

e17 Darwinian thinking < algorithm; three requirements; half an eye; crossbills >

The old argument of design in nature, as given by [William] Paley [who in *Natural Theology*, 1802, advanced the creationist thesis that as intricate and inter-connected features of a watch imply a watchmaker ‘who comprehended its construction and designed its use,’ so do such of an organism, which suits it to its habitat, imply the existence of a creator], 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 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.

—Charles Darwin, *Autobiography*, 1876.²

... a philosophy of science ... dominated by physics and by typology [essentialism] [is] entirely unsuitable as a foundation for theories dealing with biological populations. —Ernst Mayr.³

In nature, organic design can result from the operation of a crude mechanism namely, natural selection (**Footnote e17.1**). The revolutionary implication is that organic design can be the product of a mindless process. That was the shock value of Darwin’s theory when as David Quammen puts it, “essentialism and natural theology were as thick in the air ... as coal smoke and the scent of horse manure.”⁴ An oft-told tale is of a member of British society who when informed of Darwin’s theory, gasped at its implications: “Let us hope that it is not true. But if it is, let us hope that it does not become widely known.”⁵ However, Darwin, and perceptive critics, realized that his theory *did not exclude* the continuous, or episodic, operation of the miraculous or, alternatively, some metaphysical force that from the inert generates life and inexorably streams it forward from the most simple to more advanced forms, as Lamarck had postulated, and from which stream, an organism by its coping activity could produce offspring well adapted to various habitats. And were that so! for in contrast to a miraculous or a Lamarckian explanation, natural selection makes every functional feature of an organism a monument to a stupendous number of still births and lives cut short. (No comfort now from that horror for, in the twentieth century, mutation was proven to be mechanistic and is, essentially, an unstoppable feature of organic replication.)

The wings of butterflies and bats in their internal support structure are entirely different (not homologous). This is unsurprising if they were created for the different capabilities of these animals. But what of the bird and bat? These have like bones of humerus, ulna, radius, and fingers. But why if they were separately created animals? And, even more surprising is that the same variety of bones occur in the forelimb of cats, humans, and whales. These bones differing only in shape and size (homologous) are unrelated to the function of the limb in these various animals. Separate creation could have installed unrelated components in limbs used for flight, walking, grasping, or swimming. The simple explanation for this not being so, is that birds, bats, cats, humans, and whales have evolved from a common distant ancestor.

The Origin of Species (1959)⁶ explains diversity and fitness of organic nature. In it and in other books, Darwin proved in the context of his day, which included Lamarck, that modern species are revised descendants of earlier species. He does so by explaining how “descent with modification” is by natural selection of heritable variation that naturally appears in individuals of a species. So simple are these ideas that their revolutionary import could be missed: “Professor [Samuel] Houghton [1821-1897] of Dublin ... [his] verdict was that all that was new in them was false, and what was true was old.”² Previously, the publication the Wallace/Darwin paper on August 20, 1958, by the Linnean Society had not prompted president Thomas Bell to find any striking discoveries that year that revolutionize.⁷ But Aristotle’s concept of species as eternal ideal Forms, hence immutable, doctrinal for 2,000 years, is replaced with individuals that vary in a population. Darwin’s population thinking stresses the uniqueness in a living world of each related organism. Species are mutable. “No two ways of looking at nature could be more different,” observed Ernst Mayr⁸ (**Figure e17.1**). Keith G. Davies clarifies: “A species is a statistical abstraction and only unique individuals have a reality. Aristotle thought the reverse: the ideal Form is real and individual variation is an illusion.”⁹

Since the publication of *Origin*, Mendel's understanding of genetic inheritance ("... it is perfectly immaterial whether the dominant character belongs to the seed plant or to the pollen plant; the form of the hybrid remains identical in both cases. This interesting fact ... also emphasized by [Carl Friedrich von] Gartner [1772-1806]"¹⁰) was rediscovered and molecular biology has exploded onto the scene with impressive insights and no letup of discovery in sight.¹¹ How has Darwinian thinking stayed relevant? Daniel C. Dennett (1995)¹² makes the case that Darwinian thinking is the elaboration of an algorithm, which is the *proof* that Darwin spelled out in *Origin* and which in neo-Darwinian parlance is: nonrandom survival of randomly varying hereditary instructions for building embryos.¹³

A mechanical procedure that though a sequence of simple steps can successfully yield an anticipated result is called an *algorithm*. According to Dennett, three key features of an algorithm are:

1. Substrate neutrality: The power of the procedure is a result of its logical structure, not the materials that happen to be used in carrying it out.
2. Underlying mindlessness: Although the overall design of the procedure may be awe inspiring, each constituent step is utterly simple.
3. Guaranteed results: Whatever it is an algorithm does, it always does it, provided the algorithm is executed without misstep.

Eörs Szathmáry informs: "Units of evolution must multiply, have heredity, and possess variability; and among the heritable traits, some must affect survival and/or reproduction. If these criteria are met, evolution by natural selection is possible in a population of such entities."¹⁴ Computer programming to investigate biological evolution involving *selection*, *replication*, and *mutation*, by such as Thomas Schneider,¹⁵ N. A. Baricelli and A. S. Fraser, and evolution-inspired genetic algorithm programming developed separately, 1950-1980, notably by John Holland, to solve engineering problems, have converged.¹⁶

Since its inception, the burden to disprove *Origin's* logic shifted to its skeptics. Clerical objections comfortably expressed throughout the Christian world were first shaken profoundly when holdout Lyell declared in 1866 his acceptance of its truth. New import then for the Industrial revolution inspired *Sea of Faith*, 1867 (begun in 1851), when, for religion, Matthew Arnold "could only hear / Its melancholy, long, withdrawing roar."¹⁷ But mainstream theology had bent enough by the time Darwin (d. 1882) was interred (upon Galton's request for this to Royal Society president William Spottiswoode) in Westminster Abbey (next to the grave of Isaac Newton) that his funeral eulogy offered by Canon Frederic William Farrar (1831-1903), F.R.S. (for his *An Essay on the Origin of Language*, 1860)¹⁸ was echoed from many pulpits in Europe and America.¹⁹

Darwinian thinking has survived each wave of insight as to mechanism. At no time has a fatal flaw been discovered, even though few ideas have spawned so many critics. The present crop of anti-Darwinism debaters, dubbed neo-creos (Michael Behe's "irreducible complexity," Cornelius Plantinga Jr.'s "Darwinism is self-undermining," and William Dembski's "information theory"), press what they claim to be evidence of intelligent design (the "breathtaking inanity" ruled to be "not science" by Judge John E. Jones III in 2005). Counter "Not-Darwinism" is "Not Intelligent Design," for were nature fashioned by a hands-on Divine Artificer, it ought to exhibit a certain elegance and efficiency and not all the imperfections manifest in the biological world: as the webbed feet of the frigate bird (which does not need them for paddling), nonfunctional junk DNA that litters genomes (**Footnote e17.2**), and the sheer waste of 99.99 percent of the species known to have existed, gone extinct individually and severally at different past times including the dinosaurs; created only to be snuffed by a stray asteroid—their run to nowhere lasted for 160 million years.²⁰

Darwinian evolution of an eagle's sharp eye, say, needs the passage of time, far exceeding that of history, so that many steps could be taken from an ancestor's photo-sensitive eye spot, *through some half formed stage*, and on, to the existing eye. Intelligence does not intervene in the process as is evident from the product (**Footnote e17.3**). "Without a correlative increase in the size and complexity of the optic nerve, an increase in the size and complexity of photoreceptive membranes can have no effect [unless] these changes come about simultaneously" puffs David Berlinski.²¹ Darwinian evolution he posits cannot explain how such independent components coevolve as a tightly integrated whole. However, that they must is a hypothesis that trips over the uncoordinated evolution of his own head, which lagged his body, in the fossil record of his ancestors.

Is it design or evidence of contingency that puts testes outside of the body cavity of male mammals. Too hot within for normal sperm production. Yet what of goodnighting? Robert Hendrickson in *Happy Trails*, a 1994 dictionary of Western expression explains this eponym: “Students of the old West may be aware that bulls on long cattle drives often suffered from chafing of the testicles, which frequently swelled so large that the animal sickened and died. The remedy was to cut off the testicle bag, push the testicles up into the body and sew the cut—a process that enabled the bulls to travel well and did not impair breeding.”²² The remedy is called *goodnighting* after its inventor cattleman (and bison conservationist)²³ Charles Goodnight, and is surely among the most unusual of words named after people.²⁴

Darwin in *Natural Selection* offered the beak of the crossbill as an example of a deformity that evolution would operate to eliminate. Its appearance in a species he ascribed to a laxity in natural selection during good times. However, observation provided a rosier picture. Crossbills’ beaks *are* (**Figure e17.2**) adaptively fit. Moreover, they provide a repeatable example of how a highly specialized feature need not appear all at once but can develop, and so can have evolved, incrementally. Craig W. Benkman and Anna K. Lindholm demonstrated that in 1990 by the very direct experiment of clipping away the crossed part of the beaks of some pine-seed eating crossbills and noting how they fared. At first they survived by eating seeds from open pine cones but as their beaks grew back they became ever more successful with extracting seeds from partially opened ones until, when their beaks were fully grown again, they could pry out seeds from closed cones. Their specialized cross beak gives them first access to food and the evolutionary path for like competitors is closed.²⁵ A cross bill is not a “hopeful monster” (a term geneticist Richard Benedict Goldschmidt used for a gross mutant that by luck finds an existing ecological niche in which it can survive).²⁶

The three “requirements” Darwinian evolution should occur in *any* system in which can be recognized: 1) *variation that is strictly accidental and unintentional*,²⁷ 2) *inheritance*, and 3) *selection*. The great surprise for such systems (be they genetic, cultural, or social) would not be that there is evolution but only if there were not. Dispassionately viewed, the make-do features of organisms give the lie to Aristotle’s aphorism: “If one way be better than another, that you may be sure is Nature’s way.” Steven Vogel in *Cats’ Paws and Catapults*, 2000, writes: “The biomechanic usually recognizes nature’s use of some neat device only when the engineer has already provided us with a model.”²⁸ A diligent search finds few useful inventions that copy nature: Barbed wire has a patently different design from the prickly limbs that inspired it of the slow-growing Osage orange hedgerows once planted in Midwestern states. Surfaces on which water-droplets bead, and so are easily shaken off, need only a rough microstructure as have (although quite different in detail) butterfly wings and lotus plant leaves. Inspired by the multicomponent structure of the eye, David Gregory in 1695 suggested it might point a way to devising a multicomponent aberration free lens. But are the protein “crystalline” (*sic*) lenses of the eye and its structure in anyway close to the first successful aberration-free three part “sandwich” lens—a pair of convex crown-glass lenses enclosing a concave flint-glass patented by John Dollond in 1757 (a two lens version contrived in 1733 by Chester Moor Hill had proved too inferior for serious use)—that Joseph Fraunhofer placed, for star parallax measurements, in the refractor telescope completed in 1824 for Wilhelm Struve and the heliometer completed in 1829 for Friedrich Bessel.²⁹ The chunky teeth of a chainsaw are copies (but to what extent?) of the efficient cutting jaw parts of a common wood-boring beetle. Burrs stick to anything shaggy but George de Mestral’s “Velcro inspired by nature” was *designed* not to—the hooks of its one part stick only to the loops of its other part, and not to the rest of clothing.³⁰ The history of flight is an unhappy tale while engineers tried to emulate nature’s way of flapping wings. But the human can produce a boomerang (found in aboriginal Australia, the tomb of Tutankhamen, Egypt, and a possibly ceremonial, 18,000 year old, great ivory one from Oblazowa, Poland).³¹

“Put another way, biomechanics mainly still studies how, where, and why nature does what engineers do.” For example, to produce sparkling clear wines, beers and fruit juices, rather than pour the fluid through a sieve (dead-end filtration), cross-flow filtration has been developed in which the flow is over, so any particles in the fluid tend to be transported away from the surface of the sieve,

minimizing clogging as they become a concentrated slurry in the fluid that remains. Long assumed to function as a ‘dead-end’ filter are gill arches and gill rakers in the back of the throat of suspension-feeding’ fishes. Not so for the gizzard shad, *Ngege tilapia*, and goldfish studied by S. L. Sanderson in 2001.³² These employ (the important industrial process known for decades) cross-flow filtration. In *Digital Biology*, 2002, by author and researcher Peter J. Bentley we learn of a method for laying out networks of cellphone towers that was suggested by the “strategy” ants use to follow scent and of a programmer hands-off method for turning a small program into a complex one that mimics the way embryos “develop.” The implication could be that we understand the biology. But consider: a way to destroy computer viruses, Bentley also tells us, was inspired by 1970s model of the immune system that immunologists now discount.³³

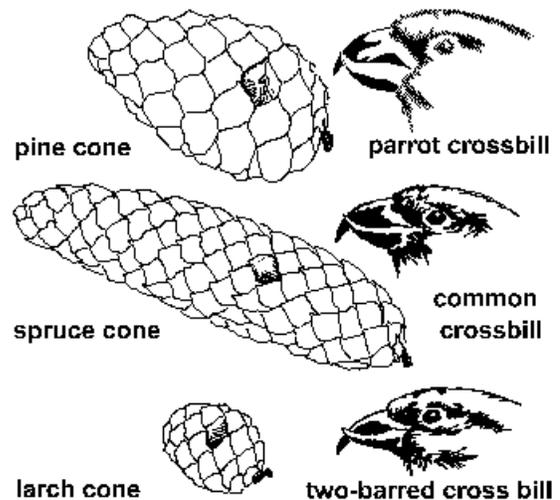
Developmental constraints, John Maynard Smith in 1985 posited, are “a bias in the production of variant phenotypes or a limitation on phenotypic variability caused by the structure, character, composition or dynamics of the developmental system.”³⁴ Darwinism is knowledge of the process of natural selection that without thought or plan operates by, as Steven Jay Gould summarizes: “the twofold process of producing copious and undirected variation within a population and then passing along only a biased (selected) portion of this variation to the next generation;”³⁵ as Richard Dawkins summarizes: “random mutation plus non-random cumulative selection.”³⁶ Given that nature is unconscious, this process has no moral content. A wrenching realization that prompted George C. Williams to fire off a paper on evolutionary ethics entitled: “Mother Nature is a Wicked Old Witch.”³⁷ Any attempt to apply this process consciously to achieve a planned result is artificial. Artificial selection involves moral decisions and evil consequences are possible. In this, as a human, you are best guided by love that you should feel for yourself (if you do not, then seek professional help), the love of another (this love is blind, you know it or you have not been in love), the love for your family and close relatives; the love for all others (this is the test of your humanity) that you want in equal measure, the personal love you have for a pet (that you experience back in measure more than you give). □



Figure e17.1 Ernst Mayr (pronounced *ernst mir*) (1904-2005)
 “Anyone who writes about ‘Darwin’s theory of evolution’ in the singular ... will be quite unable to discuss the subject competently.”³⁸

“Evolution ... as Darwin always insisted [is] actually composed of five quite independent theories. Two of these were readily accepted by the Darwinians: the simple fact of evolution (the ‘non-constancy of species’ as Darwin called it) and the branching theory of common descent. The other three—gradual evolution, the multiplication of species, and natural selection—were accepted by only a minority of Darwin’s followers. Indeed, these three theories were not universally accepted until the so-called *Evolutionary Synthesis* of the 1940s.”³⁹

Figure e17.2 Crossbills, genus *Loxia*, sparrow-sized songbirds in the finch family Fringillidae includes twenty-five species and subspecies distributed across North America, Europe, and Asia. According to legend, they twisted their beaks when they were trying to wrest the nails from Christ’s cross. The red on the breast of the male is the blood of Christ. Jonathan Weiner in his book *The Beak of the Finch* points out that “the connection between the beak and the food is so obvious that it was accepted by evolutionists even at the time Lack wrote, when his colleagues believed that most differences between sibling species have no adaptive significance at all.”⁴⁰ (David Lack first published an account of the evolution of the finches in 1940.)⁴¹



Footnote e17.2 Comparison of marsupial and placental genomes has made a truism of “evolution is recycling” for, as Tarjei Mikkelsen has found, “It’s much easier to repurpose old parts from junk DNA (conserved non-coding elements), than to invent new ones from scratch.”⁴²

Footnote e17.3 Evolution of sight

When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.

—Arthur C. Clarke, *Profiles of the Future*.⁴³

‘Doublethink,’ Orwell scoffed, is ‘the power of holding two contradictory beliefs in one’s mind, and accepting both of them.’⁴⁴

... in as much as intelligence is associated with the ability to do sophisticated computations it should in no way require billions of years of biological evolution to produce—and indeed we should see it all over the place, in all sorts of systems, whether biological or otherwise.

And certainly some everyday turns of phrase might suggest that we do. For when we say that the weather has a mind of its own we are in effect attributing something like intelligence to the motion of a fluid.

Yet ... —Stephen Wolfram *A New Kind of Science*, 2002.⁴⁵

And Plato very clearly says that astronomy is the reason humans have been given eyes.

—Georg Joachim Rheticus, *Preface to the Sphere*, 1531.⁴⁶

Our eyes stay nearly the same size from birth but our nose and ears never stop growing.⁴⁷

Of the eye, Charles Darwin, had this to say:⁴⁸

“To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree. When it was first said that the sun stood still and the world turned round, the common sense of mankind declared the doctrine false; but the old saying of *Vox populi, vox Dei* [The voice of the people is the voice of God.⁴⁹], as every philosopher knows, cannot be trusted in science. Reason tells me, that 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, should not be considered as subversive of the theory.”

Of the eye, Kenneth R. Miller, has this to say:⁵⁰

“Another way to respond to the theory of intelligent design is to carefully examine complex biological systems for errors that no intelligent designer would have committed. Because intelligent design works from a clean sheet of paper, it should produce organisms that have been optimally designed for the tasks they perform. Conversely, because evolution is confined to modifying existing structures, it should not necessarily produce perfection. Which is it?”

“The eye, that supposed paragon of intelligent design, offers an answer. We have already sung the virtues of this extraordinary organ, but we have not considered specific aspects of its design, such as the neural wiring of its light-sensing units. These photoreceptor cells, located in the retina, pass impulses to a series of interconnecting cells that eventually pass information to the cells of the optic nerve, which leads to the brain.

“An intelligent designer, working with the components of this wiring, would choose the orientation that produces the highest degree of visual quality. No one, for example, would suggest that the neural connections should be placed in front of the photoreceptor cells—thus blocking the light from reaching them—rather than behind the retina. Incredibly, this is exactly how the human retina is constructed. ...

“A more serious flaw occurs because the neural wiring must poke directly through the wall of the retina to carry the nerve impulses produced by photoreceptor cells to the brain. The result is a blind spot in the retina—a region where thousands of impulse-carrying cells have pushed the sensory cells aside. ...

“None of this should be taken to suggest that the eye functions poorly. It is a superb visual instrument that serves us exceedingly well. ... The key to the intelligent design theory ... is not whether an organ or system works well but whether its basic structural plan is the obvious product of design. The structural plan of the eye is not.”

Unwilling to take refuge in the time-honored petulant retreat of *certum est, quia impossibile est*,⁵¹ Michael J. Behe in considering the above information in his book *Darwin’s Black Box* grumbles that “an objective observer would conclude only that the vertebrate eye was not designed by a person who

is impressed with the argument from imperfection” and he offers that narratives which can account for the eye starts with already functioning systems and these have *irreducible* complexities (those that he cannot explain) such as: the three seemingly unrelated methods that a nucleated cell uses in concert to orchestrate the movement of proteins within itself, the way blood clots, the functioning of the immune system, and the working assemblage of components in a bacterial flagellum.⁵²

However, science is pursued because it does have a track record of successfully explaining, in *humanly* understandable and useful ways, what may seem a priori to have no explanation. And no explanation is one that finds purpose in evolution. Those who might tilt against dysteleologic science on philosophical grounds should be forewarned of the delusions of our brain’s likely-evolved bias towards explanatory forms deriving, writes Steve Blinkhorn,⁵³

“... from mentalistic concepts such as intention, purpose and motive embedded so deep that it pervades all language and all languages. The kind of religious thinking that purports to discern divine [teleologic] intention in natural catastrophes can be seen as over-enthusiastic application of theory of mind [the ability to make inferences about the mental states, such as beliefs and intentions, of others] to the physical world.

“The truth is that language serves science very poorly in providing few clear, concise and cogent ways of indicating that randomness in a process does not necessarily lead to random results, so you do not always need purpose to account for order. We all know that, but communicating it is the very devil of a job. And, in English at least, it can take a good deal of effort to distinguish clearly between fitness for function and purpose intended, between what things are good for and what they were made for. Axes are good for chopping wood, but was the first flint hand-axe made for the purpose, or was it just found to be fit for that use (if that’s what hand axes were used for at all—itsself a matter of some debate [as their sharp-flaked top would wound a holding hand])?”

H. Allen Orr has written sensibly, in *Darwin v. Intelligent Design (Again)*, 1996, that:⁵⁴

“... an irreducibly complex system can be built gradually by adding parts that, while initially just advantageous, become—because of later changes—essential. ... Some part (A) initially does some job. ... Another part (B) later gets added because it helps A. This new part isn’t essential, it merely improves things. But later on, A ... may change in such a way that B now becomes indispensable. This process continues as further parts get folded into the system. At the end of the day, many parts may all be required.”

Richard Dawkins describes an analogy for apparently irreducibly complex structures offered by Alexander Graham Cairns-Smith in *Seven Clues to the Origin of Life*:⁵⁵

“A free-standing arch of rough-hewn stones and no mortar can be a stable structure, but it is irreducibly complex: it collapses if any one stone is removed. How, then, was it built in the first place? One way is with scaffolding that was later removed and is no longer visible. Once the structure is completed, the scaffolding can be safely removed and the structure remains standing. In evolution, too, the organ or structure you are looking at may have had scaffolding in an ancestor which has since been removed.” □

Figure e18.1 The European hedgehog is one of some thirteen spiny species of fruit-sized omnivorous mammals that live throughout Eurasia and Africa. Hedgehogs mostly rely on their acute senses of smell and hearing to locate digging insects but as would-be carnivores they sometimes feast on small snakes, frogs, mice, and an occasional birds’ egg.¹ Even though the territory in which they live is vast, extant hedgehogs keep their ambitions, and size, small, and they forage nocturnally in a home range no bigger than an acre.² By contrast, on a Mediterranean island the hedgehog *Deinogalerix* (Miocene) was a giant carnivore. Of interest, when hedgehogs were introduced in 1974 to North Uist, South Uist, and Benbecula, western isles of Scotland, where free to exercised their taste for eggs, their populations soared while ground-breeding waders, including ringed plover and dunlin, populations declined.³ Dubious is pet making of wild hedgehogs as they are known carriers of foot-and-mouth disease virus, as well as *Salmonella*, *Mycobacteria*, and dermal fungal infections harmful to humans.⁵

