

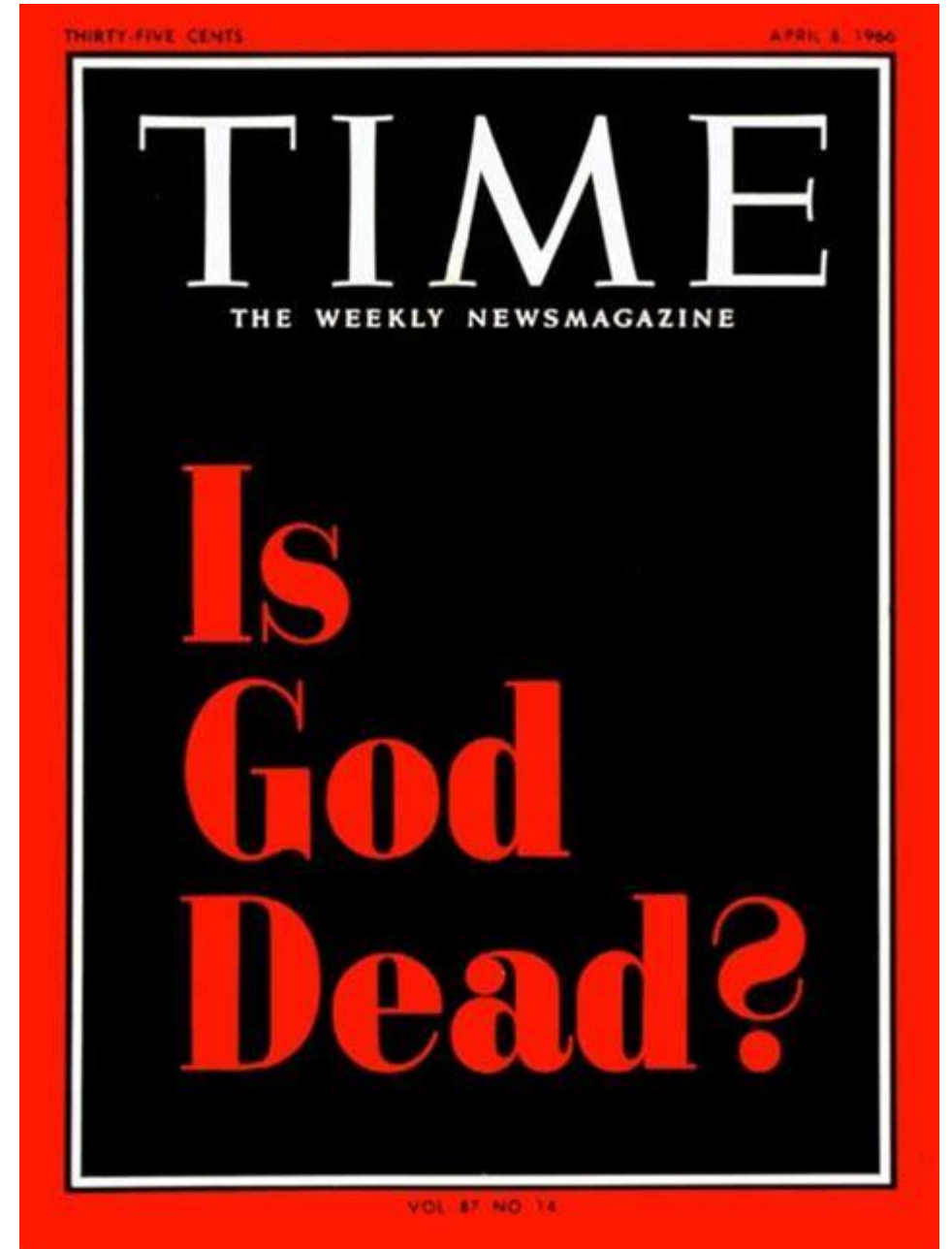
C.S. Lewis on Science

“...we must be very cautious of snatching at any scientific theory which, for the moment, seems to be in our favour. We may *mention* such things; but we must mention them lightly and without claiming that they are more than *‘interesting’*. Sentences beginning ‘Science has now proved’ should be avoided. If we try to base our apologetics on some recent development in science, we shall usually find that just as we have put the finishing touches to our argument science has changed its mind and quietly withdrawn the theory we have been using as our foundation stone.”

From a paper delivered at ‘Carmarthen Conference for Youth Leaders and Junior Clergy’ of the Church in Wales at Carmarthen, Easter 1945

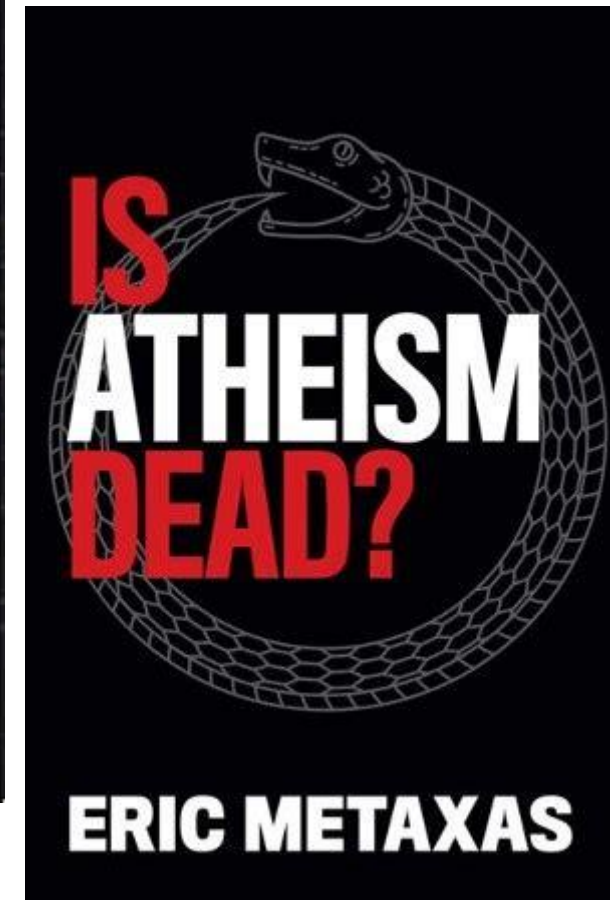
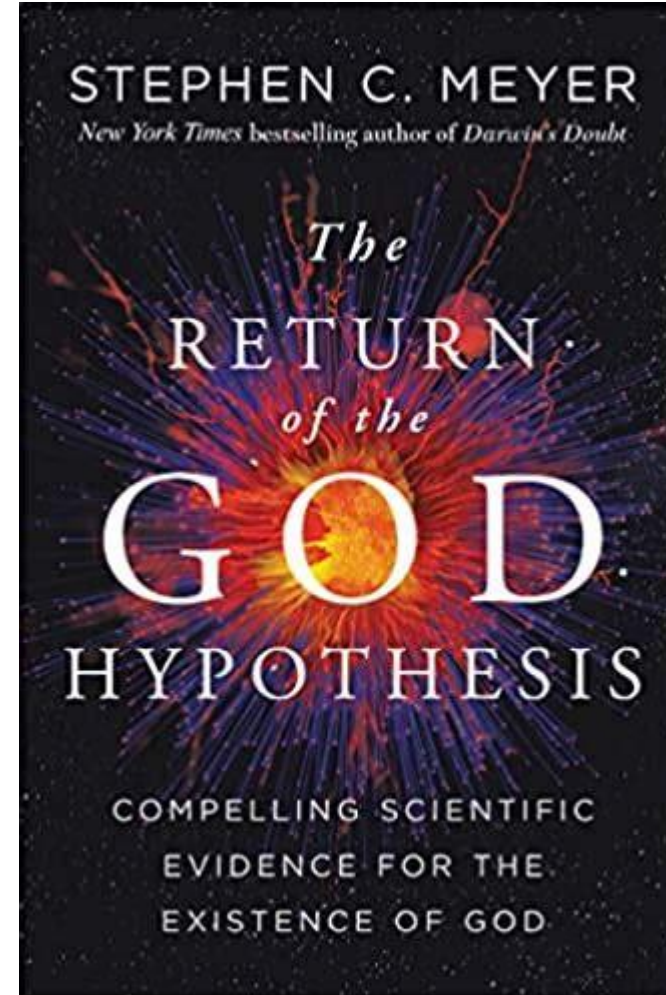
The weight of scientific evidence since 1966 points in one direction....

...and it's NOT in the direction that TIME Magazine thought it would point.



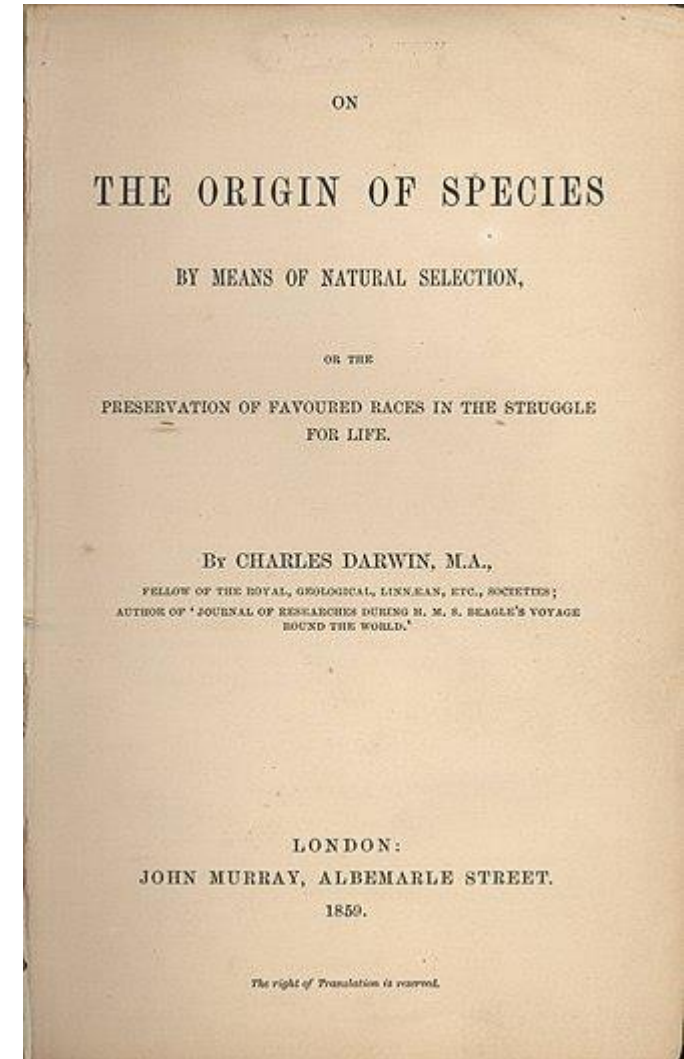
Return of the God Hypothesis

- The Big Bang Theory
 - The universe had a beginning
- The “Goldilocks” Universe
 - The properties of the universe are exquisitely fine tuned to support life
- The DNA Enigma
 - The digital information encoded within cells is incredibly complex
- Socrates in the City
 - <https://socratesinthecity.com/>
 - <https://www.youtube.com/@socratesinthecity>



Darwin & Natural Selection

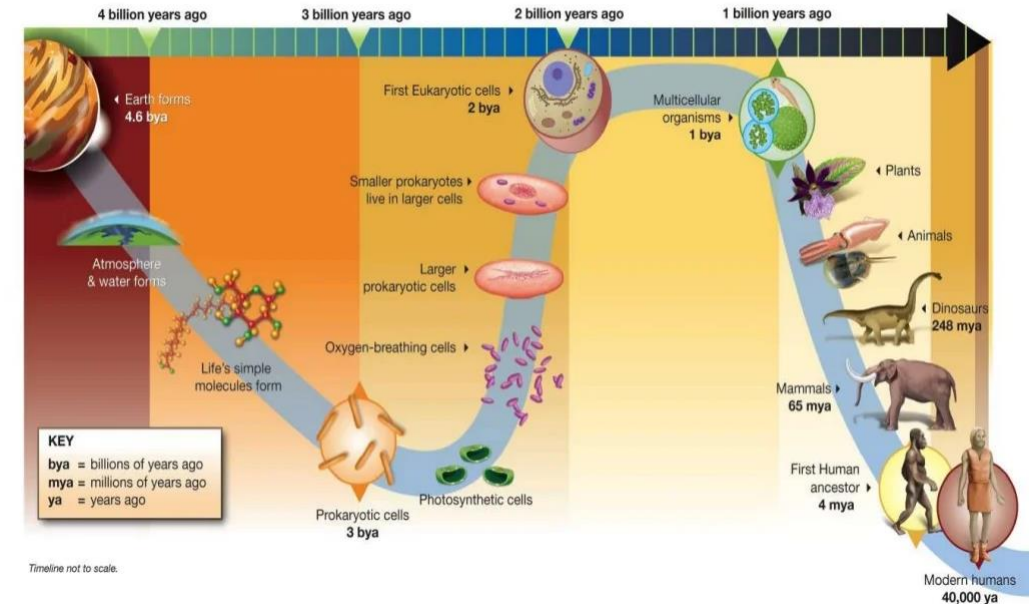
- Variation of traits exists within all organisms
- Some traits are more favorable to survival than others
- Traits of organisms that survive are passed on to the next generation
- Random mutation **creates** new traits
 - Precise mechanism for mutation not known in Darwin's time
- Natural selection **preserves** favorable traits
 - "Survival of the fittest"
- Over time, favorable traits become common in the overall population
 - Microevolution
 - Macroevolution
- *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*
 - Published November 24, 1859



Darwin's theory made some big claims

- All life derived from a common ancestor
- Cumulative effect of small variations can produce large changes given enough time
 - Later combined with the work of Mendel on genetics to complete the theory
 - “Genes” were the creators of change, but still not well understood
- Enormously controversial when published
- 1860 Oxford Evolution debate
 - Bishop Samuel Wilberforce
 - Thomas Huxley (“Darwin’s bulldog”)
- “Infinite monkey” parable
 - A million monkeys at a million typewriters typing for a million years would eventually produce the works of Shakespeare
 - Incorrectly attributed to Huxley

Life Timeline

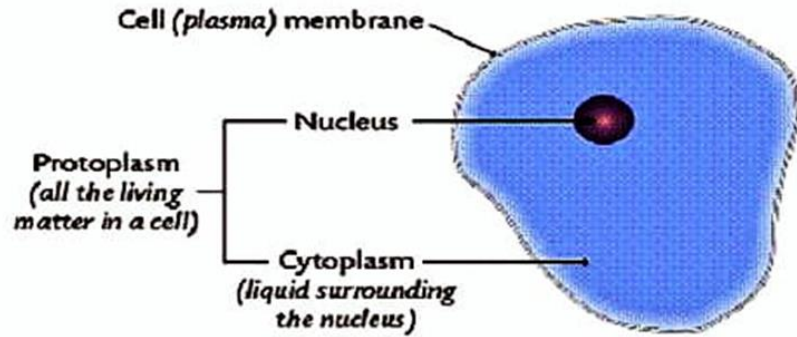


The Infinite Monkey Theorem

- The concept is of ancient origin
 - Aristotle
 - Cicero
- Re-stated during The Enlightenment
 - Jonathan Swift
 - Blaise Pascal
- Common argument in evolution discussions in modern times
- Has become part of popular culture
 - Bob Newhart
 - The Simpsons
 - Dr. Who
- Typically employed to shut down rather than enhance a debate

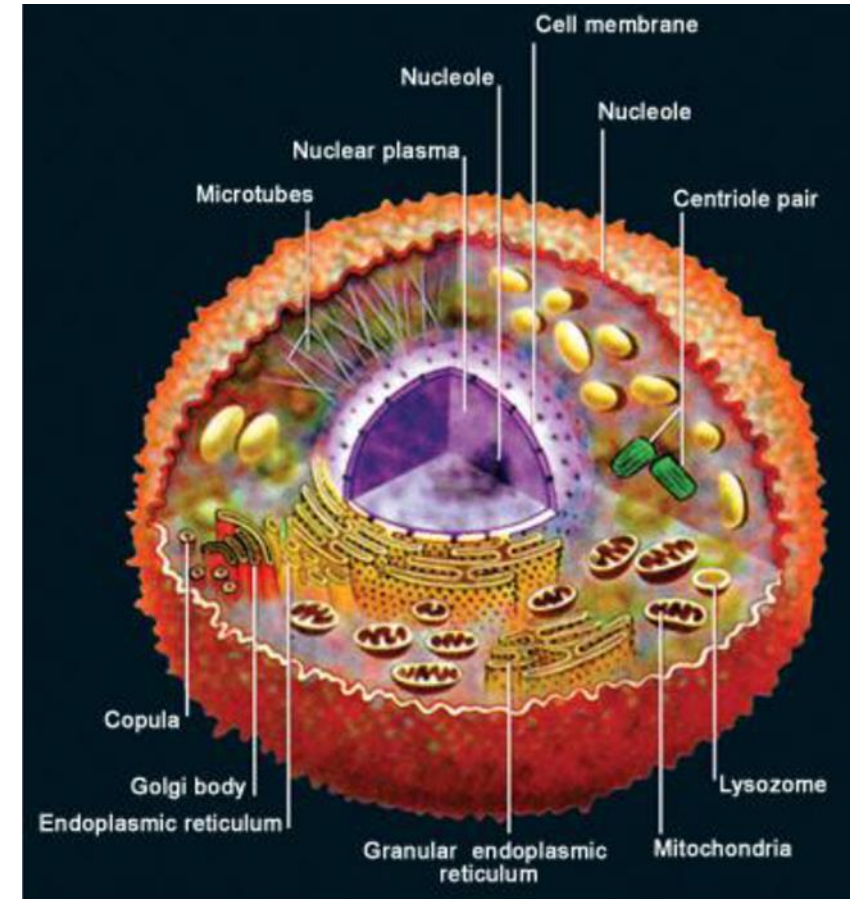


The Single Cell – Then and Now



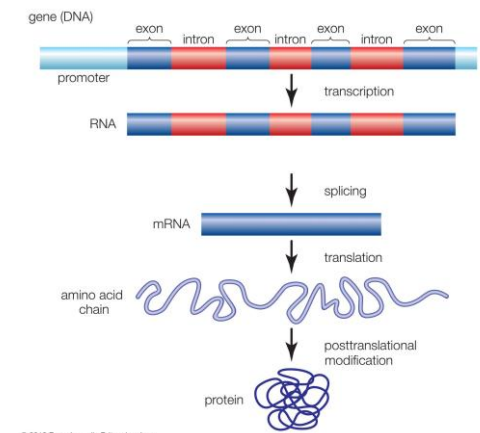
"Although the tiniest bacterial cells are incredibly small, weighing less than 10^{-12} grams, each is in effect a veritable microminiaturized factory containing thousands of exquisitely designed pieces of intricate molecular machinery, made up altogether of one hundred thousand million atoms, far more complicated than any machine built by man and absolutely without parallel in the non-living world."

– Dr. Michael Denton



Watson & Crick

- Discovered the structure of DNA in 1953
 - Famed “double helix” structure
 - Awarded Nobel Prize for this discovery
- Genes no longer something abstract
 - Have a definite structure
 - Correspond to long sequences of bases on a strand of DNA
- *Central dogma of molecular biology – Crick 1957*
 - Deals with the flow of **information** in a biological system
 - DNA → RNA → mRNA → amino acid → protein



The Information Stored in DNA

- Four nucleotide bases
 - Adenine, Thymine, Guanine, and Cytosine (A, T, G, and C)
- *Sequence Hypothesis – Crick 1958*
 - Nucleotide bases function just as **letters in an alphabet**
 - Specific sequences of bases provide assembly instructions for building proteins that cells need to survive
 - Some sequences are meaningful while others are gibberish
 - Hypothesis later confirmed via experimentation

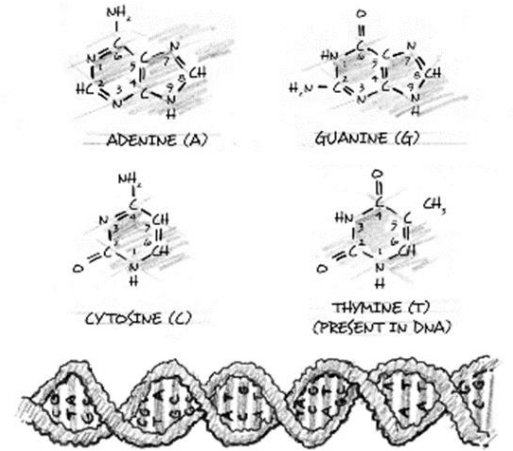
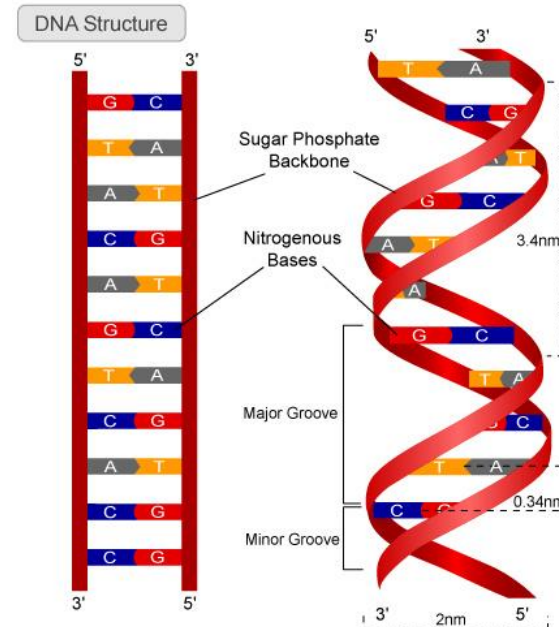
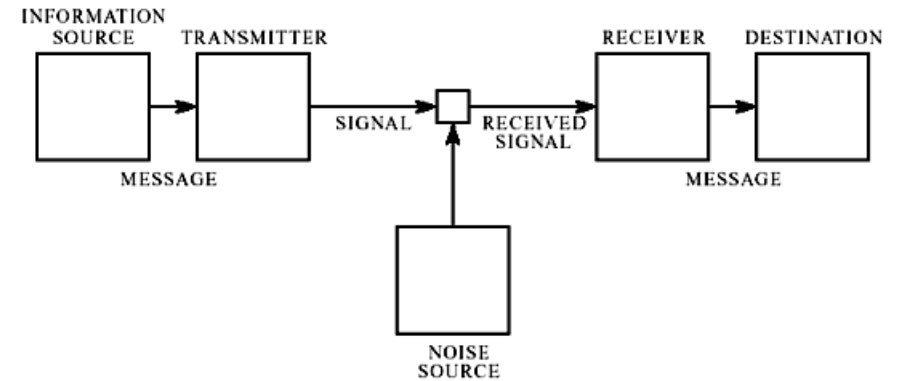


FIGURE 9.2



The Information Stored in DNA

- Information Theory – Claude Shannon
- Languages have rules & grammar
 - Rules & grammar separate information from noise
 - “To be or not to be” and “Ro notbett beo o “ contain the same letters and spaces
 - But one conveys information while the other is gibberish
- Using 100 letters, approximately 10^{25} grammatical sentences can be constructed in English
- There are 26^{100} total 100 letter combinations that are possible
- The number of possible *sentences* is *miniscule* compared to the number of possible *letter combinations*



Reprinted with corrections from *The Bell System Technical Journal*,
Vol. 27, pp. 379-423, 623-656, July, October, 1948.

A Mathematical Theory of Communication

By C. E. SHANNON

INTRODUCTION

THE recent development of various methods of modulation such as PCM and PPM which exchange bandwidth for signal-to-noise ratio has intensified the interest in a general theory of communication. A basis for such a theory is contained in the important papers of Nyquist¹ and Hartley² on this subject. In the present paper we will extend the theory to include a number of new factors, in particular the effect of noise in the channel, and the savings possible due to the statistical structure of the original message and due to the nature of the final destination of the information.

The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem. The significant aspect is that the actual message is one *selected from a set* of possible messages. The system must be designed to operate for each possible selection, not just the one which will actually be chosen since this is unknown at the time of design.

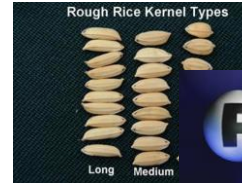
If the number of messages in the set is finite then this number or any monotonic function of this number can be regarded as a measure of the information produced when one message is chosen from the set, all choices being equally likely. As was pointed out by Hartley the most natural choice is the logarithmic function. Although this definition must be generalized considerably when we consider the influence of the statistics of the message and when we have a continuous range of messages, we will in all cases use an essentially logarithmic measure.

The logarithmic measure is more convenient for various reasons:

1. It is practically more useful. Parameters of engineering importance such as time, bandwidth, number of relays, etc., tend to vary linearly with the logarithm of the number of possibilities. For example, adding one relay to a group doubles the number of possible states of the relays. It adds 1 to the base 2 logarithm of this number. Doubling the time roughly squares the number of possible messages, or doubles the logarithm, etc.
2. It is nearer to our intuitive feeling as to the proper measure. This is closely related to (1) since we intuitively measure entities by linear comparison with common standards. One feels, for example, that two punched cards should have twice the capacity of one for information storage, and two identical channels twice the capacity of one for transmitting information.

Exponentials

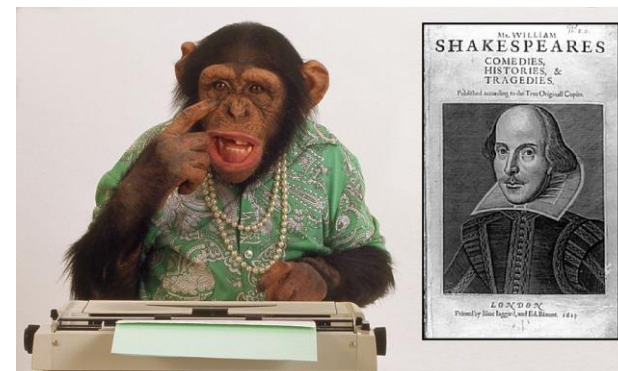
- What is the average size of a grain of rice?
 - Length = 6.14 mm
 - Width = 2.81 mm
 - Area = 17.25 mm²
- What are the odds of winning Powerball ?
 - One chance in 292,201,338
 - How much area is covered by 292,201,338 grains of rice?



- Chinese emperor and the inventor of chess
 - How many grains of rice did the emperor agree to pay?
 - $2 \times 2^{64} - 1$ or approximately 3.7×10^{19} grains
 - How much area is covered by those rice grains?
 - Understand: 10^{20} is 10 times 10^{19} and 10^{21} is **100 times** 10^{19}

To be, or not to be...

- Now that we have a better grasp of exponentials...
 - What is the probability that one million monkeys could eventually produce all the works of Shakespeare?
- Let's start with something easier like just one sentence of Shakespeare
 - Recently simulated with computers
 - *The Mathematical Case for Monkeys Producing Shakespeare – Eventually* - Scientific American, May 2024
 - “To be or not to be that is the question”
 - Requires
 - 2.68×10^{69} characters to be generated
 - 9.35×10^{58} years for the computer to complete just one sentence
 - The universe is only 1.4×10^{10} years old...
- No, one million monkeys could **never, ever** (even in a million years !) produce the works of Shakespeare



Could evolution happen as Darwinians say?

- After the Sequence Hypothesis was confirmed, questions arose:
 - *Given that DNA information behaves like a language, how likely is it that random mutation can produce even one functional nucleotide sequence?*
- The Wistar Institute Conference
- Distinguished Scientists
 - Murray Eden (Biomedical & Electrical Engineering)
 - Marcel-Paul Schützenberger (Medicine & Mathematics)
 - Stanislaw Ulam (Mathematics, Nuclear Physics, Computer Science)
 - Ernst Mayr (Evolutionary Biology)
 - Richard Lewontin (Evolutionary Biology, Mathematics, Genetics)
 - Sir Peter Medawar (Biologist, Nobel Laureate)
- Distinguished Universities
 - Princeton, MIT, Harvard, Columbia, University of Paris, University College London, MRC Centre, Los Alamos



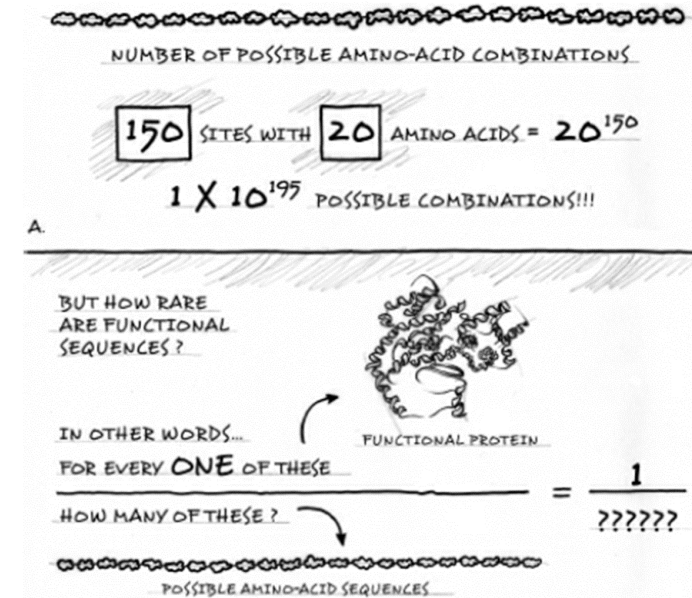
[T]he immediate cause of this conference is a pretty widespread sense of dissatisfaction about what has come to be thought as the accepted evolutionary theory in the English-speaking world, the so-called neo-Darwinian Theory. ... There are objections made by fellow scientists who feel that, in the current theory, something is missing ... These objections to current neo-Darwinian theory are very widely held among biologists generally; and we must on no account, I think, make light of them. The very fact that we are having this conference is evidence that we are not making light of them.

- Sir Peter Medawar

Could evolution happen as Darwinians say?

Wistar concluded that approximately 1×10^{195} amino acid combinations are possible

- This is an unimaginably large number
 - There are only 10^{80} atoms in the entire universe
- How many of the total combinations are functional ?
- Is it even possible that functional combinations could be found by random mutation given such a large number of possibilities to search?
- How can the Darwinian mechanism be correct if
 - Random mutation is what *creates* a new gene
 - But the probability of a functional mutation is *zero*



What are the chances of finding a functional mutation out of so many possibilities?

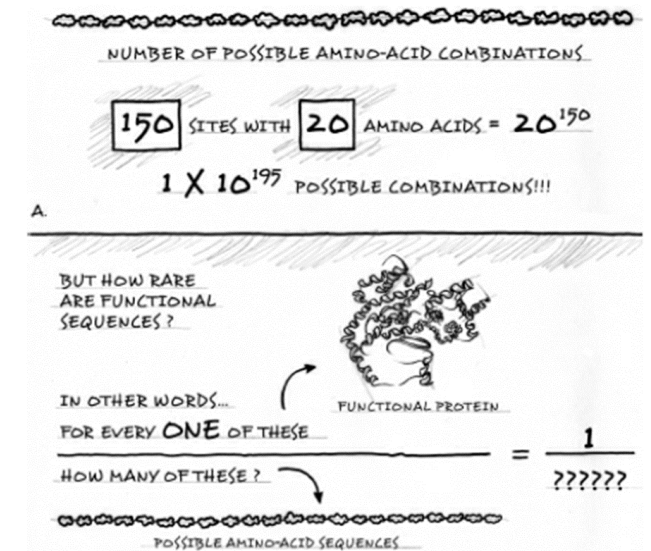
- Needed to find out how many functional combinations are possible – maybe it is an equally large number....

“...natural selection may explain the *survival* of the fittest...

but it cannot explain the *arrival* of the fittest...”

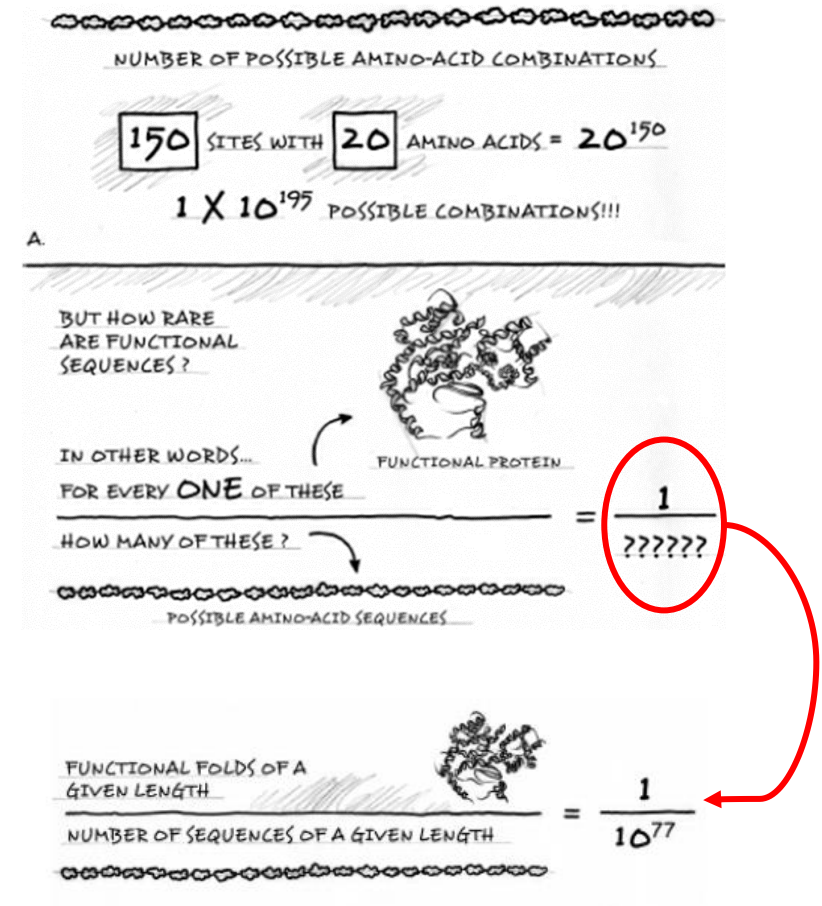
So, how many functional combinations are there ?

- New technologies had to be developed (and were) to determine this
 - Ability to make customized synthetic DNA
 - Ability to make site specific changes to DNA
- Robert Sauer
 - Biochemistry, Molecular Biology (Harvard, MIT)
 - Estimated (and emphasized) the **number** of functional combinations possible
 - Estimated total of 1×10^{132} are functional
 - Did not emphasize the **ratio** of functional combinations to total possible combinations
 - Estimated ratio of functional to total as 1 in 10^{63}



So, how many functional combinations are there ?

- Douglas Axe
 - Chemical Engineering (Cal Tech)
 - University of Cambridge, MRC Centre (post doctoral)
 - Built upon the work of Sauer and estimated the ratio as 1 in 10^{77} combinations are functional
- Saying that something has a probability of **“1 out of 10^{77} ”** is **indistinguishable** from saying that it has a probability of **“zero”**
- Creating new organisms by random mutations over time has the same probability as one million monkeys creating Shakespeare - **zero**.



So how long has this been known ?

- Wistar Conference
 - *“Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution.”* - Philadelphia, 1966
- Robert Sauer
 - *“Functionally Acceptable Substitutions in Two Alpha-Helical Regions of Lambda Repressor”* - Proteins Vol 7 Issue 4, 1990
- Douglas Axe
 - *“Estimating the Prevalence of Protein Sequences Adopting Functional Enzyme Folds.”* – Journal of Molecular Biology Vol 341 Issue 5, 2004
- Stephen Meyer
 - *“The Origin of Biological Information and the Higher Taxonomic Categories.”* – Proceedings of the Biological Society of Washington, Vol 117, 2004

What has been the reaction?

- Some scientific responses
 - Attempts to refute the mathematical arguments
 - Attempts to modify Darwinian theory
- Too many unscientific responses
 - Ad hominem attacks, silence, professional retaliation
- David Gelernter (Computer Science – Yale)
 - *“Giving Up Darwin”* – Claremont Review of Books, Spring Issue, 2019
 - *Like so many others, I grew up with Darwin’s theory, and had always believed it was true. I had heard doubts over the years from well-informed, sometimes brilliant people, but I had my hands full cultivating my garden, and it was easier to let biology take care of itself. But in recent years, reading and discussion have shut that road down for good.*
 - *The theory of evolution virtually functions as “religion” to scholars, especially within scientific fields. As far as they are concerned, take your life in your hands to challenge it intellectually,” Gelernter said.*
 - *“They will destroy you if you challenge it.” Such extreme allegiance to evolutionary biology fosters a deficit of free speech within academic communities.*
 - *What I’ve seen, in their behavior intellectually and at colleges across the West, is nothing approaching free speech on this topic,” Gelernter said. “It’s a bitter rejection... It effectively shuts down meaningful scientific intellectual discussion.”*

Essay by David Gelernter

GIVING UP DARWIN



DARWINIAN EVOLUTION IS A BRILLIANT and beautiful scientific theory. Once it was a daring guess. Today it is basic to the credo that defines the modern worldview. Accepting the theory as settled truth—no more subject to debate than the earth being round or the sky blue or force being mass times acceleration—certifies that you are devoutly orthodox in your scientific views; which in turn is an essential first step towards being taken seriously in any part of modern intellectual life. But what if Darwin was wrong?

Like so many others, I grew up with Darwin’s theory, and had always believed it was true. I had heard doubts over the years from well-informed, sometimes brilliant people, but I had my hands full cultivating my garden, and it was easier to let biology take care of itself. But in recent years, reading and discussion have shut that road down for good.

This is sad. It is no victory of any sort for religion. It is a defeat for human ingenuity. It means one less beautiful idea in our world, and one more hugely difficult and important problem back on mankind’s to-do list. But we each need to make our peace with the facts, and not try to make life on earth simpler than it really is.

Charles Darwin explained monumental change by making one basic assumption—all life-forms descend from a common ancestor—and adding two simple processes anyone can understand: random, heritable variation and

natural selection. Out of these simple ingredients, conceived to be operating blindly over hundreds of millions of years, he conjured up change that *seems* like the deliberate unfolding of a grand plan, designed and carried out with superhuman genius. Could nature really have pulled out of its hat the invention of life, of increasingly sophisticated life-forms and, ultimately, the unique-in-the-cosmos (so far as we know) human mind—given no strategy but trial and error? The mindless accumulation of small changes? It is an astounding idea. Yet Darwin’s brilliant and lovely theory explains how it *could* have happened.

Its beauty is important. Beauty is often a telltale sign of truth. Beauty is our guide to the intellectual universe—walking beside us through the uncharted wilderness, pointing us in the right direction, keeping us on track—most of the time.

Demolishing a Worldview

THERE’S NO REASON TO DOUBT THAT Darwin successfully explained the small adjustments by which an organism adapts to local circumstances: changes to fur density or wing style or beak shape. Yet there are many reasons to doubt whether he can answer the hard questions and explain the big picture—not the fine-tuning of existing species but the emergence of new ones. The origin of species is exactly what Darwin *cannot* explain.

Stephen Meyer’s thoughtful and meticulous *Darwin’s Doubt* (2013) convinced me that Darwin has failed. He cannot answer the big question. Two other books are also essential: *The Deniable Darwin and Other Essays* (2009), by David Berlinski, and *Debating Darwin’s Doubt* (2015), an anthology edited by David Klinghoffer, which collects some of the arguments Meyer’s book stirred up. These three form a fateful battle group that most people would rather ignore. Bringing to bear the work of many dozen scientists over many decades, Meyer, who after a stint as a geophysicist in Dallas earned a Ph.D. in History and Philosophy of Science from Cambridge and now directs the Discovery Institute’s Center for Science and Culture, disassembles the theory of evolution piece by piece. *Darwin’s Doubt* is one of the most important books in a generation. Few open-minded people will finish it with their faith in Darwin intact.

Meyer doesn’t only demolish Darwin; he defends a replacement theory, intelligent design (I.D.). Although I can’t accept intelligent design as Meyer presents it, he does show that it is a plain case of the emperor’s new clothes: it says aloud what anyone who ponders biology *must* think, at some point, while sifting possible answers to hard questions. Intelligent design as Meyer explains it never uses religious arguments, draws religious conclusions, or refers to religion in any way. It does underline an obvious but important truth: Darwin’s

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Crick & Directed Panspermia

ICARUS 19, 341-346 (1973)

Directed Panspermia

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Received June 22, 1972; revised December 20, 1972

It now seems unlikely that extraterrestrial living organisms could have reached the earth either as spores driven by the radiation pressure from another star or as living organisms imbedded in a meteorite. As an alternative to these nineteenth-century mechanisms, we have considered Directed Panspermia, the theory that organisms were deliberately transmitted to the earth by intelligent beings on another planet. We conclude that it is possible that life reached the earth in this way, but that the scientific evidence is inadequate at the present time to say anything about the probability. We draw attention to the kinds of evidence that might throw additional light on the topic.

INTRODUCTION

It was not until the middle of the nineteenth century that Pasteur and Tyndall completed the demonstration that spontaneous generation is not occurring on the Earth nowadays. Darwin and a number of other biologists concluded that life must have evolved here long ago when conditions were more favourable. A number of scientists, however, drew a quite different conclusion. They supposed that if life does not evolve from terrestrial nonliving matter nowadays, it may never have done so. Hence, they argued, life reached the earth as an "infection" from another planet (Oparin, 1957).

Arrhenius (1908) proposed that spores had been driven here by the pressure of the light from the central star of another planetary system. His theory is known as Panspermia. Kelvin suggested that the first organisms reached the Earth in a meteorite. Neither of these theories is absurd, but both can be subjected to severe criticism. Sagan (Shklovski and Sagan, 1966; Sagan and Whitehall, 1973) has shown that any known type of radiation-

resistant spore would receive so large a dose of radiation during its journey to the Earth from another Solar System that it would be extremely unlikely to remain viable. The probability that sufficiently massive objects escape from a Solar System and arrive on the planet of another one is considered to be so small that it is unlikely that a single meteorite of extrasolar origin has ever reached the surface of the Earth (Sagan, private communication). These arguments may not be conclusive, but they argue against the "infective" theories of the origins of life that were proposed in the nineteenth century.

It has also been argued that "infective" theories of the origins of terrestrial life should be rejected because they do no more than transfer the problem of origins to another planet. This view is mistaken; the historical facts are important in their own right. For all we know there may be other types of planet on which the origin of life *ab initio* is greatly more probable than on our own. For example, such a planet may possess a mineral, or compound, of crucial catalytic importance, which is rare on

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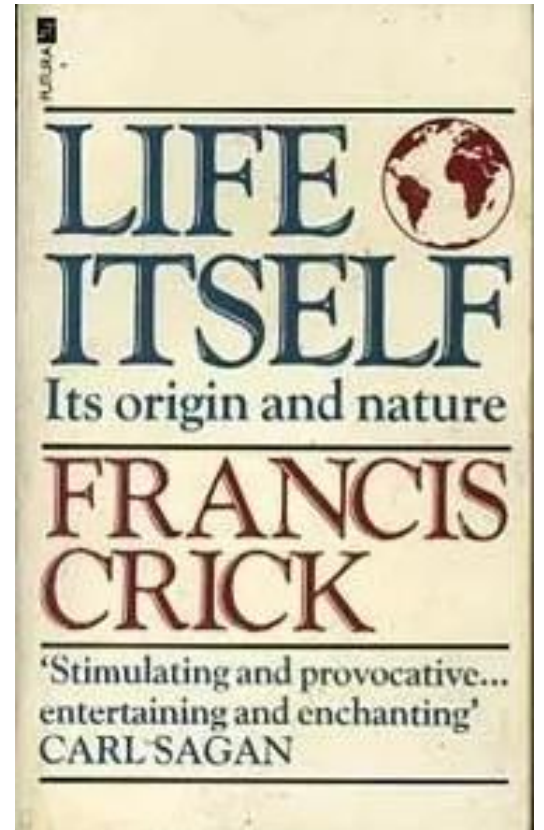
"I do not respect Christian beliefs. I think they are ridiculous. If we could get rid of them we could more easily get down to the serious problem of trying to find out what the world is all about."

– Francis Crick

- The deliberate transport of microorganisms into space to be used as introduced species on other astronomical objects.
- In other words, space aliens planted life on earth....

Directed Panspermia

– Icarus Vol 19 Issue 3, 1973



Life Itself

Its origin and nature

- 1981 Simon and Schuster

Building a better mousetrap

- Next week, we increase the degree of difficulty...

