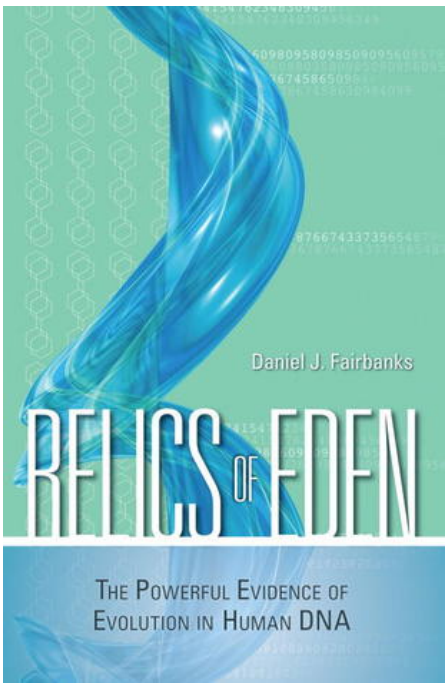

Relics of Eden: The Powerful Evidence of Evolution in Human DNA

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Since the publication in 1859 of Darwin's Origin of Species, debate over the theory of evolution has been continuous and often impassioned. In recent years, opponents of "Darwin's dangerous idea" have mounted history's most sophisticated and generously funded attack, claiming that evolution is "a theory in crisis." Ironically, these claims are being made at a time when the explosion of information from genome projects has revealed the most compelling and overwhelming evidence of evolution ever discovered. Much of the latest evidence of human evolution comes not from our genes, but from so-called "junk DNA," leftover relics of our evolutionary history that make up the vast majority of our DNA.
Relics of Eden explores this powerful DNA-based evidence of human evolution. The "relics" are the millions of functionally useless but scientifically informative remnants of our evolutionary ancestry trapped in the DNA of every person on the planet. For example, the analysis of the chimpanzee and Rhesus monkey genomes shows indisputable evidence of the human evolutionary relationship with other primates. Over 95 percent of our genome is identical with that of chimpanzees and we also have a good deal in common with other animal species.
Author Daniel J. Fairbanks also discusses what DNA analysis reveals about where humans originated. The diversity of DNA sequences repeatedly confirms the archeological evidence that humans originated in sub-Saharan Africa (the "Eden" of the title) and from there migrated through the Middle East and Asia to Europe, Australia, and the Americas. In conclusion, Fairbanks confronts the supposed dichotomy between evolution and religion, arguing that both science and religion are complementary ways to seek truth. He appeals to the vast majority of Americans who hold religious convictions not to be fooled by the pseudoscience of Creationists and Intelligent Design advocates and to abandon the false dichotomy between religion and real science.
This concise, very readable presentation of recent genetic research is completely accessible to the nonspecialist and makes for enlightening and fascinating reading.

Relics of Eden: The Powerful Evidence of Evolution in Human DNA Details

Date	:	Published October 31st 2007 by Prometheus Books
ISBN	:	9781591025641
Author	:	Daniel J. Fairbanks
Format	:	Hardcover 281 pages
Genre	:	Science, Biology, Evolution, Nonfiction, Genetics

Daniel J. Fairbanks

From Reader Review Relics of Eden: The Powerful Evidence of Evolution in Human DNA for online ebook

Sam says

Excellent book, a chapter at end gives a very good historical summary from Darwin to 2000 of how ideas and science evolved.

Genetics professor Fairbanks, author of several science books for laymen (Genetics: The Continuity of Life), presents the details of evolution as gleaned from a close study of genetics, but marshals his evidence in a conversational style readily comprehensible to general readers.

Fairbanks excels at explaining the momentous discoveries in genetics in the past 20 years in clear, concise language, helpfully defining relatively new terms (introns, telomeres, transposable elements) as well as older terms (mutation, natural selection). Using comparative genomics, in which the human genome is compared to those of other primates, mammals, vertebrates, insects and bacteria, Fairbanks shows how the human genome can only be explained as the evolutionary product of numerous pre-existing species, placing humans in a family tree that ties together all life on Earth and maps its genetic changes over time.

From there, he engages in a familiar critique of the “intelligent design” theory of creation (“When Faith and Reason Clash”); himself a Mormon, Fairbanks makes some interesting points regarding the canard that the sciences in general, and evolution in particular, are at odds with religion.

Notes, references and extensive appendices go into greater technical detail; general readers looking for an overview of current genetics and evolution science will find this a great place to start.

David says

This is a *very* well written account of the recent evidence for evolution in DNA (and I have read quite a few books on the general topic of evolution and DNA).

Daniel Fairbanks, the author, is a respected biologist and is currently the Dean of Undergraduate Education at Brigham Young University. He brings together many years of research in the field.

Fairbanks presents the evidence, which by any measure is overwhelming. He presents a particularly compelling example by showing how humans (and certain other primates) have lost the ability to manufacture their own Vitamin C -- evidently this was lost when our ancestors adopted a diet rich in fruit. DNA for the basic machinery, which consists of numerous intricate biochemical steps, is still present in our genome, but a mutation has inactivated a key final step, so it is of no use. Interestingly, the same mutation is present in other primates, and several subsequent mutations can be seen to have occurred since the split between humans and primates.

Another compelling example is the joining of two earlier chromosomes to form a single chromosome. Biologists observed many years ago that humans have only 23 sets of chromosomes, whereas other primates have 24. Thus they hypothesized that one of our 23 chromosomes is a fusion of two. This hypothesis was spectacularly confirmed in the 1990s, when DNA analysis identified the precise point of fusion, which joins

two sets of telomeres that otherwise would have marked the end of a chromosome.

Later in the book Fairbanks addresses head-on the claims of creationists and "intelligent design" writers. He shows how such claims are not only utterly refuted with the latest DNA evidence, but that they even made bad theology, because otherwise we are left with a "designer" who made mistakes and even copied mistakes from one species to another.

In general, this is arguably the best book on the latest research on DNA and the compelling case it makes for evolution. Highly recommended.

Soren Petersen says

It's a good solid overview of the latest DNA evidence for common descent, aimed at the general reader. Fairbanks concentrates on the human/chimpanzee evidence (partly because that's what people are interested in, partly because that's his own specialty). I would have actually preferred if he had ranged further afield--I don't need Fairbanks to convince me that I'm a primate, and I'd have liked to have learned more about how the new molecular evidence is effecting taxonomy as a whole. That said, so much work is being done that it's very hard for an interested layman like myself to keep up, Fairbanks is a fine clear writer, and a snapshot of the field ca. 2006 is much appreciated.

My main problem with the book is the two chapters he devoted to the culture wars. It's not that he's wrong (he's a Christian who doesn't read *Genesis* literally, and who thinks that Creationists and ID folks are an embarrassment)--it's just that pretty much everything has been said, and Yet Another voice of sweet reason doesn't add anything useful. I'd have much rather had fifty more pages on the science.

Holly says

The book's target audience seems to be the 45% of Americans who believe in special creation in some form. He appeals to them that this isn't your parents' fossil record full of gaps. With recent genome sequencing methods, DNA evidence for common ancestry is overwhelming.

I haven't had biology since tenth grade, and even then we only spent a moment on genetics. While the book was technical, it was pretty basic and easy to understand. He starts with human chromosome 2 and chimpanzee chromosomes 2A and 2B, and explains how we can tell whether 2A and 2B fused or whether 2 split. (Once we see the contents of human chromosome 2, it's pretty obvious).

Then he goes through different types of mutations (insertions, deletions, substitutions), how most disable a gene's function and then get passed down through generations (these pseudogenes are his "relics of eden"). The odds of any mutation randomly occurring in the exact same position on your DNA as mine is highly unlikely, so it follows that two with the exact same mutation in the same location had a common ancestor. Example: the GULO gene allows dogs/cats to make Vitamin C out of other substances. This gene has been mutated/disabled in humans, from a section of 55 base-pairs on the gene that has been deleted. Without that functionality, humans have to consume vitamin C in food to survive. A deletion like this is very rare, yet all the other species of primates have this exact deletion. The odds of multiple species acquiring this independently is so small it's hard to consider. (And he left unsaid, the idea of a supernatural creator creating

genes that don't function doesn't agree with any theology).

The chapter on geographic origins of the food supply was interesting, as was using DNA analysis to track the original migration of native peoples of the world. In Genghis Khan's former empire in central Asia, 8% of all men have the same Y chromosome. GK's sons were also powerful and sexually prolific. So 30 million men today have Genghis Khan as their common ancestor, just through the paternal line.

It discusses the "irreducibly complex" systems that Intelligent Design promoters use as arguments and addresses how the example of the blood clotting system could have arisen.

The book seems current enough now, but I imagine it will be dated quickly, 2007.

Eric Liknes says

I chose the book as the topic for an evolution seminar course that I teach. One of the strengths of this book - its easy readability and the author's ability to easily explain complicated genetics - actually worked against us as there was usually little need for group discussion or explanation. For those of you who are not aware of the impact of the human genome project on the understanding of human relatedness, this is a wonderful book. One of the reasons why I chose this book was the inclusion, in the last two chapters, a discussion of the controversy between evolution and religion. I found these chapters to be the biggest disappointment as Fairbanks referred the reader to Miller's "Finding Darwin's God" and didn't have much more to add. Understandably so. Nevertheless, this is a great book.

Alex says

Relics of Eden is a excellent introduction to evolutionary genetics. It traces the molecular evidence for evolution and even hints at themes that will play a role in other more advanced specialized texts. For example why is the "junk" DNA similar in evolutionary similar species. Although the immediate consequences are quite obvious,they're related from an evolutionary point of view, this observation will have profound implications regarding evolution itself. Villareal writes quite a bit about this in his books of viruses but I won't spoil the surprise!

This text is easy and breezy to read and even doesn't require a strong command of evolutionary theory or biology to understand. Yet despite it's ease it's also remarkably powerful as well Fairbanks lays out a compelling case for the validity of Darwin's theory in our genes themselves.

Of course it's best if you have some evolutionary background and of course if you start reading more advanced texts the story becomes slightly more convoluted, but far more interesting! However Fairbanks book is a great introduction to evolutionary genetics for someone who doesn't want to plow through other more complicated and involving work.

Outstanding!

Maria says

"Relics of Eden" by geneticist Daniel J. Fairbanks is an essential must read Neo-Darwinism based book that approaches the basic concepts of the genetic evidence of evolution.

But, can DNA really support the evidence that humans and great apes share a common ancestry??? Yes, of course it does, and this is what the author accomplishes in this book, he demonstrates a great ability to explain genetics in such an easy and clear way for everyone, for those passionate about science and also for the non scientific reader but who wish to comprehend what genetics has to offer in this wonderful topic... The Theory of Evolution.

Beginning with chapter one, Fairbanks introduces the reader with the concept of fusion and its implications in DNA. There is a well known article published on the journal Science in 1982 by Yunis and Prakash. On this article, these superb scientists confirmed the genetic sequence similarities between humans, orangutans, chimpanzees and gorillas. What it made this article so amazing was the fact that our human chromosome number 2 matches the chromosomes of chimpanzees number 2A and 2B if you align them together. So, the human genome consists of 46 DNA molecules with a total of approximately 6 billion nucleotides while great apes consist of an extra pair of chromosomes. Out of the many three basic possibilities, fussion of those two chromosomes (2A/2B) is the only possible explanation and to be more precise, it relies at the level of centromeres and telomeres. But I guess I should leave you with the full explanation to enjoy.

Another chapter that I was really pleased was the one that approaches the research of one of my favorite female scientists, the 1983 Nobel laureate Barbara McClintock. People always seem to remember the work of Marie Curie on radioactivity or Rosalind Franklin on X-ray crystallography, but the work of McClintock doesn't really get the recognition I believe it deserves. Thanks to the work of such amazing woman on transposable elements, we now have an advanced understanding on genetics, evolution, disease and cancer. Transposons (also known as "jumping genes") have an incredible ability to "jump" from one place to another along our entire DNA sequence and cause gene disruption or mutations by a process known as methylation. Once a gene is methylated or "switched off", it looses its function in an irreversible way. The importance of these transposons and methylations and the role that the environment plays on this process have given the rise to the field that is now known as Epigenetics. This is not really in the book, but the importance of McClintock's works as well as that of another Nobel laureate Dr. Paul Berg are essential for the understanding the fundamental bases of Epigenetics.

Anyways, back to evolution, transposable elements offer an evidence or a glimpse to our evolutionary past. They can either transpose or retrotranspose. Transpose, meaning just a "copy-paste" similar function, in which they just jump and bind to another DNA site; making up about 2.8% of our entire genome. On the other side, we also have retrotransposons which make up about 42.8% of our entire genome! But, their insertion to our genome is similar to that of the HIV infectious process, requiring to make a DNA copy from an RNA copy and then inserting itself back to our genome at a different binding site. It is believed that this virus-like behavior of retrotransposons originated from ancient viruses and its DNA was transmitted from one generation to the next. There are two common and well known retrotransposon families in our entire DNA sequence, they are the Alu family and the LINE family. They are just tandem repeat DNAs, but the interesting thing is that the more a sequence is repeated in our DNA, the more evolution it has gone through that particular species, like ours. If you compare the Alu family of human genome with that of a chimpanzee you will find the same location and orientation of this sequence, but ours being a little longer repeated sequence of course. Like these examples, we also have the HERV-K elements or the CMT1A duplicated sequence among many others. Regardless of their function, what is a fact is that they do offer a window to

our ancestry.

Fairbank's closes beautifully with two interesting chapters:
One, the science-faith dichotomy and its impact on the Theory of Evolution. Sadly, we still find the Theory of Evolution being continually challenged or questioned by faith or, worse its lack of understanding. and,
Two: a very short but brilliant summary from Darwin's publication of "Origin of Species" on June 30, 1860 all the way to the human genome project led by Francis Collins.

I strongly believe we need to read books like this and recommend them to younger generations to keep stimulating the use of deductive reasoning and the continued application and exercise of the scientific method.

Daniel J. Fairbanks was formerly Dean of Science & Health at Utah Valley University, and has been a professor at the University of Massachusetts–Amherst, Southern Virginia University, Brigham Young University, and Fulbright Professor at the Universidade Estadual de Londrina in Brazil. He is a geneticist with an expertise in evolutionary genetics, international scientific development, science education, and the history of genetics. For more information and publications by this author here is a link to his page:

http://danielfairbanks.net/articles

To finalize, ill just close with one of my favorite scientific quotes:

"Nothing in biology makes sense except in the light of evolution.”
? Theodosius Grigorievich Dobzhansky

Paul Bruggink says

Daniel Fairbank's book is an excellent and up-to-date (as of 2007) description and explanation of the multiple types of recent DNA evidence (fusions, fissions, inversions, translocations, duplications, and deletions), that point to human evolution from a common ancestor with the great apes. The book is a bit technical, but his clear descriptions of the logic of the research and the conclusions are easy to follow. This is followed by two chapters on the creation-evolution issue, focusing on putting aside the pseudoscientific claims of young-earth creationism and intelligent design.

The author states that he holds deep religious convictions but strongly believes "that attempts to discredit the powerful evidence of evolution actually harm faith rather than promote it." (p. 15)

His book has three appendices: two with further technical information and a really interesting 37-page history of the major contributions to evolutionary genetics and how they came about.

In addition to notes at the end of each chapter, his book includes a 7-page glossary, a 14-page bibliography, and a 13-page index.

This book is an excellent complement to books on evolution which emphasize the fossil record and natural selection, such as Jerry Coyne's "Why Evolution is True," Neil Shubin's "Your Inner Fish," and Donald Prothero's "Evolution: What the Fossils Say and Why It Matters."

David S. T. says

I've been on an evolution book kick lately, but out of the three books I've read so far none have addressed my biggest question. If we share a common ancestor with apes why do we have 23 chromosomes while all other apes have 24. Knowing this is a huge issue Fairbanks addresses the fusion of two ape chromosomes into one right away in the first chapter. This book goes into detail on DNA evidence for evolution, I can kind of see why its not as often mentioned in the other books, its a little harder to understand and isn't quite as interesting or obvious as something like the fossil record. In any case though the evidence is also there and this makes a great companion book to another introduction to evolution. Also expect a couple of chapters on Religion and Evolution (the author is a Mormon), it has a similar feel as Finding Darwin’s God (but not as in depth).

Matthew Jarman says

This is, simply put, A MUST READ. Written for the layman by a molecular biology professor (LDS and from BYU, no less). It lays to rest any dispute regarding the reality of evolution and the inanity of both creationist and intelligent design theories, while simultaneously arguing against the need for any dichotomy whatsoever between evolution and religion. My only criticism is that the book merely whet the appetite. I wanted more! Fortunately, there are ample footnotes and a bulging bibliography.

Jim says

Interesting read.

Rick Staten says

I have always been a strong believer in evolution, but i was always very cautious about it due to a lack of understanding as to how to integrate it with faith. It went as far as a girlfriend telling me i was going to burn in hell for believing in it. At that point it kind of became a crusade of mine to determine my faiths views on evolution, integrating it with my own, and perhaps just open peoples thoughts to the possibility. As it turns out, my religion, as do many others, has no official stance on it, essentially they state they are in charge of the salvation of ones soul not the mechanisms to which we came to be. This is in stark contrast to many members view of evil evolution. This book was written by a professor of biology at BYU an LDS institution. The first three quarters of the book is the scientific evidence linking our DNA to a common ancestry with the great apes, and all other species down the line. For an individual not versed in molecular biology it becomes very technical, but is well written and thus easy to follow. If ones accepts this authors credentials and one is intellectually honest there is no denying the link. The final few chapters are about the alleged dichotomy between evolution and faith. The book points out that all the religious texts in the world contain a wealth of information on the purpose of creation but nothing in regards to the mechanisms behind it, where as science deals sole with the mechanism. As the book says - religion and science become complimentary ways to interpret our world, and it asks the question, if someone can believe that all living organisms share the same

creator, why not consider that all living organisms share a common genetic heritage. Like any muscle in the human body, faith grows through challenging and using it. To those who deny evolution i challenge you to read this book and hopefully upon completion you will understand that evolution is not a challenge to ones faith but a testament to a creator and thus strengthening ones testimony.

Voijarisa says

This book has a ton of great information. However, it was poorly organized. It seemed to toss most of the information first, and then organize it later, after most readers would likely be confused at the significance. I think the writing could have been greatly improved by essentially reversing the book (appendices included), teaching more about the history of evolution and genetics, then looking at how the evidence fit those predictions. I also think that the way the evidence was presented could have been much stronger. It should be made much clearer that every way these evolutionary trees are constructed, no matter which gene, pseudogene, chromosomal reversal, or other genetic bit mentioned, they always come out the same and provide independent evidence. While it's hinted at weakly, it's never directly compared to the parsimony of a designer independently making all these changes in order to fool us. I've seen that argument presented elsewhere, and it's devastating to ID/Creationism. Yet the author sidesteps it.

Another note is that this book is rather technical. While the terms are defined, they are then immediately used heavily and readers are expected to keep up. Having a good background and having taught biology before, I followed along without too many problems, but an inexperienced reader would likely struggle. The introduction to terms could be improved as well as the usage when terms are required later.

So in closing, not bad, but needs an overhaul in the organization for the average reader.

Robin says

I originally picked up this book looking for a good summary of the evidence for evolution. Though this book focuses almost entirely on the genomic evidence, it certainly gives plenty of it - presented in a straight-forward and clear manner - to succeed in defending the scientific rigor of the theory of evolution. What I did not know when purchasing the book was that the author also holds a theistic worldview (as a professor at BYU, my assumption is that he is a Mormon), and as a very pleasant surprise, the book included a thoughtful discussion on the interaction between the worlds of science and religion. My assessment of this book is probably colored somewhat by the fact that on this last point the author and I already shared largely the same position. Nevertheless, I learned much from this book, and it left me with plenty to ponder.

Graham says

If you or anyone else you know is unconvinced by the fossil evidence for biological evolution, I highly recommend the book Relics of Eden. There is stronger evidence in the DNA of living species than in the fossil record for biological evolution, as it is significantly better preserved.

Distinctions are made between genes (DNA that codes for proteins) and non-coding DNA (sometimes colloquially called junk DNA, though some is functional and some is not) and how measuring mutations

relative to each other, and relative to other species, lay out solid evidence for biological evolution. The equations for calculating the similarity between human and chimpanzee DNA is well covered and clears up the confusion in the multiple published numbers. 99% of coding DNA, vs. > 95% of non-coding DNA, and how reversed strands are counted. A particularly interesting section shows how two human chromosomes merged after chimpanzees and humans split, not only explaining the difference in the number of chromosomes, but also where they joined together.

There are other interesting bits not directly related to human-chimpanzee similarities regarding mitochondrial DNA, and how mitochondria likely share a common origin with chloroplasts and that both were likely originally symbiotes of early organisms, as opposed to parts of the organisms themselves. Also covered was the discrepancy between mitochondrial Eve and y-chromosome Adam, showing that polygamy was prevalent amongst our earliest ancestors. The retroviral influence on the human genome is also briefly covered.

There are two reasons that I did not give this book 5 stars. The first is that two of the three appendices should not have been appendices. The two appendices were more details on the NANOG gene and the reversals between common chimpanzee and human DNA. They were not overly technical, and were both important topics and should have been included inline to eliminate context switching. The second reason is that the author took it upon himself to address the conflict between science and religion. In doing so he stated that atheism is just as much a belief as Christianity. Apparently he missed the definition "lack of belief in theism". Lack of belief is a belief? Just like not collecting stamps is a hobby? I understand the author is a Christian and wishes to reconcile his knowledge of biological evolution with his religious convictions, but I found it to be an unnecessary aside to an otherwise excellent technical book.
