

## WRITING EXERCISES

### THE SENTENCE

The fact that oceanic islands are isolated and resource-poor is the basis for their providing evidence for common descent.

The biologists conducted an investigation of the genetic discrepancy.

The destruction of the rainforests is a prime example of human impact and a force as powerful as any natural selection.

The choice by females of what male to mate with has implications for the evolution of the species as profound as any produced by predation or competition for food.

The definition of variation in a population that the teacher gave us seems vague, but it can be made more quantitative in several ways for those who care to investigate.

## THE PARAGRAPH

The discovery of *Deinonychus* by Ostrom in 1964 changed the perceptions of paleontologists about the evolution of birds. With so many features shared by birds and “raptors,” as dromaeosaurs like *Deinonychus* came to be called, it became unavoidable for the scientists to see the links between them. When *Archaeopteryx* was discovered long before, it could not be clearly classified as dinosaur or bird, but the presence of feathers led to it being called “the first bird.” On the other hand, *Deinonychus* had been thought a dinosaur from the beginning. Yet many fine points of bone structure were similar between birds and *Deinonychus*. Ostrom’s argument about this was well stated but controversial. There were differences that many paleontologists saw as discrediting Ostrom’s hypothesis. The claim by ornithologists, for example, that dromaeosaurs and birds had different foot development was seen as conclusive in this regard. When it was later discovered that raptors very likely had feathers and air sacs in their bones, as birds do, support for the dinosaur-bird link grew. Genetic studies also showed the error in the ornithologist’s developmental argument. At the present, after many transitional forms have been discovered, it’s clear that most biologists accept the evolutionary link between the dromaeosaurid and avian lineages. The dinosaurs are not extinct.

## THE DOCUMENT

You say you want some evolution, well you know, you need more than love. While it is true that reproduction is an important requirement for evolution to take place, there are other requirements as well. For example, traits must be inherited if what happens in one generation is going to affect the next generation. When gene frequencies change, evolution takes place across generations. Migration can produce changes in gene frequency, as can differential survival among genotypes. But chance is the least understood force causing evolution. Chance comes in many forms, not all equivalent.

When most people think of random events, they imagine something like the proverbial monkeys typing at a typewriter. Will the monkeys type out the text to *Hamlet*? It is possible, yes, but the probability is very small. So small that we never expect to see it happen. But evolution does not depend on chance events like this one. It depends on chance operating within a population, not on low probability events. Sorting among the types in a population is what evolution does. If there is only one type, then nothing happens. It is when chance produces many types that evolution can act, not on individuals but on the population as a whole.

Mutation is one critical action of chance in a population. Random events, either subatomic particles or radiation or chemicals in the environment, cause changes to an organism's DNA. If the DNA that changes is in the body cells, then it affects the organism only but not later generations. This is one reason we age, for example. But if organism's gametes have their DNA changed by mutation, then the mutation might appear in the next generation. It does not matter what the mutation is, it will have some effect as long as offspring are produced. If the mutation is fatal, then that organism will have fewer offspring, changing the gene frequency in the population. If the mutation is beneficial, then that organism's offspring will itself tend to have more offspring, again changing the gene frequency in the population. Many mutations are thought to have no effect and just accumulate over time. Thus, mutation is a source of chance that enables evolution without requiring any unlikely events.

Still, mutations are rare, and mutations that affect a gamete are even

rarer. This raises the question of whether there is enough chance variation within a population. If not, then evolution would grind to a halt, and every organism would end up with the same type, a process called fixation. This has not happened yet, so there must be enough chance to have kept evolution going. But what are the sources of chance variation? Mutation is the main one. Even though rare, an accumulation of mutations over vast spans of time is enough to produce the changes we have seen. There are other sources as well. Evolution reduces variation in a population, so it is important to know what the possible sources are.

People arguing against evolution often use the argument that all living things could not have been produced by chance alone. This is a poor argument. Evolution makes no such claim.