

CHAPTER 10

INTELLIGENT DESIGN

IS THE EVOLUTION OF COMPLEXITY IMPROBABLE?

When we calculate the probability that something could happen, that calculation is always based upon certain assumptions. For example, suppose we ask the following question: What is the probability that the top ten cards in a deck of cards are all of the same suit? If the deck of cards was randomly shuffled, then it is very improbable that the top ten cards are all the same suit. (The odds are about 1 in 14 million.) Now suppose that the deck of cards is brand new and has never been shuffled, or suppose that the owner of the deck of cards likes to sort each deck. In that case, it is very probable (almost a sure thing) that the top ten cards are all the same suit.

Consider the bacteria *flagellum*. It is constructed out of more than 20 different proteins, most of them in multiple copies all working together. Supporters of Intelligent Design theory often call these sorts of systems *irreducibly complex*. (This term was popularized by Michael Behe in *Darwin's Black Box: The Biochemical Challenge to Evolution*, Simon and Schuster, 1996.) All of the genes for these proteins must be working properly for the *flagellum* to work.

What is the probability that the mechanisms of evolution could produce something that is irreducibly complex? The answer to that question depends on what assumptions we make. When the theory of evolution is explained in basic science textbooks or in popular books about science, it is often simplified with certain assumptions. Those assumptions go something like this:

- ▶ Each organism has a fixed number of genes. (Humans have about 30,000 genes.)
- ▶ Each gene produces a single type of protein.
- ▶ Each protein has a single function in the organism.
- ▶ A mutation in a gene only changes one DNA "letter" in the gene.
- ▶ The only way that a mutated gene can spread throughout an entire species is if that mutation offers some advantage (differential reproductive success) to the individuals who have that mutation.

If these assumptions were true, then the first claim of Intelligent Design theory would be true: it would be very improbable that something that was irreducibly complex, like the bacteria *flagellum*, could have evolved.

But these assumptions are false. The real situation is more interesting. Here's a list of some things that scientists have discovered about evolution in the past several decades:

- ▶ Sometimes entire genes or sets of genes are duplicated. Therefore, the number of genes in an organism is not fixed.
- ▶ Sometimes entire genes or sets of genes are transferred from one organism to another other through means other than reproduction. At times this happens through viral infections between species.
- ▶ Many genes make more than one protein.
- ▶ Many proteins serve more than one function in the organism.
- ▶ Many functions of the organism can be accomplished by more than one set of proteins. If a mutation in a gene causes one protein to become significantly altered, the functions of that protein might be accomplished by other proteins so that the organism is not harmed by the mutation. (Engineers sometimes call this having redundancy in the system.)
- ▶ Changes in the environment can sometimes trigger changes in the rates at which mutations happen.
- ▶ Many mutations are *neutral*; they have no discernable effect on the protein's function. But if a gene accumulates several neutral mutations, one additional mutation could have a large effect on the way the protein behaves.
- ▶ When environments change, features of an organism that were previously unimportant or neutral can suddenly become important for its survival.
- ▶ In small, isolated populations of individuals, some mutations can become common in that population even if these mutations don't offer any particular advantages.

More items could be added to the list. These discoveries make the situation more interesting and more complicated than the way evolution is sometimes presented in basic textbooks or popular science books.

Under this new set of assumptions what is the probability that irreducibly complex things like the bacteria *flagellum* could evolve? Scientists don't know. Given our current level of technology and scientific knowledge, it's too complicated to figure out, it would be like trying to predict the exact moment that a leaf will fall off a tree weeks in advance.

Within the last few years it has become possible to sequence all of the genes in the DNA of a species. (To sequence means to figure out every DNA "letter" in every gene "word" of a species.) This was accomplished most famously with the Human Genome Project, an amazing achievement, which promises to yield many medical benefits. Scientists didn't stop with humans. Thus far about two dozen species of plants and animals and a few dozen single-celled organisms have been sequenced, and many more species have had portions of their DNA, sequenced. This work has already revealed a lot about the common ancestry of species, but much more needs to be learned. There are millions of species of animals, plants, and bacteria, so it will be many decades before all the genes in all of these species are sequenced. Once that is done, a lot of questions about the theory of evolution will be answered. But even this accomplishment, by itself, will not be enough to answer the question of whether or not complex things (like the bacteria *flagellum*) could have evolved. Whether or not all complexity can evolve is a very hard question, and sequencing the DNA of many different species is only one of several hurdles scientists will have to overcome before they have a definite answer.

Scientists have, however, figured out plausible explanations for several particular examples of irreducible complexity. One example is the complex structure of the mammalian middle ear. Three tiny bones called the hammer, anvil, and stirrup are joined together so that they relay signals from the ear drum to the inner ear. If any one of these bones is removed, the middle ear would not function, thus it is irreducibly complex. Yet there is an evolutionary explanation for how this complex system developed. The fossil record shows us that these three bones started out functioning as jaw bones in reptiles. In transitional species between reptiles and mammals, the bones served dual functioning both in the jaw and in hearing. As other jaw bones evolved further, these three bones became redundant in the jaw, stopped assisting jaw motion, and evolved further to support only hearing.

In hundreds of other examples of irreducible complexity, scientists do not have enough information yet to decide whether it is probable or improbable that they could have evolved. The debate over Intelligent Design theory has helped motivate the scientific community to realize more clearly that the evolution of complexity is a very interesting and a very difficult scientific question.