



**WWW.STANDINGFORTRUTHMINISTRIES.COM**

**ARTICLE**

**REFUTING ARGUMENTS AGAINST GENETIC ENTROPY**

*Does genetic drift solve the mutation load paradox?*

by **Christopher Rupe & Donny Budinsky**



**FIRST THINGS FIRST**

We spent considerable time on this article. Why would we devote so much time to responding to even our most hostile critics? I can tell you with confidence it is not because we want to one-up them as if this was some sort of competition—it's because we truly care about them. Despite sometimes being frustrated by their strong resistance to our proclamation of the truth, we love them and sincerely want them to believe and be saved.

We also want to offer a word of caution to our readers: this article is not an easy read; it is semi-

technical. Although some of the technical aspects may not be easily grasped, we are confident our readers will understand the major points and big picture concepts that argue persuasively for the reality and severity of genetic entropy.

## **THE REALITY OF GENETIC ENTROPY**

Genetic entropy is a term first coined by former evolutionist and geneticist of Cornell University, Dr. John Sanford, the author of the book that goes by the same title (1). Genetic entropy is a process of genomic degeneration due to the accumulation of mutations over time. It is based on the observation that the mutation rate is high, and that most mutations are *harmful* (or “deleterious”), yet not harmful enough to be removed from the population by natural selection. These so-called “*very slightly deleterious mutations*” are the underlying cause of genetic degeneration.

## **WHAT ARE MUTATIONS?**

Genetic degeneration has to do with mutations. Mutations are copying errors that arise in the nucleotide sequence of our genome during the process of DNA replication. Mutations can also be induced by the environment from chemicals or radiation. Even though we have remarkably designed DNA repair enzymes that run along the length of our DNA to fix many of these errors, a concerning number of mutations escape this “proof-reading” process every generation.

Mutations that confer a fitness advantage are considered beneficial mutations and those with harmful effects are known as deleterious mutations. It is widely acknowledged that the overwhelming majority of mutations that arise in a population are deleterious. Leading evolutionary population geneticists affirm this, stating:

In summary, the vast majority of mutations are deleterious. This is one of the most well-established principles of evolutionary genetics, supported by both molecular and quantitative-genetic data. (2)

Biblical creationists believe that the process of mutation accumulation began when the first man, Adam, sinned resulting in the entrance of death and a fallen creation. It should be of no surprise then to learn that mutations are generally disease-causing and destructive to biological systems. They are a source of death and pain. They certainly don't result in genome-building evolution over time.

Throughout our lifetime, mutations are constantly accumulating in all the cells of our body. They occur every time our trillions of cells divide during DNA replication. Mutations that arise in our body cells are known as somatic cells (e.g., skin cells). Mutation accumulation in our body cells is the primary reason for the aging and death of individuals.

Fortunately, somatic mutations are not passed on to our children. However, gametic mutations that arise in our reproductive cells (egg or sperm) can be passed on to the next generation in our progeny. The mutation rate in humans is alarmingly high. It is roughly 60-100 mutations per person per generation. Thus, humans are not only dying at the individual level, we are also dying as a species at the population level. In other words, the human genome has a “shelf life”.

According to the biblical view of history, humans have not been around long enough for us to be fearful of ever fully reaching “mutational meltdown”—Christ will surely return long before that happens! However, the accumulation of mutations over deep time has serious implications for the theory of evolution.

### **NATURAL SELECTION TO THE RESCUE?**

Critics of genetic entropy have long suggested that natural selection can come to the rescue by removing most of these harmful mutations from the population and amplify any rare beneficial mutations. These critics insist that selection is efficient enough to overcome perpetual fitness decline. But is this really feasible?

Natural selection is defined by differential reproduction due to fitness variation. Individuals in a population with the most fit genotypes are generally more likely to reproduce than others. In an ideal evolutionary scenario, mutations with deleterious effects on fitness would be eliminated from the population due to purifying selection or *negative selection*. Mutations with beneficial effects on fitness would be amplified by *positive selection*, such that they increase in frequency in the population. Mutations coupled with the reproductive filter of natural selection is widely considered to be the primary mechanism of evolutionary change.

Selection involves the excess death of less fit individuals. The fact that selection is a process of “removal by death” in a finite population means that selection is *limited*. One could say there is a “reproductive cost” to selection. Molecular geneticist, Dr. Chase Nelson, from the National Institutes of Health and visiting scientist at the American Museum of Natural History in New York City, explains:

Evolution by natural selection requires excess reproduction of a new (advantageous) mutant, implying excess death of an old (suboptimal) gene, *and a species’ reproductive capacity limits the rate at which this can proceed* [emphasis added]. (3)

This concept was first described in the famous paper, “The cost of natural selection” by J.B.S Haldane (4), a principal architect of the neo-Darwinian theory and one of the founding fathers of population genetics. Haldane understood that the process of genetic fixation requires a rare mutant allele to increase in frequency in the population until it completely replaces the wild type allele (non-mutant gene). This occurs through the selective elimination of 100% of the non-

mutant alleles (molecular geneticists use the term “substitution” to describe this fundamental process of evolution). Therefore, the cost of substitution can be defined as the relative number of individuals that must be selectively eliminated from the population every generation (this was Haldane’s definition). Remine defined the cost of substitution in the reverse, as “excess reproduction rate” of the beneficial trait. (6) Since a new mutant starts out as a very rare allele, and since a new mutant can only have a limited number of progeny per generation, the process of substitution is limited by the reproductive capacity of the species.

Haldane recognized that the reproductive cost of substitution largely determines the “speed of evolution”. The problem is, the speed is far too slow, particularly for mammalian species, which tend to have relatively few offspring per breeding pair. Haldane calculated that the time required for a single substitution is equivalent to roughly 300 generations. He concluded that the process of genetic fixation occurs too slowly via positive selection to accomplish any meaningful evolutionary change, even over hundreds of thousands of generations (millions of years). Haldane emphasized in his paper, “Even the geological timescale is too short for such processes to go on in respect to thousands of loci.” (4) This problem later become widely recognized as “Haldane’s Dilemma”.

Brilliant mathematician and renowned evolutionary population geneticist, Motoo Kimura, recognized the severity of Haldane’s “cost of natural selection”. It was because of the slowness of evolutionary rates of substitution that Kimura championed his neutral theory of molecular evolution. He argued that the mammalian substitution rate is too slow to explain the great amount of genetic diversity found even in very similar organisms (called intraspecific variability). He wrote:

Under the assumption that the majority of mutation substitutions at the molecular level are carried out by positive selection... to maintain the same population number and still carry out mutant substitution... each parent must leave... 3.27 million offspring to survive and reproduce. (5)

This raises an important question that is especially relevant to addressing the latest claims made by critics of genetic entropy. If selection is so severely limited by reproductive capacity, how then can we explain the origin of the great amount of genetic diversity observed among mammalian species, if it were not by selective substitutions? One obvious solution, which we think best explains the genetic evidence, is the concept of “created heterozygosity” or “pre-programmed diversity” (this has immense implications for the creation/evolution debate and will be discussed in a separate article).

Kimura’s solution was to invoke the process of genetic drift, which operates apart from selection to bring mutant alleles to fixation at a considerably faster rate. Kimura calculated a substitution rate of one mutation every 1.8 years in mammalian genomes. Kimura’s proposed solution to

Haldane's Dilemma was described in his seminal *Nature* (1968) publication, "Evolutionary Rate at the Molecular Level" and later in, "The Neutral Theory of Molecular Evolution" (1983).

*Interestingly, Kimura's solution creates a catch-22 for evolutionary theory. Even assuming that the rate of neutral evolution via genetic drift solves selection's "slowness of evolution" problem, it creates a far worse problem relating to the genetic fixation of effectively neutral (unselectable), slightly deleterious mutations—the implications of which are devastating for evolutionary theory. More on that later.*

Haldane spoke of his dilemma in terms of the substitution rate of beneficial mutations under positive selection, through the complete elimination of the wild type allele. However, a reproductive cost is also required to meet the high demands of negative selection (purifying selection)—i.e., the selective removal of deleterious mutations from the population. (6) *In light of the limited reproductive capacity and the high reproductive cost of selection in mammalian populations, how can there be a sufficient number of progeny available for selective elimination every generation, as would be needed to counteract the high rates of deleterious mutation accumulation?* Sanford captures the essence of this problem in *Genetic Entropy*, writing:

We cannot stop genomic degeneration because of the high number of mutations occurring in the human population and the prohibitive reproductive cost of eliminating each one. ... It is widely acknowledged that we each inherit many thousands of deleterious mutations from previous generations... we can't get rid of enough of the mutants and still maintain population size. The cost of selection clearly limits how many mutations we can eliminate per generation, and the known mutation rate for humans is too high to be counteracted by any level of selection. Therefore, mutations will accumulate, and the species must degenerate! (1)

Let's summarize our main points in simple terms to bring the conversation back to ground level. There are two key points to consider so far: 1) deleterious mutations vastly outnumber rare beneficial mutations, and 2) there is a high reproductive cost of selection (i.e., selection is both limited and inefficient). *The problem this creates for evolution is that deleterious mutations are entering the population faster than they can be removed by selection.* Since selection is limited and mutation accumulation is relentless, purifying selection can *slow* genetic degeneration but it cannot stop it. Over deep time, the accumulation of deleterious mutations must result in continuous fitness decline, which is antithetical to evolutionary advance.

## **CONTAMINATION OF THE GENOME BY "VERY SLIGHTLY DELETERIOUS MUTATIONS"**

So far, we have only considered mutations with fitness effects that are significant enough to be affected by natural selection. However, evolutionary geneticists have long recognized that there

is a class of mutation with fitness effects that are too subtle to be acted on by selection. They are referred to as “nearly neutral” or “very slightly deleterious”, which is to say that although the vast majority of mutations are deleterious, most of these have fitness effects that are too small to be seized upon by selection. *Thus, the problem for evolution becomes much more severe when we realize that most mutations are very slightly deleterious or nearly neutral (low impact)—such that they are “invisible” to purifying selection.* So, what happens to mutations with deleterious effects that are too small to be noticed by selection? Those mutations accumulate relentlessly, regardless of selection.

They are termed “effectively neutral” mutations because they act as though they were perfectly neutral in the sense that they do not respond to selection at all. The fact that most mutations are very slightly deleterious is extremely problematic for evolution because it means selection can do nothing to remove them from the population, and so more and more mutations continue to accumulate in the genome every generation. As a result of this ongoing process, the human population must be moving toward extinction due to the contamination of the genome by these very slightly deleterious mutations over time—a process that eventually culminates in what population geneticists refer to as “mutational meltdown.”

Evolutionary population geneticists are well aware of this problem and refer to it as the “mutational load paradox”. As population geneticists, Alexey Kondrashov writes, “...*because the stochastic mutation load paradox appears real—it requires a resolution.*” (7) The problem of genetic degeneration has never been resolved, despite very many attempts that have been made by evolutionary population geneticists for the past several decades. Some of these failed rescue devices include synergistic epistasis, mutation count mechanism, truncation selection, and more. The latest rescue device has to do with a process known as genetic drift.

## **GENETIC DRIFT TO THE RESCUE?**

The most destructive mutations can be removed by purifying selection, however, since most mutations are too subtle to be acted on by selection, they are subject to the process of genetic drift. Genetic drift is defined as random changes in allele frequencies within a population due to a “sampling error” in the transmission of gametes. Genetic drift is random—it just creates noise.

The vast majority of all mutations are lost to drift, but some survive and increase in frequency within the population. In fact, over time a fraction of these surviving mutations become fixed in the genome. This becomes *systematic* once “mutation-fixation equilibrium” is reached (more on that in a moment). Genetic drift in no way resolves the mutational load paradox. *Drift makes the problem worse. It means that many deleterious mutations will randomly drift to fixation—locking in harmful mutations.* For example, Kimura argued most substitutions in mammalian species occurred apart from selection via genetic drift. Prominent evolutionary biologist and anti-creationist, Douglas Futuyma, affirms this stating:

The neutral theory of molecular evolution holds that although a small minority of mutations in DNA or protein sequences are advantageous and are fixed by natural selection, and although many mutations are disadvantageous and are eliminated by natural selection, *the great majority of those mutations that are fixed are effectively neutral with respect to fitness and are fixed by genetic drift* [emphasis added]. (8)

## REFUTING THE CRITICS – GENETIC DRIFT DOES NOT SOLVE THE DEGENERATION PROBLEM

The coauthor of this article, Donny Budinsky, engaged in a podcast debate with cell biology student, Taylor Gray (who goes by *Snake Was Right* on YouTube) on January 02, 2023. (9) The title of the debate was “*Is Genetic Entropy a Legitimate Challenge for Evolution?*” This debate sparked an “aftershow” (10) on a channel called Based Theory that is run by a proponent of evolution and a frequent debater named Grayson. Donny has debated Grayson 3 times on the topic of creation, evolution, and ancestry (1 formal and 2 informal).

Grayson has not given in. He has advanced arguments that have been debunked countless times. He has, like most critics, ignored responses to his fallacious claims. One specific argument that he continues to employ in an attempt to rescue evolution from the cumulative effects of slightly deleterious mutations is genetic drift. What follows is a refutation of this repeated, and easily debunked argument:

**Claim:** The reason why these slightly deleterious mutations do not add up over time is because they are culled by genetic drift. 99% of all mutations are erased over time due to genetic drift.

This argument (which was made at timestamp 12:00 of the “aftershow” hosted by Grayson) is at odds with the basic principles of population genetics. Grayson claims genetic drift removes the vast majority of slightly deleterious mutations that enter the population. This is only half the story—he is missing the most relevant aspect of this process, and that is *genetic fixation*. Invoking genetic drift to stop genetic degeneration reveals a fundamental misunderstanding of how evolution is said to operate at the population-genetic level. Grayson claims the mutational load paradox can be resolved through the random loss of alleles due to drift, yet *genetic drift is the very process by which these slightly deleterious mutations become fixed, meaning—permanently established in the population.*

Evolutionists who continue to make this argument fail to recognize a fundamental principle of population genetics, which should be somewhat embarrassing to them. In an introductory level textbook, *Evolution*, evolutionary biologist, Douglas Futuyma, writes:

Since, on average, it will take  $4N_e$  generations for such mutations to reach fixation,

about the same number of neutral mutations should be fixed every generation: the rate of fixation of mutations is theoretically constant, and equals the neutral mutation rate. This is the theoretical basis of the molecular clock. (8)

Any proponent of evolution who understands Kimura's formulation of  $4N_e$  (which is the time it takes for an effectively neutral mutation to become fixed in a population) knows better than to use genetic drift as a serious argument against genetic degeneration. *This is because the fixation of effectively neutral mutations via genetic drift is the underlying cause of the mutational load paradox.* Yet, many evolutionists simply do not understand these basic concepts, which is why they fail to provide a sophisticated response to genetic entropy. Genetic drift does not nullify the effects of slightly deleterious mutation accumulation. These types of arguments are based on a surprisingly basic misunderstanding of how genetic drift and the process of fixation work.

Those who have studied the field of population genetics, even at a very fundamental level, understand why it is scientifically baseless to claim genetic drift is a reasonable solution to the mutational load paradox. To reiterate, *standard population genetics theory teaches that the rate of fixation of neutral mutations (which includes effectively neutral mutations—i.e., very slightly deleterious mutations) in a population equals the neutral mutation rate.*

It is true that the vast majority of mutations are lost from the population via genetic drift, especially immediately after they first enter the population while they are very rare alleles (i.e., when they are vastly outnumbered by the wild type allele). However, our critics should know that *two things can be true at the same time.* Even with ongoing random loss due to genetic drift, classical population genetic theory states that over evolutionary timescales, a neutral mutation-fixation equilibrium point will be reached. When this occurs, the neutral mutation rate will equal the fixation rate. For example, *if the effectively neutral mutation rate is 50 per person per generation, then that means 50 nearly neutral (very slightly deleterious) mutations will become fixed every generation.* Even if we erroneously grant for the sake of argument that our genome is 90% “junk DNA”, and we accordingly reduce the mutation rate to 10 per person per generation, this would still be devastating to evolution, as has been acknowledged by several prominent evolutionary population geneticists. In fact, Kondrashov writes, “...the load can become excessive even when  $U < 1$  [mutation rate of  $< 1$ ] ... as my analysis suggests—contamination by VSDMs [very slightly deleterious mutations] implies an excessive load, leading to stochastic mutational load paradox.” (7) This is a massive problem for those who claim genetic drift can magically solve the mutational load paradox—it is wishful thinking.

Every generation, the small percentage of slightly deleterious mutations that escape random loss due to genetic drift will persist in the population in varying frequencies. *According to Kimura's formulation of  $4N_e$ , a fraction of those mutations will become fixed in the population every generation at a rate equal to the neutral mutation rate.* (Fixations can also occur from population bottleneck effects, which are typically much more devastating to fitness, particularly

if they are prolonged over many generations, which is very problematic for the Out of Africa theory). Thus, all of the slightly deleterious mutations that become fixed in the population in times past and present, represent *irreversible genetic damage*. *Once those nucleotides become fixed, they can never be removed from the population due to genetic drift or purifying selection, except in the highly uncommon circumstance of a back mutation—they have become permanently established in the genome*. The inevitable consequence of this process of fixation via genetic drift is the systematic decline in mean fitness (typically in very small increments) every time a deleterious fixation event occurs. This problem has been thoroughly studied by Rupe and Sanford and has been named “Haldane’s Ratchet” (10).

But that’s not all. The sword of genetic drift cuts both ways—the concept doesn’t just apply to deleterious mutations. Again, it is certainly true that the vast majority of mutations are lost due to drift, however, *this includes beneficial mutations!* Nelson notes, “More than 99.9% of beneficial mutations appearing in the human population are lost by random genetic drift” (3)—an observation that is consistent with the results from Mendel’s Accountant (11) This happens to be the underlying reason why the “waiting time problem” is so devastating to the theory of evolution (12).

Interestingly, the biblical creation model does not require neutral mutation-fixation equilibrium to be reached through these perfect evolutionary circumstances, which population geneticists conveniently invoke in their hypothetical models, such as the Out of Africa theory. Evolutionary population geneticists’ resort to idealized circumstances in an attempt to make their evolutionary models seem genetically feasible. Yet these types of special conditions rely on a series of purely theoretical, biologically unrealistic assumptions (e.g., truncation selection, infinite population sizes, etc.). The field itself assumes deep time (millions of years) for neutral mutation-fixation equilibrium to be reached and further assumes the ultimate source of all genetic variation was the result of mutation accumulation over time (i.e., every nucleotide was at one time in evolutionary history a rare mutant allele). Concepts like created heterozygosity or pre-programmed genetic diversity have no meaning to them since their evolutionary philosophical (unscientific) presuppositions preclude it. From their perspective, mutation accumulation is not necessarily a bad thing, it’s how we evolve! And so, they tend to ignore the fact that every single human on the planet today is “multiply mutant” since every individual has inherited a load of very slightly deleterious mutations from their parents, grandparents, great grandparents, and so on, ever since the Fall.

After reading this article, some of our critics will surely dig their heels in and argue, “You’re ignoring the compensatory effects of beneficial mutations!” However, the very occasional beneficial mutation occurs too little and too late to keep up with the accumulating damage caused by the far more prevalent slightly deleterious mutations. This is the essence of genetic entropy. Sadly, the process of genetic degeneration is unstoppable and should remind us of our fragile human condition and desperate need for a Savior.

## CONCLUDING COMMENTS

Critics have claimed that random loss due to genetic drift resolves the mutational load paradox. *Ironically, genetic drift is the very means by which slightly deleterious mutations become fixed in the genome!* Again, these effectively neutral mutations that escape random loss, become fixed every generation at a rate equal to the neutral mutation rate, resulting in the slow, systematic erosion of the genome. *What evolutionary process is capable of stopping genetic degeneration, if the underlying cause of genetic deterioration are low-impact mutations that are invisible to natural selection—and consequently become fixed in the genome via genetic drift?*

Genetic drift is perhaps the worst rescue device proposed to date (worse than synergistic epistasis and mutation count mechanism) and this is not surprising since it has not been postulated by any serious population geneticist, but rather by an anti-creationist who is largely untrained in the basic principles of population genetics. The truth is, the process of genetic drift coupled with the cumulative fixation of very slightly deleterious mutations represents a fatal blow to the modern theory of evolution.

It is worth adding that the way critics such as Grayson have employed their argument from genetic drift undermines the entire basis for the molecular clock, which they defend in other topics of debate such as the Out-of-Africa theory.

We urge our readers to put your full trust in Jesus rather than in futile rescue devices proposed by those who go to great lengths to invent highly imaginative ways of circumventing the fundamental biological reality of genetic entropy.

## REFERENCES

1. Sanford J.C., *Genetic Entropy*, 4th Edition, FMS Publications, 2014.
2. Keightley, Peter D., and Michael Lynch. "Toward a realistic model of mutations affecting fitness." *Evolution; International Journal of Organic Evolution*, vol. 57,3 (2003): 683-5; discussion 686-9. doi:10.1111/j.0014-3820.2003.tb01561.x
3. Nelson, C. "Haldane's Dilemma." *Inference: International Review of Science*, vol. 1,3 (2015): <https://inference-review.com/article/haldanes-dilemma>
4. Haldane, J.B.S. "The cost of natural selection." *J. Genetics* 55:511-524 (1957).
5. Kimura, M. "Evolutionary rate at the molecular level" *Nature* 217:624-626 (1968).

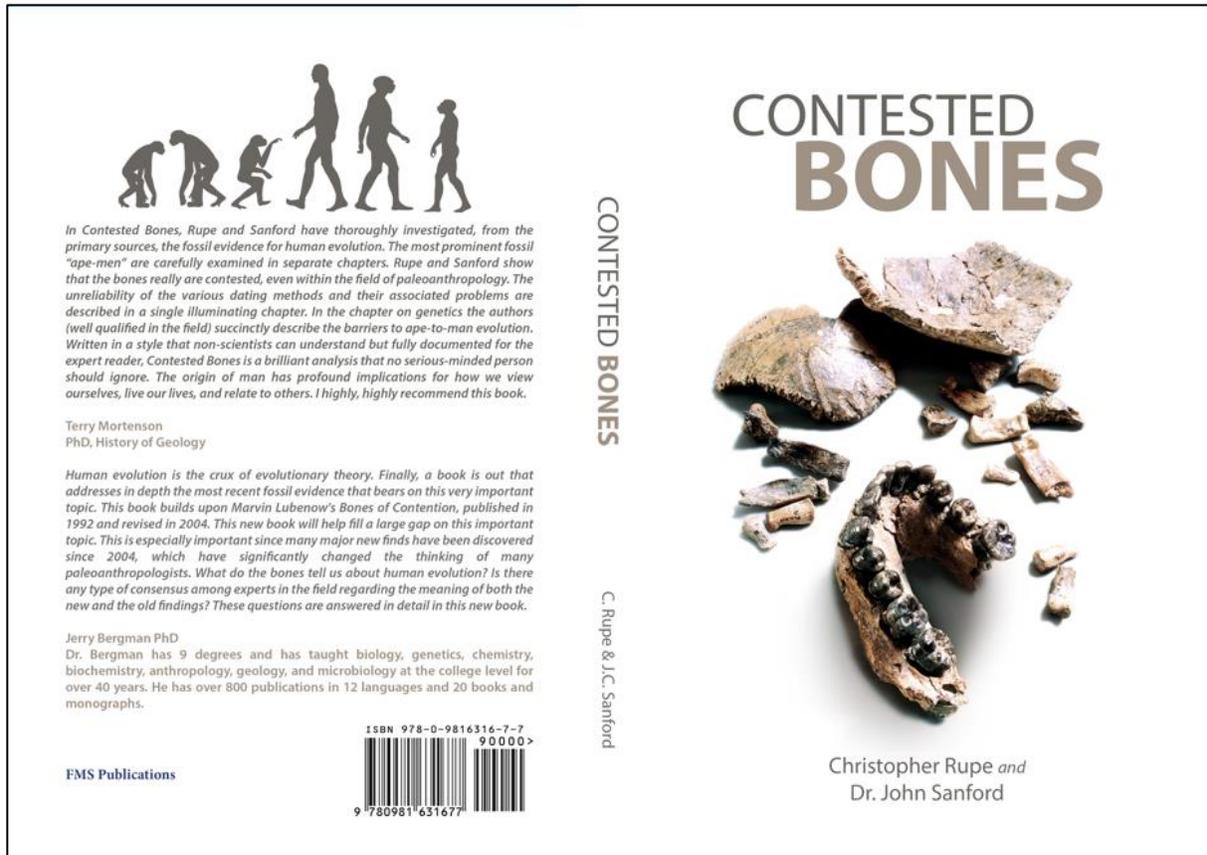
6. Remine, W. "Cost of Selection Theory." *Technical Journal* 19:113-125 (2005).
7. Kondrashov, A S. "Contamination of the genome by very slightly deleterious mutations: why have we not died 100 times over?." *Journal of theoretical biology* vol. 175,4 (1995): 583-94. doi:10.1006/jtbi.1995.0167
8. Douglas J. Futuyma, *Evolution*, Sinauer Associates, Inc. Publishers. Sunderland, MA (2005).
9. PODCAST DEBATE | Is Genetic Entropy a Legitimate Problem for Evolution? –Donny vs Taylor. (n.d.). [www.youtube.com](http://www.youtube.com). Retrieved February 3, 2023, from <https://www.youtube.com/watch?v=5U792L6Fe6E&t=7089s>
10. Is Genetic Entropy Real? | Aftershow feat. Snake Was Right, Mark Reid, Praise I Am, HiveSci. (n.d.). [www.youtube.com](http://www.youtube.com). Retrieved February 3, 2023, from <https://www.youtube.com/watch?v=TxwbLUNoNeo&t=993s>
11. Rupe, Christopher L. and Sanford, John C. (2013) "Using Numerical Simulation to Better Understand Fixation Rates, and Establishment of a New Principle: Haldane's Ratchet, Proceedings of the International Conference on Creationism: Vol. 7, Article 32.
12. Sanford, J., Brewer, W., Smith, F., and Baumgardner, J., (2015), The waiting time problem in a model hominin population: *Theoretical Biology and Medical Modelling*, v. 12, no. 1, p. 1-28.

## **RECOMMENDED RESOURCES**

**(Continued on next page)**



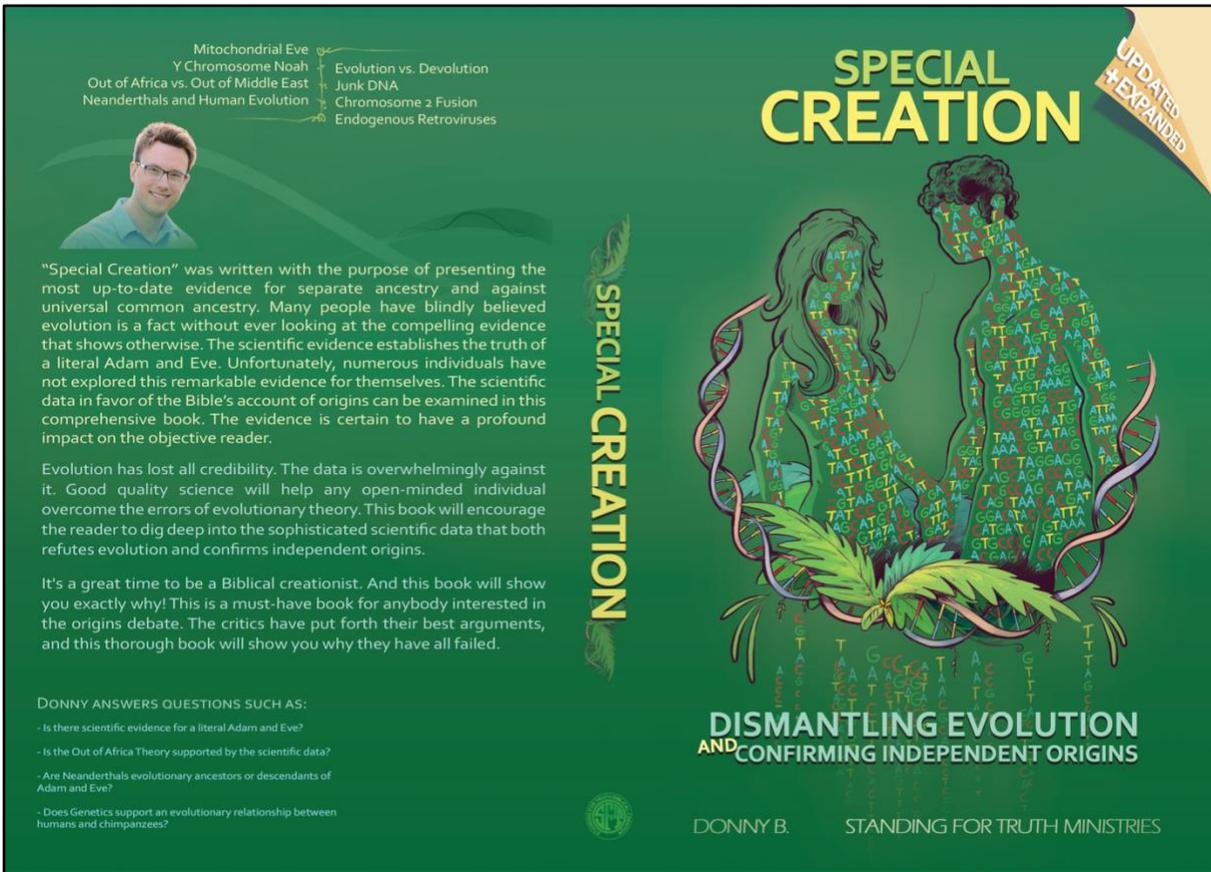
Contested Bones – by Christopher Rupe and Dr. John Sanford



Available at: <http://www.contestedbones.org>

Also available on Amazon Kindle

Special Creation - Dismantling Evolution and Confirming Independent Origins  
by Donny Budinsky

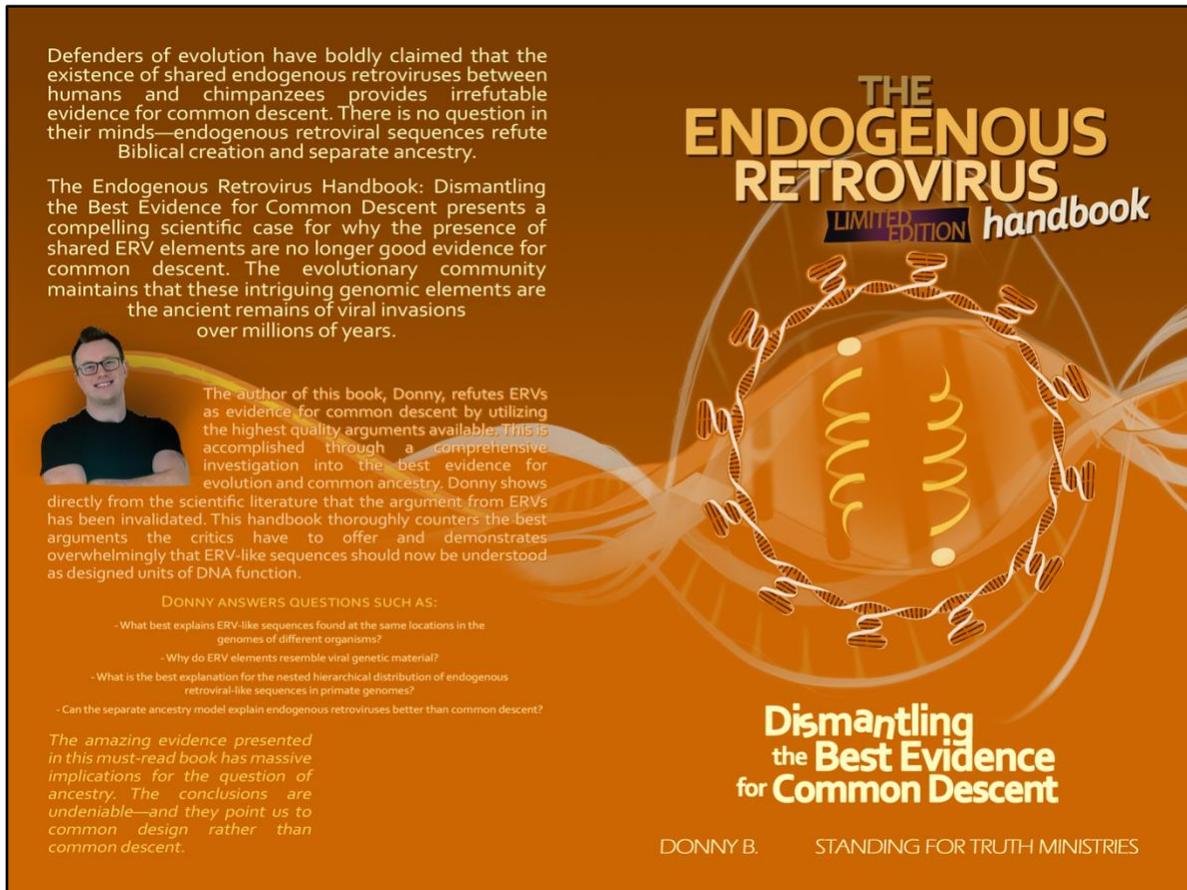


**Black and White** -

<https://www.amazon.com/dp/B08R64MPQ7>

**Full Color** - <https://www.amazon.com/dp/B0BD55T5FQ>

The Endogenous Retrovirus Handbook - Dismantling the Best Evidence for Common Descent  
by Donny Budinsky



**Black and White version -**

<https://www.amazon.com/dp/B0B14KHL8G>

**Full Color -** <https://www.amazon.com/dp/B0B1B1N8F6>

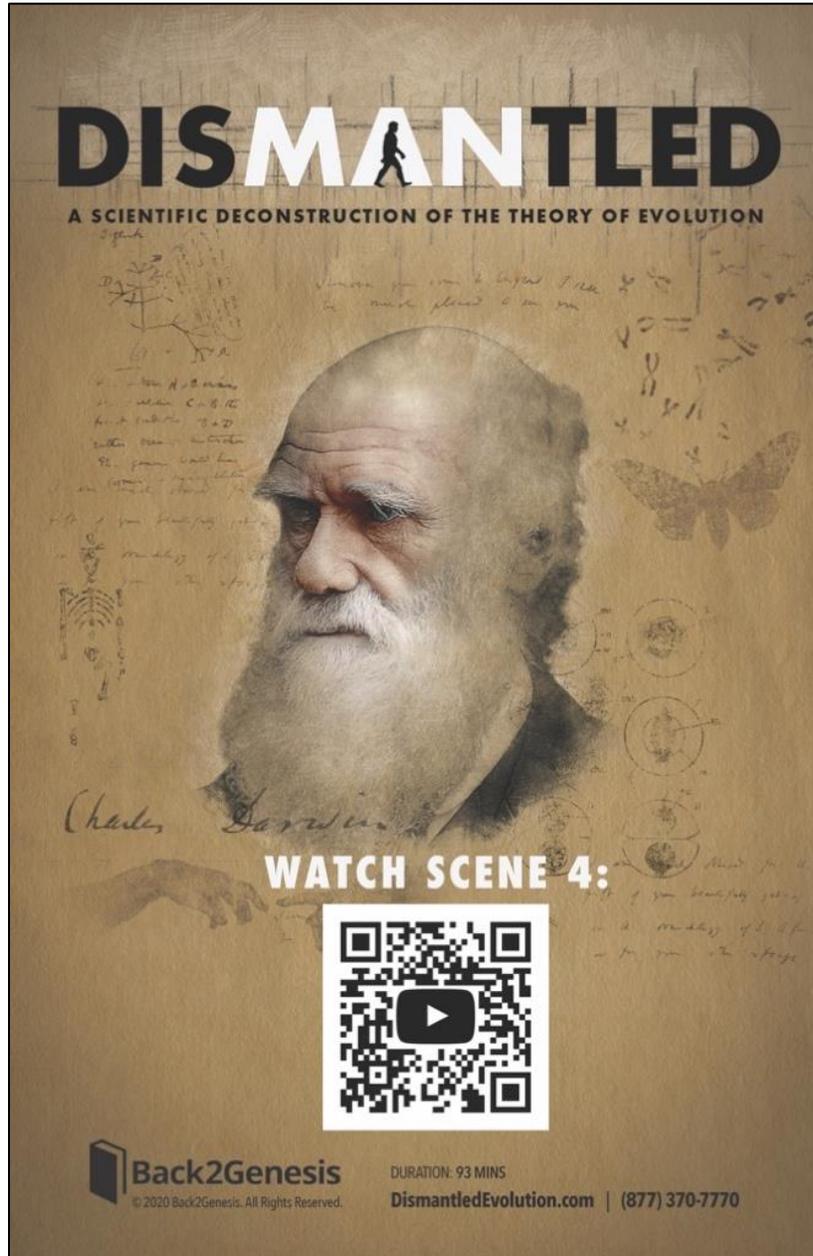
Standing For Truth Ministries' Official YouTube Channel  
<https://www.youtube.com/@StandingForTruthMinistries>

<https://standingfortruthministries.com/>

Full length feature film – Dismantled: A Scientific Deconstruction of the Theory of Evolution

02-21-23

by Christopher Rupe



Watch scene 4 for Free on YouTube: <https://youtu.be/GhEPAXXwcX0>

The full feature film is available here: <http://www.dismantledevolution.com/shop>

Host a free video showing at your church or community venue:  
<https://www.dismantledevolution.com/screenings>