

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