

Religion and Evolutionary Biology

Is humanity an accident, or made in God's
image?

Ancient theories of origins

- Plato was a (kind of) creationist, teaching that biological species were abstract 'Forms' existing in a realm that could only be accessed through rational thought.
 - Actual organisms were created by a (divine) craftsman ('demiurge'), using the Forms as templates.
 - The species were therefore fixed, since the Forms are eternal and unchanging.

Teleology vs. chance

- Aristotle also rejected the idea that living organisms were due to chance, as did the Stoics (e.g. Seneca, Epictetus).
- It seemed clear to these thinkers that organisms, and especially parts of organisms, had *purposes*.

E.g. Teleology in Socrates

With such signs of forethought in these arrangements, can you doubt whether they are the work of chance or design?

(concerning sex organs being for the purposes of procreation, he concludes:

Undoubtedly these too look like the contrivances of one who deliberately willed the existence of living creatures.

-- as reported by Xenophon in *Memorabilia* (I, iv, 6-7)

Ancient atomism

- **Atomists rejected the notions of design and purpose in biology**, since the world was simply atoms moving in the void.
 - There were no gods or other beings to do the designing.
- **Atomists appealed to chance** to account for the first organisms.
 - Most of these would have been ‘monsters’, quickly eliminated by natural selection. The relatively few viable organisms are the ones that remain with us.

St. Augustine (354-430 AD)

(“The African Doctor”. Catholic bishop, philosopher, theologian. Very influential in the middle ages, and among Catholics and Protestants today.)

- Augustine understood that the meaning of a text is the **author’s intention**, which may be different from a literal reading.
 - E.g. There may be metaphors, hyperbole, poetic license, etc.
- Augustine thought that there couldn’t be any real contradiction between valid science and scripture.
 - Hence scripture should be interpreted in a manner that is consistent with (proven) science.

St. Augustine (354-430 AD)

“Often, a non-Christian knows something about the earth, the heavens, and the other parts of the world, about the motions and orbits of the stars and even their sizes and distances, ... and this knowledge he holds with certainty from reason and experience. It is thus offensive and disgraceful for an unbeliever to hear a Christian talk nonsense about such things, claiming that what he is saying is based in Scripture. We should do all we can to avoid such an embarrassing situation, which people see as ignorance in the Christian and laugh to scorn.”

[Augustine, *The Literal Meaning of Genesis*]

Lamarck

- Lamarck developed the first modern theory of evolution (1802).
 - At that time, evolution was known as ‘transmutation’, and was the view that descendents could be very different from their ancestors, to the extent of being distinct kinds.
 - Thus transmutation was opposed to Plato’s and Aristotle’s essentialist view of species.

Lamarck

- There is some kind of ‘life force’ (*Le pouvoir de la vie, la force qui tend sans cesse à composer l'organisation*) that drives organisms to evolve into ever more specialised forms.
 - Yet, oddly perhaps, **this life force was seen as *purely physical***, and grounded in the principles of alchemy.
- Lamarck’s theory also included ongoing spontaneous generation of simple living organisms, and inheritance of acquired characteristics.
 - (Today, “Lamarckism” is often thought to be the view that evolution is driven by the inheritance of acquired characteristics.)

“The rapid motion of fluids will etch canals between delicate tissues. Soon their flow will begin to vary, leading to the emergence of distinct organs. The fluids themselves, now more elaborate, will become more complex, engendering a greater variety of secretions and substances composing the organs.

Lamarck, *Histoire naturelle des animaux sans vertebres*, 1815.

William Paley's IBE 'design argument' (1802)



1. A watch shows the marks of design, such as having parts with obvious purposes, etc.
2. Watches couldn't have come about any other way. (E.g. not by self-organization.)

∴ Watches are obviously designed
(And similar reasoning applies to living organisms.)

Were there no example in the world, of contrivance, except that of **the eye**, it would be alone sufficient to support the conclusion which we draw from it, as to the necessity of an **intelligent Creator**. It could never be got rid of; **because it could not be accounted for by any other supposition ...**

[An eye's] coats and humours, constructed, as the lenses of a telescope are constructed, for the refraction of rays of light to a point, which forms the proper action of the organ; the provision in its muscular tendons for turning its pupil to the object, similar to that which is given to the telescope by screws ... these provisions compose altogether an apparatus, a system of parts, a preparation of means, so manifest in their design, so exquisite in their contrivance, so successful in their issue, so precious, and so infinitely beneficial in their use, as, in my opinion, to bear down all doubt that can be raised upon the subject.

(Paley, *Natural Theology*, 1802)

George Cuvier (1769 – 1832)

- French biologist of great authority and prestige
- Lifelong Christian (but old-earthier)
- Rejected transmutation, saying that:
 - the anatomic parts of living organisms are too interdependent—too finely designed—for the whole to evolve piecemeal
 - the fossil record showed no sign of transitional forms.
- N.B. **transmutation was seen as a materialist idea**, and Cuvier believed that material processes could not accomplish simultaneous, **coordinated** changes across the organism.

George Cuvier (1769 – 1832)

- Cuvier was a fossil expert, and saw *many layers of rock, each containing a different set of species*. Each was wiped out by natural catastrophe (“revolution”), he thought, and then new species were created (by God) in the next epoch.
 - Thus most fossil species are now extinct, he said.

Geology and the book of Genesis

- Many Christian geologists in Britain and America tried to reconcile geological knowledge with the Genesis account.
 - In 1814, Scottish natural theologian Thomas Chalmers proposed that a gap existed in the Genesis narrative between the book's first and second verses. This opened unlimited time for geologic epochs between "the beginning" and God's creation of current species.
- Scottish geologist Hugh Miller suggested that the days of creation in Genesis symbolized geologic epochs.
- Yale University geologists Benjamin Silliman and James Dwight Dana championed the "day-age theory" in the United States.

Awareness of species extinctions

- By the 1820s it became clear that species both appeared and disappeared over time.
- There was simply no place where the newly appearing species could have migrated from: They must truly be *new*.

Rev. William Buckland, 1836

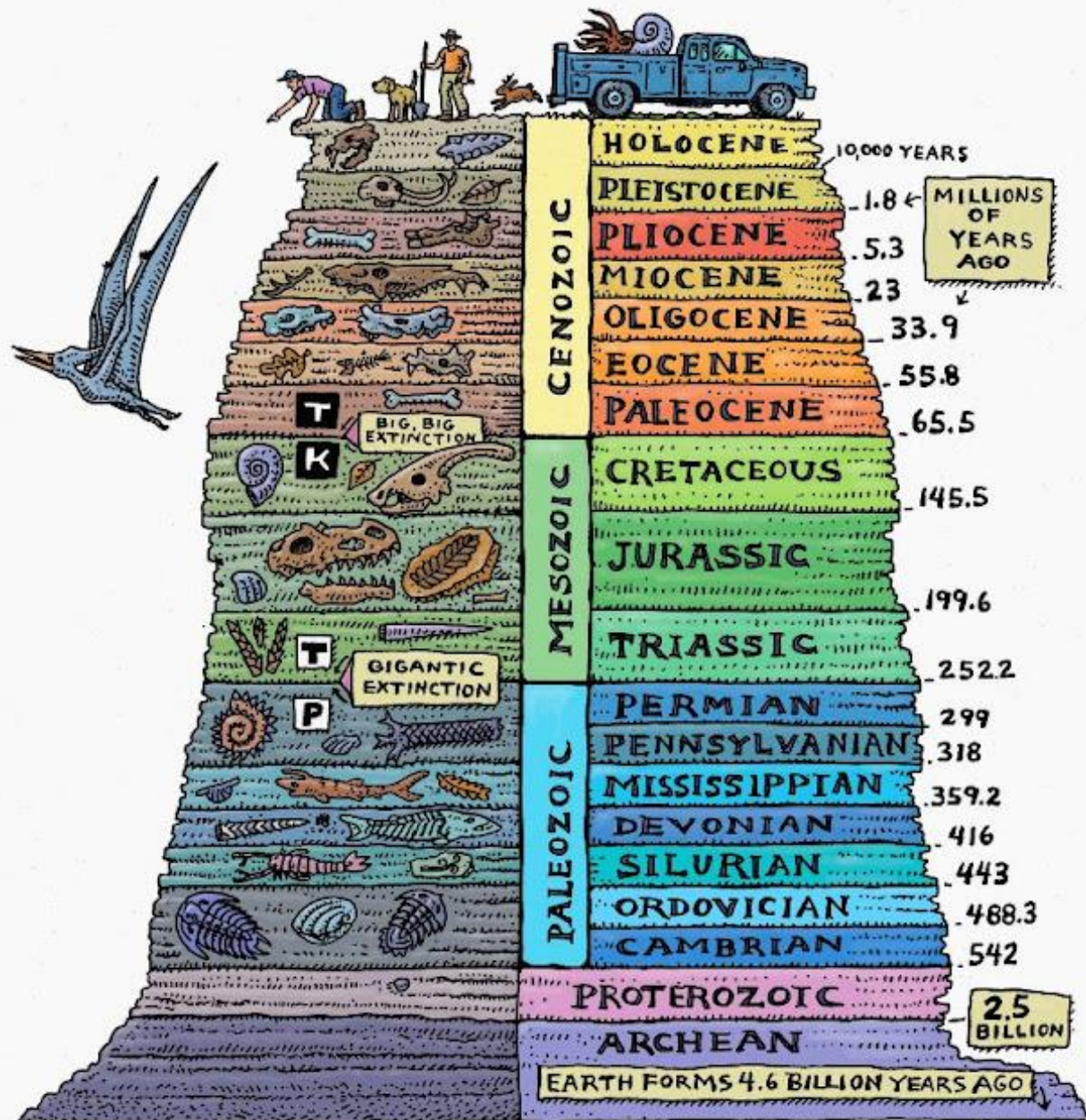
- Buckland envisioned a good **God creating a progressive succession of species**, each perfectly designed for the climate of its particular geologic epoch and all pointing toward the ultimate creation of humans in God's image when conditions became right.

(When encountering an alleged miracle of martyr's blood perpetually wetting the floor of a Roman Catholic cathedral, Buckland tested the hypothesis by licking the spot with his tongue. "Bat urine," the Anglican cleric pronounced.)

Adam Sedgwick, 1845

“Now, I allow (as all geologists must) a kind of progressive development. For example, the first fish are below the reptiles; and the first reptiles older than man ... I say, we have successive forms of animal life adapted to successive conditions (so far, proving design), and not derived in natural succession in the ordinary way of generation” [i.e. by transmutation or organic evolution].

- According to Sedgwick, God lovingly designed new populations perfectly fitting the ever-cooling, ever-improving terrestrial climate while mercifully destroying the preceding populations when they no longer fit.
- This was known as ‘catastrophism’



Idealists

- Idealists (e.g. Louis Agassiz, Richard Owen) saw the connections and similarities between successive organisms (during the history of life) as the result of **the *developing ideas* of their creator**.
 - E.g. motor vehicles have developed over time, but later models develop out of earlier ones at the level of thoughts, or ideas, not physically. There is no *transmutation* of motor vehicles.
- For Agassiz, the progressive appearance of increasingly specialized species solely reflected **their origin in the mind of God**, not the impact of environmental factors or evolution.

Charles Lyell

- Lyell is known for his role in establishing ‘uniformitarian’ geology. Also known as “steady state vulcanism”. There is no overall direction to geological history, and the past basically the same as the present.
- He had at least two motivations.
 - He thought that **science should only employ known naturalistic causes operating in observable ways to explain natural phenomena**. Invoking larger-than-life past catastrophes smacked of religion.
 - He believed that a nondirectional geologic history would undermine Lamarckism, which he saw as dangerously subversive of human dignity.

- Uniformitarianism explained geological features in terms of ordinary processes we can observe now, operating over vast periods of time.
- In *Principles of Geology*, Lyell offered the gradualist view that God (a “Presiding Mind”) continually created species to fit local environments.
 - According to this view, those species would spread out from their “centres or foci of creation” to occupy suitable territory for so long as environmental conditions permitted, and then become extinct.

Darwin and Lyell

- Darwin and Lyell were close friends and allies.
- Darwin read Lyell's *Principles of Geology* on the Beagle expedition, and became a convert to uniformitarianism.
 - Darwin spent much of his time during the Beagle expedition looking for the Lyellian “centres of creation” for individual species, and interpreting the distribution of various plants and animals accordingly.

Other theories of transmutation

- There were other theories of transmutation, e.g. the publisher Robert Chambers wrote *Vestiges of the Natural History of Creation*, published anonymously in England in 1844.
 - A popular best seller, but criticised by scientists for its scientific errors. (Trashed by Sedgwick, Lyell, Huxley, etc.)
 - It prepared the ground for Darwin's *Origin*.
 - It had no good response to Paley's argument.

“creation by law”, not miracles

“...how can we suppose that the august Being who brought all these countless worlds into form by the simple establishment of a natural principle flowing from his mind, **was to interfere personally and specially on every occasion** when a new shell-fish or reptile was to be ushered into existence on *one* of these worlds? Surely this idea is too ridiculous to be for a moment entertained.” (Chambers, *Vestiges*, p. 154)

“To a reasonable mind the Divine attributes must appear, not diminished or reduced in some way, by supposing a **creation by law**, but infinitely exalted.” (Chambers, *Vestiges*, p. 156)

Chambers distanced himself from Lamarck

- “Now it is possible that wants and the exercise of faculties have entered in some manner into the production of the phenomena which we have been considering; but certainly not in the way suggested by Lamarck, **whose whole notion is obviously so inadequate** to account for the rise of the organic kingdoms, that **we only can place it with pity among the follies of the wise.**”
- Chambers, *Vestiges* (1844), p. 231.

Part 2

Enter Darwin

Charles Darwin

1809-1882

- As a geologist, Darwin was initially a catastrophist like Sedgwick, but then converted to Lyell's uniformitarianism during his voyage on the Beagle (1831-1836).
 - Darwin rejected Lyell's views in biology however, after observing Cape Verde and Galapagos and comparing them with the nearby mainlands.



Galapagos Islands



Close to America

Cape Verde Islands

Close to Africa



Galapagos - Cape Verde comparison

- Similar geography
 - Volcanic origin
 - climate
 - soil
 - size, height
- Different species
 - Galapagos species similar to *American*
 - Cape Verde species similar to *African*



“The most striking and important fact for us in regard to the inhabitants of islands, is **their affinity to those of the nearest mainland**, without being actually the same species. Numerous instances could be given of this fact. I will give only one, that of the Galapagos Archipelago, situated under the equator, between 500 and 600 miles from the shores of South America. **Here almost every product of the land and water bears the unmistakeable stamp of the American continent.** There are twenty-six land birds, and twenty-five of those are ranked by Mr Gould as distinct species, supposed to have been created here; yet the close affinity of most of these birds to American species in every character, in their habits, gestures, and tones of voice, was manifest. ...

(Darwin, *Origin*, Chapter XIII, section 4.)

“Why should this be so? why should the species which are supposed to have been created in the Galapagos Archipelago, and nowhere else, bear so plain a stamp of affinity to those created in America? There is nothing in the conditions of life, in the geological nature of the islands, in their height or climate, or in the proportions in which the several classes are associated together, which resembles closely the conditions of the South American coast: in fact there is a considerable dissimilarity in all these respects.

“On the other hand, there is a considerable degree of resemblance in the volcanic nature of the soil, in climate, height, and size of the islands, between the Galapagos and Cape de Verde Archipelagos: but what an entire and absolute difference in their inhabitants! The inhabitants of the Cape de Verde Islands are related to those of Africa, like those of the Galapagos to America. **I believe this grand fact can receive no sort of explanation on the ordinary view of independent creation; whereas on the view here maintained, it is obvious that the Galapagos Islands would be likely to receive colonists, whether by occasional means of transport or by formerly continuous land, from America; and the Cape de Verde Islands from Africa; and that such colonists would be liable to modifications; the principle of inheritance still betraying their original birthplace.**”

Darwin, 1844 essay

“The creationist [must consider these] as so many **ultimate facts** ... He can only say that it so pleased the Creator...that the inhabitants of the Galapagos Archipelago should be related to those of Chile...and that all its inhabitants should be totally unlike those of the similarly volcanic and arid Cape de Verde and Canary Islands. ... but it is absolutely opposed to every analogy, drawn from [physics] that facts, when connected, should be considered as ultimate and not the direct consequence of more general laws.”

(N.B. See the similarity to Copernicus's arguments?)

- This is **good evidence of transmutation**, at least on a small scale. (It shows that Galapagos finches are probably descended from a different species of finch in South America).
- But what *mechanism* drives evolutionary change?

Natural Selection, 1838

- Darwin came up with the idea of selection in 1838, after reading Malthus on population growth and catastrophe.
- “As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring **struggle for existence**, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.” (*Origin*, 1859)

Darwin and Paley

“I do not think I hardly ever admired a book more than Paley’s ‘Natural Theology’. I could almost formerly have said it by heart.”

Darwin, Letter to John Lubbock, 1859

- Nevertheless, Darwin believed that the theory of natural selection allowed the watch-like mechanisms of life **to be explained without conscious design.**

“The old argument of design in nature, as given by Paley, which formerly seemed to me so conclusive, fails, now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings and in the action of natural selection, than in the course which the wind blows. Everything in nature is the result of fixed laws.”

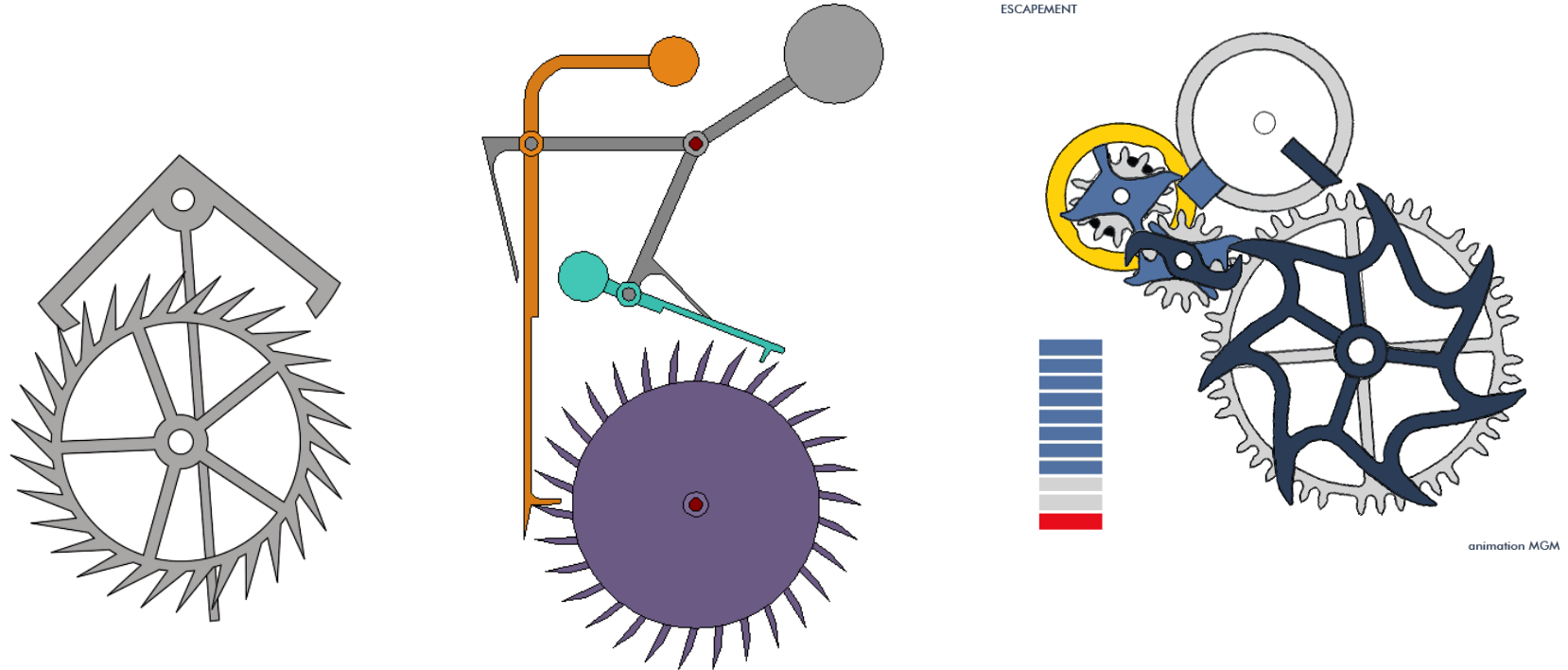
Charles Darwin, *Autobiography*.

T. H. Huxley's response to Paley

“Suppose, however, that any one had been able to show that the watch had not been made directly by any person, but that it was the result of the modification of another watch which kept time but poorly; and that this again had proceeded from a structure which could hardly be called a watch at all—seeing that it had no figures on the dial and the hands were rudimentary; and that going back and back in time we came at last to a revolving barrel as the earliest traceable rudiment of the whole fabric. And imagine that it had been possible to show that all these changes had resulted, first, from a tendency of the structure to vary indefinitely; and secondly, from something in the surrounding world which helped all variations in the direction of an accurate time-keeper, and checked all those in other directions; then it is obvious that the force of Paley’s argument would be gone.”

Thomas Huxley, *Criticisms on “The Origin of Species”*, 1872

Escapement mechanisms

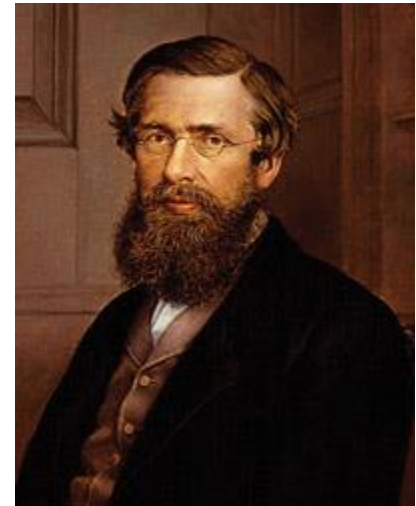


- **Qu.:** Is it obvious that functioning mechanisms like this *could arise* in the manner envisaged by Huxley?
 - (What about Cuvier's problem of interdependent parts?)

Alfred Russel Wallace (1823-1913)

- Wallace was also a believer in transmutation (converted, to some extent, by reading Chambers).
- In 1858 Wallace wrote his 'Ternate Essay' in which he proposed a mechanism of natural selection, very similar to Darwin's, as a cause of evolution.

He sent the essay to Darwin for his comments, and to pass on to Lyell if he liked it. (!!)



Human evolution

- Darwin and Wallace remained on good terms until Darwin died in 1882, although they differed on human evolution.
- In 1869 Wallace published a paper on human evolution **that appealed to the action of an “overruling intelligence”** to produce humans.
 - Even before he read the paper, Darwin wrote to his friend:
 - “I hope you have not murdered too completely your own and my child.”

- Lyell agreed with Wallace about the evolution of the human mind. Darwin's view of human evolution in *The Descent of Man* (1871) seemed rather implausible at the time.
 - Among clerics, some were neutral, many hostile. A few were enthusiastic.
- Darwin's health was poor, and it fell largely to Thomas Huxley, "Darwin's bulldog", to defend the *Origin* in public debates.
 - Huxley was a self-described agnostic, and hostile to religion. (As were the other X Club members.)

Part 3

Supporters and opponents of Darwinism

Clerical opposition to Darwinism

- A prominent critic of the *Origin* was the geologist (and Reverend) **Adam Sedgwick**. Sedgwick liked parts of the book, but was very unhappy with the idea of new species being formed through **natural selection**. This seemed to contradict God's design.

“It repudiates all reasoning from final causes; and seems to shut the door on any view (however feeble) of the God of Nature as manifested in His works. From first to last it is a dish of rank materialism cleverly cooked and served up”

- The theory, exclaimed Sedgwick:
- “would sink the human race into a lower grade of degradation than any into which it has fallen since its written record tells us of its history.”
- Sedgwick said that Darwin was not even an honest scientist; he was a vicious atheist in disguise.

- Robert G. Ingersoll, (1833–1899). An attorney, and called “the unchallenged king of American orators”.

“This century will be called Darwin’s century. He was one of the greatest men who ever touched this globe. He has explained more of the phenomena of life than all of the religious teachers. Write the name of Charles Darwin on the one hand and the name of every theologian who ever lived on the other, and from that name has come more light to the world than from all of those. His doctrine of evolution, **his doctrine of the survival of the fittest, his doctrine of the origin of species, has removed in every thinking mind the last vestige of orthodox Christianity.** ...

...Charles Darwin destroyed the foundation of orthodox Christianity. There is nothing left but faith in what we know could not and did not happen. **Religion and science are enemies.** One is a superstition; the other is a fact. One rests upon the false, the other upon the true. One is the result of fear and faith, the other of investigation and reason.”

Clerical *acceptance* of Darwinism

- In 1860 a group of liberal theologians and clergymen wrote in support of Darwin's theory.
 - Their most famous member was Baden Powell, the founder of the Scouts (and also a scientist).
- Powell was opposed to primary causation in natural history. A miracle would mean that God was breaking his own laws, which is absurd.
 - God would surely endow his creation with sufficient powers to produce all forms of life by itself, without any divine meddling. (Like a good clock maker.)

Asa Gray

- Gray was an American friend of Darwin and Hooker. He was a botanist of the first rank and a Christian.
 - Gray supported Darwin's theory, e.g. By arranging for the *Origin* to be printed in America.
- Gray tried unsuccessfully to persuade Darwin that his theory was consistent with life being created by God.

“However much we may wish it, we can hardly follow Professor Asa Gray in his belief that “variation has been led along certain beneficial lines,” like a stream “along definite and useful lines of irrigation.” **If we assume that each particular variation was from the beginning of all time preordained, then** that plasticity of organisation, which leads to many injurious deviations of structure, as well as the redundant power of reproduction which inevitably leads to a struggle for existence, and, as a consequence, to the **natural selection** or survival of the fittest, **must appear to us superfluous laws of nature.** On the other hand, an omnipotent and omniscient Creator ordains everything and foresees everything.”

Darwin, *The Variation of Animals and Plants Under Domestication*, 1868, p. 428.

[I.e. God’s front-loading of evolution would make natural selection redundant.]

“I cannot see, as plainly as others do, & as I sh^d wish to do, evidence of design & beneficence on all sides of us. **There seems to me too much misery in the world. ...**

... On the other hand I cannot anyhow be contented to view this wonderful universe & especially the nature of man, & to conclude that everything is the result of brute force. **I am inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of what we may call chance.** Not that this notion *at all* satisfies me ...”

Darwin, writing to Asa Gray, May 22 1860.

St. George Mivart

- Mivart was a zoologist who was Catholic, and also a believer in evolution. **He saw evolution as fully consistent with Catholic theology.**
- When we say that God created all species, this might be secondary causation, i.e.
- “God created them by conferring on the material world the power to evolve them under suitable conditions.”
 - Mivart, *On the Genesis of the Species*, 1871.
- However, in the same book **Mivart attacked natural selection** for its alleged inability to account for the selection of incipient stages. “What good is half an eye?”
 - (This argument has been developed in detail by contemporary “intelligent design” theorists, especially Mike Behe.)

The problem of incipient stages

- Darwin admitted that for an eye to evolve by natural selection seemed “absurd in the highest possible degree”, at first sight.

Yet, “...if numerous gradations from a simple and imperfect eye to one complex and perfect can be shown to exist, each grade being useful to its possessor, as is certainly the case; if further, the eye ever varies and the variations be inherited, as is likewise certainly the case and if such variations should be useful to any animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, should not be considered as subversive of the theory.” (Darwin)

“If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down. But I can find no such case.” (Darwin, *Origin of Species*)

Question: “Has anyone shown that my theory does **not** predict the data?”

- N.B. This question shifts the usual burden of proof in science:
 - Supporters of a theory must show that it **does** predict the data.

Direct empirical evidence for evolution?

- Many scientists criticised Darwin for the **lack of any direct empirical evidence** for his theory of natural selection, or even evolution at all (beyond rather small changes).
- **We don't see evolution**, either in human history or in the fossil record.
- E.g. Louis Agassiz:

“**Between** two successive geological periods, changes have taken place among plants and animals. But none of those primordial forms of life which naturalists call species, are known to have changed **during** any of these periods. It cannot be denied that the species of different successive periods are supposed by some naturalists to derive their distinguishing features from changes which have taken place in those of preceding ages, but **this is a mere supposition, supported neither by physiological nor by geological evidence**”

(It's still true today)

“Every paleontologist knows that most species don't change. That's bothersome ... brings terrible distress. ... They may get a little bigger or bumpier. But they remain the same species and that's not due to imperfection and gaps but stasis.”

Stephen Jay Gould (1980), Lecture at Hobart & William Smith College, February 14.

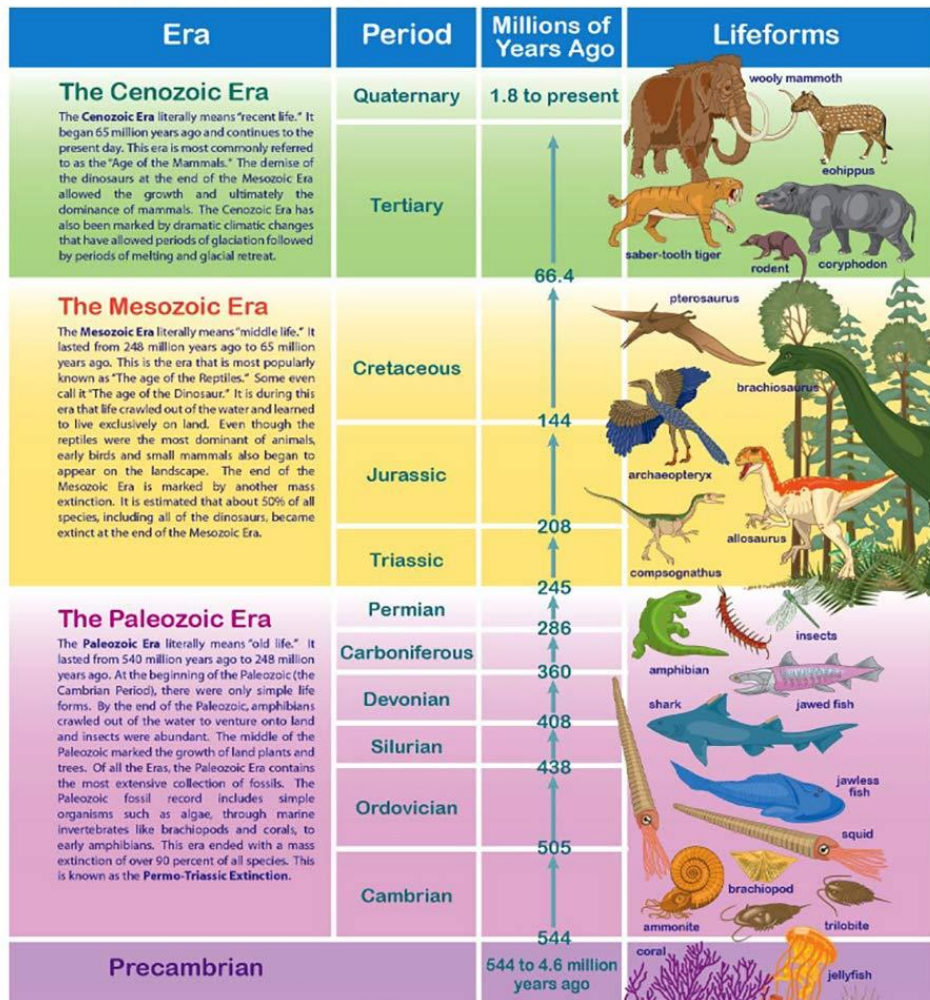
“The observation that species are amazingly conservative and static entities throughout long periods of time has all the qualities of the emperor's new clothes: everyone knew it but preferred to ignore it. Paleontologists, faced with a recalcitrant record obstinately refusing to yield Darwin's predicted pattern, simply looked the other way.”

Eldredge, N. and Tattersall, I. (1982) *The Myths of Human Evolution*, Columbia University Press, p. 45-46

Geologic Time Scale

The **geologic time scale** is a map that divides Earth's history into logical segments of time. The oldest portion is at the bottom of the scale and the youngest is at the top of the scale. The divisions on the scale mark significant transitions in Earth's history. Most often, these transitions represent important, and sometimes dramatic, changes in the life forms present on Earth and significant changes in geologic history.

The geologic time scale is broken into divisions and subdivisions. The broadest divisions are called **eons**. Eons are divided into **eras**, eras are divided into **periods** and periods are divided into **epochs**.



The 'Cambrian Explosion': sudden appearance of animal phyla (blue) and classes (yellow) in the fossil record.



Source: "The origin and diversification of **animals** as inferred from the geologic and genetic fossil records.", Erwin et al., *Science*, 2011.

Criticism of pangenesis

- Darwin's own theory of inheritance, called 'pangenesis', entailed the Lamarckian view that acquired characteristics can be inherited.
 - Pangenesis also implied that the offspring receive a **blend** (average) of the traits of the parents.
- Fleeming Jenkin (an engineer) criticised natural selection with the “**swamping argument**”.
 - A superior trait that appears by chance, in one organism, cannot be preserved by natural selection.
 - The superior organism must mate with inferior ones, so the improved feature it will be 'swamped' to extinction.

The 'Eclipse of Darwinism'

- The *Origin* was published in 1859. Between then and 1930 almost all scientists came to accept organic evolution, but few were convinced that natural selection was a major force driving evolution.
- During this period, various alternative mechanisms were proposed, including:
 - theistic evolution,
 - orthogenesis
 - mutationism.
 - (N.B. these can be combined.)

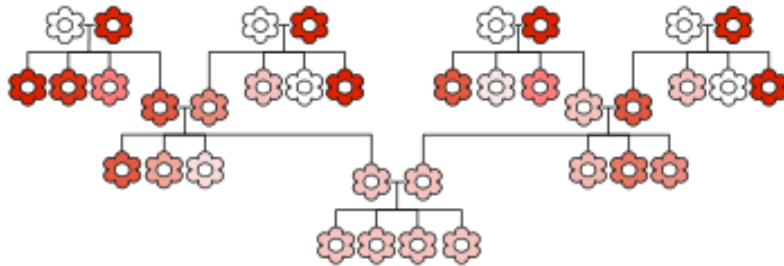
- Theistic evolution
 - God ultimately controls the process of evolution, though perhaps acting only through secondary causes.
- Orthogenesis
 - Evolution is driven by something *endogenous* (inside the organism), like an inner “program”, as with embryonic development.
- Mutationism
 - The creativity and innovation we see in the history of life comes from genetic mutations.
 - Natural selection is not *creative*, but merely *preserves* some of the varieties that mutation creates.
 - (E.g. a mutationist Hugo de Vries said that selection fails to explain the “*arrival of the fittest*”.)

Darwinism strikes back!

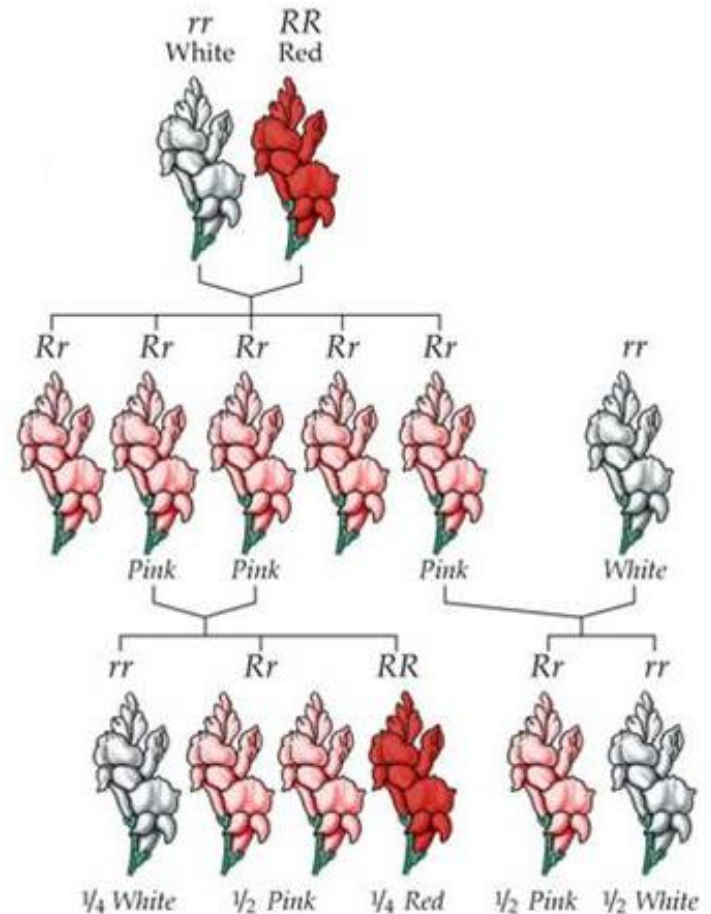
- In the years 1930-1950 Darwinism (i.e. an emphasis on selection as the creative force behind evolution) made a strong comeback, in the form of “the modern synthesis”, or “the neo-Darwinian synthesis”, “the synthetic theory”, etc.
- In a nutshell:
Neo-Darwinism = Darwinism + Mendelian genetics

Blending inheritance

(e.g. pangenesis)



Mendelian genetics



‘Swamping’ problem solved

- Mendelian genetics **allows for brand-new traits to preserved by selection**, and not blended away after a few generations.
 - Mathematicians analysed how the frequencies of genetic variants in a population would vary of time, under the force of natural selection.
- Assuming that the population contains enormous genetic diversity (a large gene pool) **the rate of evolution is driven by recombination and selection**.
 - Mutation merely replenishes the amount of variety in the gene pool.

“The Mendelians [mutationists] allowed that evolutionary change could be initiated by an event of mutation, and they interpreted this to mean that **mutation was (to an unknown degree) a source of initiative, discontinuity, creativity and direction in evolution.** The MS represents a very deliberate rejection of this view, and proposes instead that evolution is a complex sorting out of available variation to achieve a new multi-locus equilibrium, literally by “shifting gene frequencies” in the “gene pool”. The rate of evolution, in this view, does not depend on mutation, which merely supplies the “gene pool” with variation; **evolution is not shaped by mutation**, which is the “ultimate” source of variation, but not the proximate source.” (Arlin Stoltzfus)

- For the MS, natural selection is the artist, or “blind watchmaker”, and mutation simply the clay.
- For the Mendelians, mutation is the artist, and selection simply a fixing process.)

The essence of Darwinism

“The essence of Darwinism lies in its claim that **natural selection creates the fit**. Variation is ubiquitous and random in direction. It supplies raw material only. Natural selection directs the course of evolutionary change.”

Stephen Jay Gould (1977)

Part 4

The present day

Mutationism has severe difficulties, especially the problem that specific multiple point mutations are improbable, and in small populations (e.g. humans) the “waiting time” for just one such pair of mutations is around 100 million years.

(See Durrett R, Schmidt D, *Genetics* (2008) vol. 180(3):1501-9, “Waiting for two mutations: with applications to regulatory sequence evolution and the limits of Darwinian evolution.”)

That’s why Darwinists insist that there must be a **gradual path** leading to any novel complex trait, a series of probable mutations that are all selectable.

MS and ‘macroevolution’

“we are compelled at the present level of knowledge reluctantly to put a sign of equality between the mechanisms of macro- and microevolution”

Theodosius Dobzhansky, *Genetics and the Origin of Species* (1937), p. 12

According to the Modern Synthesis, new species, families, classes etc. appear by **fundamentally the same process** as the one that produced all the Galapagos finch species from a single mainland finch ancestor.

- Today, a substantial minority of scientists think that the mutationists were right in their view that selection isn't creative.
- Some also think that macroevolution involves processes very different from microevolution. (E.g. symbiogenesis, genome reorganisation.)

Rationale

People

Books

Related reading

Contact

The vast majority of people believe that there are only two alternative ways to explain the origins of biological diversity. One way is Creationism that depends upon supernatural intervention by a divine Creator. The other way is Neo-Darwinism, which has elevated Natural Selection into a unique creative force that solves all the difficult evolutionary problems. Both views are inconsistent with significant bodies of empirical evidence and have evolved into hard-line ideologies. There is a need for a more open “third way” of discussing evolutionary change based on empirical observations.

**James A. Shapiro**

Department of Biochemistry and Molecular Biology; University of Chicago

Shapiro has worked as professor of microbiology at the University of Chicago since 1973. An expert in bacterial genetics, he proposes the concept of Natural Genetic Engineering, a process described to account for novelty created in the process of biological evolution. Shapiro is an advocate of non-Darwinian evolution and is a critic of the modern synthesis.

DNA compone

“... the book’s contention that natural selection’s importance for evolution has been hugely overstated represents a point of view that has a growing set of adherents. (A few months ago, I was amazed to hear it expressed, in the strongest terms, from another highly eminent microbiologist.) My impression is that evolutionary biology is increasingly separating into two camps, divided over just this question. On the one hand are the population geneticists and evolutionary biologists who continue to believe that **selection has a “creative” and crucial role in evolution** and, on the other, there is a growing body of scientists (largely those who have come into evolution from molecular biology, developmental biology or developmental genetics, and microbiology) **who reject it.”**

Adam S. Wilkins, review of James Shapiro’s *Evolution: A View from the 21st Century*, in *Genome Biology and Evolution*, January 2012.

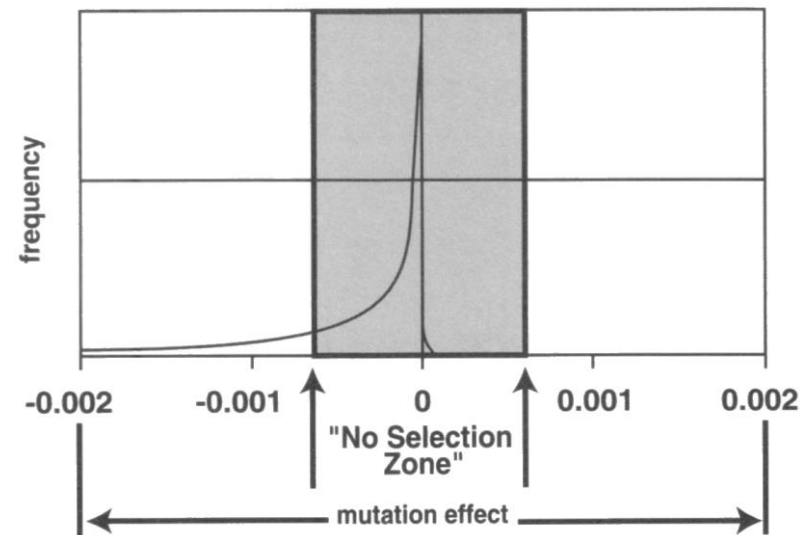
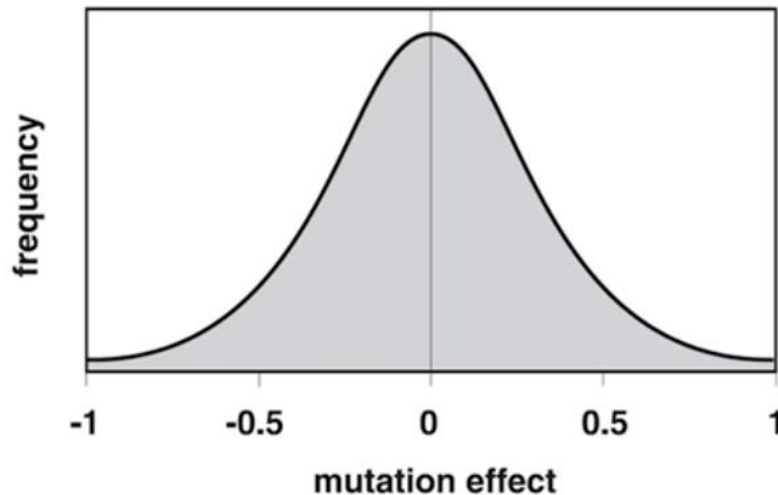
“The vast majority of biologists engaged in evolutionary studies interpret virtually every aspect of biodiversity in adaptive terms [i.e. in terms of selection]. This narrow view of evolution has become untenable in light of recent observations from genomic sequencing and population genetic theory. Numerous aspects of genomic architecture, gene structure, and developmental pathways are difficult to explain without invoking the nonadaptive forces of genetic drift and mutation.”

Michael Lynch, *PNAS*, May 15, 2007 vol. 104 suppl. 1 8597–8604

The (nearly) neutral theory

- R. A. Fisher's mathematical work on population genetics *apparently* showed that the fitness of a population must increase over time.
- The “fundamental theorem of natural selection”

Mutation - normal distribution ?



The (nearly) neutral theory

- It is now generally accepted by evolutionary biologists that most of the *molecular* evolution that occurs in a population consists of the fixation of (nearly) neutral mutations, that are not selectable.
- The fixation of a (nearly) neutral mutation is purely random, and so this process is called 'genetic drift'.
- Obviously drift isn't a creative 'blind watchmaker', so selection is still held to be crucial, even though it's responsible for very few molecular changes.

Conclusions

1. There's a now *more substantial* conflict between religion and evolutionary theory than there ever was between religion and astronomy.
 - Some theologians view Darwinism and the modern synthesis as “a dish of rank materialism cleverly cooked and served up” (Sedgwick), since there is apparently no need for purpose, design, etc.
 - Other theologians however prefer that God act only through secondary (i.e. natural) causes, and interpret the modern synthesis in such terms.

Conclusions

2. Some religious scientists with no theological objection to evolution *per se* have criticised Darwin's theory and the Modern Synthesis on scientific grounds.
 - E.g. (Catholics) George Mivart and Michael Behe.
 - These objections have been dismissed by *mainstream* biologists, since around 1940, but are endorsed by a few (e.g. Lynn Margulis, James Shapiro, Masatoshi Nei)

Behe: multiple mutations needed

- Biochemist Michael Behe argues that creating a new biological function by mutation would require more than one mutation at a time.
 - While single mutations are occasionally beneficial, these all *break* functioning mechanisms, rather than being steps toward a novel mechanism.
 - (E.g. antibiotic resistance occurs through loss-of-function mutations.)
- Specific combinations of mutations occur too rarely to allow evolution to work this way in the time available.
 - Behe, M. J., & Snoke, D. W. (2004). Simulating evolution by gene duplication of protein features that require multiple amino acid residues. *Protein science*, 13(10), 2651–2664.

Lynn Margulis, *Discover* magazine, April 2011.

Some of your criticisms of natural selection sound a lot like those of Michael Behe, one of the most famous proponents of “intelligent design,” and yet you have debated Behe. What is the difference between your views?

The critics, including the creationist critics, are right about their criticism. It's just that they've got nothing to offer but intelligent design or “God did it.” They have no alternatives that are scientific.

Conclusions

3. Natural selection is held by the MS to be a creative force, a “blind watchmaker”, mostly because *no alternative creative force can be imagined*. (The Sherlock Holmes rule.)

As Michael Polanyi put it:

“This reminds me of the impatience with which most biologists set aside today all the difficulties of the current selectionist theory of evolution, because no other explanation that can be accepted as scientific appears conceivable.”

There is no alternative

- E.g. In a review of Masatoshi Nei's *Mutation-Driven Evolution*, Stephen Wright acknowledges the difficulty in showing that evolution is due to natural selection, but says that Nei
“fails to show how any process other than selection can explain the evolution of complex adaptations”

Evolution, Vol. 68, No. 4 (APRIL 2014), pp. 1225-1227

- Religious scientists are not so firmly committed to methodological naturalism, so it's easier for them to be sceptical of the alleged creative power of selection.
 - I think it's *good* for scientists to be sceptical of the creative ability of natural selection.
 - (Religion might be doing science a favour here.)

As (physicist) Nigel Goldenfeld and (biologist) Carl Woese put it, quoting Schrödinger:

“Instead of filling a gap by guesswork, genuine science prefers to put up with it; and this, not so much from conscientious scruples about telling lies, as from the consideration that, however irksome the gap may be, **its obliteration by a fake removes the urge to seek after a tenable answer.**”

Goldenfeld and Woese regard natural selection as just such a “fake” explanation that is holding science back.

“Life is Physics: Evolution as a Collective Phenomenon Far From Equilibrium”, *The Annual Review of Condensed Matter Physics*, January 2011.

How are we ever going to evolve
if you people keep pushing us
back into the ocean?

