

ULTIMATE ENGINEERING

EXCERPTS

Excerpt 1 (From the Introduction)

Two Views of Biology

The more we learn about living systems, the more we find ourselves stunned by the masterful designs in biology. Andrea Rinaldi, an evolutionary biologist and world-leading fungi expert, whose papers have been cited more than 7,000 times, put it this way:

Biologists often find themselves awestruck by the elegant perfection of living organisms.... From molecules to organisms, scientists and engineers have repeatedly been enthralled by nature's handiwork and have emulated natural designs in man-made innovations.¹

I am one of the engineers he's describing. I have helped design prosthetics, spacecraft for the European Space Agency, and the fastest track bicycle in the world for the British Olympic team. For four decades I have worked alongside top researchers in biology and engineering, and together we are not only awestruck by the engineering marvels of the biological realm but inspired by them to make significant engineering breakthroughs outside of biology. That pursuit, now a subdiscipline of its own, is known as biomimetics.

Despite all this, some evolutionists, including Nathan Lents, Abby Hafer, Jerry Coyne, and Richard Dawkins, insist biology is characterized by bad design. They further argue that this supports the theory of evolution, since Darwin's mechanism of natural selection working on chance variations (now understood as random genetic mutations) is a mindless, trial-and-error process that can be expected to have routinely drifted into decidedly suboptimal design solutions in the history of life.

What's behind this dramatic divide among life scientists? On the one hand, we have experimental biologists, like Rinaldi, who are reporting detailed scientific observations from the laboratory that reveal ultimate engineering in biology. On the other hand, we have biologists such as Lents and Dawkins, who make claims of bad design based on the evolutionary prediction

of bad design, and typically do so in areas of biology for which they lack expertise. This latter group are so keen to see suboptimal design in biology that they overlook evidence of ultimate engineering.

Evolutionary Theory Predicts Bad Design

Why do evolutionary theorists so often anticipate bad design? Because the evolutionary mechanism—as understood by both Darwin and by modern evolutionary theorists—is highly constrained. As Duke University professor of biology Steven Vogel put it, “The dazzling diversity of the living world too easily disguises the fact that the evolutionary process faces constraints far more severe than anything impeding human designers.”²

The most severe constraint on evolution is that of incremental change, which prevents it from producing systems that require many parts to originate simultaneously. But there are other constraints. Evolution is constrained by a limited ability to shed vestigial parts, and it cannot evolve much beyond the organism’s survival/reproduction needs. (These constraints will be further explored in Chapter 17.) Evolution is so constrained in producing changes that evolutionary biologists are well within their rights to conclude that it could only produce biological systems with many areas of poor design.

Lest one imagine I am presenting a false view of modern evolutionary theory, consider this passage from distinguished French biologist François Jacob, in his essay “Evolution and Tinkering”:

The action of natural selection has often been compared to that of an engineer. This, however, does not seem to be a suitable comparison... because the objects produced by the engineer, at least by the good engineer, approach the level of perfection made possible by the technology of the time. In contrast, evolution is far from perfection. This is a point which was repeatedly stressed by Darwin who had to fight against the argument of perfect creation. In *The Origin of Species*, Darwin emphasized over and over again the structural or functional imperfections of the living world....

If one wanted to play with a comparison, one would have to say that natural selection does not work as an engineer works. It works like a tinkerer—a tinkerer who does not know exactly what he is going to produce but uses whatever he finds around him whether it be pieces of string, fragments of wood, or old cardboards;... with odds and ends. What he ultimately produces is generally related to no special project, and it results from a series of contingent events, of all the opportunities he had to enrich his stock with leftovers. As was discussed by Levi-Strauss, none of the materials at the tinkerer’s disposal has a precise and definite function....

From an old bicycle wheel, he makes a roulette; from a broken chair the cabinet of a radio. Similarly evolution makes a wing from a leg or a part of an ear from a piece of jaw.³

Neither Jacob nor Vogel was an evolutionary naysayer or fringe figure. Vogel was a world leader in biomechanics and an unwavering evolutionist. Jacob won the Nobel Prize, and his aforementioned “Evolution and Tinkering” is a famous and influential essay in the field of

evolutionary biology. Both scientists frankly declare, as did Darwin himself, that the evolutionary process is severely constrained. This means that if such a process did indeed produce all the variety of our biosphere, then the living world should not merely contain cases of dysfunction; it should be marked top to bottom by substandard designs, ones manifestly inferior to those of skilled human engineers.

Lents, Hafer, Dawkins, and many others get it, and they have gone in search of supporting evidence. Lents, for example, has written an entire book, *Human Errors*, detailing what he regards as hundreds of design faults in the human body.⁴ Hafer, in her book *The Not-So-Intelligent Designer*, claimed the human eye would deserve an “F-grade in any decent design class.”⁵ Similarly, Dawkins, in *The Greatest Show on Earth*, has a whole section on “Unintelligent Design” in biology. He asserts that the eye is the “design of a complete idiot,” that the “arteries leaving the heart” are “a haphazard mess,” and that one branch of the laryngeal nerve takes “an astonishing detour” that “is a disgrace.”⁶ They aren’t simply complaining. Their point is that this is precisely what we should expect from the evolutionary process.

I would add that I totally agree that bad design is what we should expect *if* evolutionary theory were true. The problem for Dawkins, Lents, and Hafer is that their claims of poor design dissolve under close inspection. Indeed, many of the examples of ultimate engineering I give in the pages that follow include the very examples evolutionists regularly give as instances of bad design.

Intelligent Design Predicts Superior Design

In contrast to evolutionary theory, the intelligent design paradigm predicts that biology will not be found to be routinely characterized by bad design. As with human designers, an intelligent designer of the natural world would not face the key constraints faced by the evolutionary process. Most fundamentally, an intelligent designer, unlike evolution, can employ foresight to envision a solution well beyond anything in existence at the time, and then set about making that envisioned solution a reality.

And as this book’s title makes clear, I will go further than claiming an absence of bad design. I will argue that biology contains design that is far superior to human technology—design that is, in fact, ultimate engineering. By this I mean design at the limit of what is possible.

Take the lubrication system in animal joints. It's not just optimal. It's at the limit of what is physically possible and far better than the best human lubrication system.

This expectation of ultimate engineering fits comfortably with the intelligent design paradigm, and all the more so when reinforced by a specifically theistic design paradigm, for if the whole universe—including its laws and materials—is understood to have been made by an intelligent designer, as theism holds, then it follows that this designer would possess intimate knowledge of how to use those laws and materials to produce designs at the limit of performance.

Of course, organisms can have imperfections due to genetic disorders. However, genetic disorders are the result of the decay that we see in all living organisms, and indeed in all engineered systems in the world, no matter how brilliantly designed. What I am suggesting is that the human body and other organisms were initially made without these genetic flaws, and that the flaws arose over time. Individual organisms also develop imperfections as they age. But again, even the best engineered systems wear out as they age. So when I speak of ultimate engineering, I am describing organisms free of defects from either genetic decay or aging.