ADVANCED READING

PASSAGE 1

Although much has been written about the theological conflicts with Darwinian theory, little is known of the powerful scientific objections that modified Darwin's beliefs.

During Darwin's lifetime, the accepted theory of heredity was not Mendel's theory of particulate inheritance, which, though published, was unrecognized, but the theory of blending inheritance, which holds that forms intermediate between those of the parents result from mating. Jenkin pointed out that if a rare and favorable mutation occurred, it would soon be blended out by repeated crossings from the wild-type form. Disputing Darwin's conception of evolution as proceeding through the natural selection of those with slightly better characteristics that arose randomly, Jenkin concluded that natural selection could not account for the tremendous diversity of life, hypothesizing that large numbers of organisms mutated simultaneously in the same direction—a controlled orthogenetic process resembling a series of "special creations."

Since "special creationism" was an ideological target of his, Darwin found himself in a quandary. Although he did not abandon his theory, he admitted that natural selection played a much smaller part in evolution than he had previously claimed. He also embraced the Lamarckian concept that acquired traits in parents are transmitted to their offspring, thus providing a mechanism by which an entire population could change in the same direction at once.

Another potent objection came from the physicists led by Lord Kelvin, who contested the assumption of previous geologists and biologists that life had existed for billions of years, if not infinitely. How, they asked, could evolution proceed by slow steps in millions of years, and how could advanced forms recently evolved show such great differences? The Kelvinists, basing their conclusion on the assumption that the sun was an incandescent liquid mass rapidly radiating heat, calculated that the age of the earth was between 20 and 40 million years.

Admitting that their calculations were correct and their premises rational, Darwin was forced to adjust this theory. He proposed that change had occurred much more rapidly in the past than in the present, where species seemed static, and that more advanced forms varied more rapidly than lower forms. This provided further reason to advocate Lamarck's theory of inheritance, because that could account for the rapid change.

Interestingly, both these retreats of Darwin were later shown to be faulty. The discovery that the sun runs on a nearly infinite amount of atomic fuel totally invalidated Kelvin's argument, Mendel was "rediscovered" in the twentieth century, when it was pointed out that the particulate nature of inheritance meant that favorable mutation not only could persist, but could rapidly become prevalent.

PASSAGE 2

In terms of its prevalence, obesity is the leading disease in the United States. There is no universally accepted standard for obesity, defined generally as an excess of adipose tissue, but a common rule of thumb classifies people who are more than 20 percent above their desirable weight as obese. By this measure, 30 percent of men and 40 percent of women in America are obese. Although studies show that few of these people will ever recover fully and permanently from the disease, the incidence of obesity in future generations can be reduced.

Adipose tissue is a triumph of evolution. Fat yields 9 calories per gram, while protein, like carbohydrates, yields only 4 calories per gram. Fat also contains much less water than protein does. Therefore, fat is much more efficient for storing excess energy than is protein. Primitive humans, with uncertain food sources, had a great need for excess fat, and their bodies adapted accordingly. Modern humans, with a predictable food supply and a sedentary life-style, are burdened by this vestige of evolution. Although they need some adipose tissue to provide insulation and protect internal organs from injury, modern humans need much less than their primitive ancestors did.

In an attempt to shed excess adipose tissue, many Americans turn from one fad diet to another, and a billion-dollar diet industry has grown up to aid them in their efforts. Nevertheless, the five-year cure rate for obesity is very low. In fact, by comparison, cancer is more curable. The reasons for this are psychological as well as physiological.

From a physical standpoint, losing a pound or two a week for a few weeks is not difficult because most of the loss is in the form of protein and water, and protein carries four times its weight in water. However, protein is also the only source of nitrogen in the body, and when the body loses too much nitrogen, it acts to correct the imbalance by excreting less nitrogen than it takes in. Hence beyond a certain point additional weight loss must come from adipose tissue, which, because of its compactness, takes longer to shed. The body's tendency to return to nitrogen balance and to protect its energy reserves can be so strong that dieters may stop losing or even gain weight while still expending more calories than they ingest. As a result, they frequently suffer not only from hunger, weakness, and a decreased metabolic rate, but also from depression and inactivity, all of which lead them to abandon their diets. Probably because of numerous psychological factors as well as physiological factors such as increased lipid synthesis, they then tend to regain weight rapidly.

While vigorous attempts to reduce obesity in America should be aimed at all affected, the most successful efforts are likely to be those directed toward children. If the advertising and food industries stop trying to sell high-calorie, nutritionally deficient food to children, and if parents understand that the feeding patterns they impose on their children can determine the adolescent and adult eating habits those children will develop, the future generation may not be as fat as ours is.

PASSAGE 3

Radiation occurs from three natural sources: radioactive material in the environment, such as in soil, rock, or building materials; cosmic rays; and substances in the human body, such as radioactive potassium in bone and radioactive carbon in tissues. These natural sources account for an exposure of about 100 millirems a year for the average American.

The largest single source of man-made radiation is medical X rays, yet most scientists agree that hazards from this source are not as great as those from weapons test fallout, since strontium 90 and carbon 14 become incorporated into the body, hence delivering radiation for an entire lifetime. The issue is, however, by no means uncontroversial. The last two decades have witnessed intensified examination and dispute about the effects of low-level radiation, beginning with the United Nations Scientific Committee on the Effects of Atomic Radiation, which reported in 1958 that "even the smallest amounts of radiation are likely to cause deleterious genetic and perhaps also somatic effects."

A survey conducted in Britain confirmed that an abnormally high percentage of patients suffering from arthritis of the spine who had been treated with X rays contracted cancer. Another study revealed a high incidence of childhood cancer in cases where the mother had been given prenatal pelvic X rays. These studies have pointed to the need to reexamine the assumption that exposure to low-linear energy transfer presents only a minor risk.

Recently, examination of the death certificates of former employees of a West Coast plant that produces plutonium for nuclear weapons revealed markedly higher rates for cancers of the pancreas, lung, bone marrow, and lymphatic system than would have been expected in a normal population.

While the National Academy of Sciences committee attributes this difference to chemical or other environmental causes rather than radiation, other scientists maintain that any radiation exposure, no matter how small, leads to an increase in cancer risk. It is believed by some that a dose of one rem, if sustained over many generations, would lead to an increase of 1 percent in the number of serious genetic defects at birth, a possible increase of 1,000 disorders per million births.

In the meantime, regulatory efforts have been disorganized, fragmented, inconsistent, and characterized by internecine strife and bureaucratic delays. A Senate report concluded that coordination of regulation among involved departments and agencies was not possible because of jurisdictional disputes and confusion. One federal agency has been unsuccessful in its efforts to obtain sufficient funding and manpower for the enforcement of existing radiation laws, and the chairperson of a panel especially created to develop a coordinated federal program has resigned.