

particular concern because they are used so widely and in such enormous amounts. Furthermore, they are very potent biologically; if they weren't they would not be effective pesticides. Although the mechanisms by which most pesticides kill, or inhibit growth, or sterilize the various animal and plant pests for which they are designed is thought to be unrelated to genetic mechanisms, our ignorance of chemical mutagenesis will not allow the assumption of safety without specific mutagenic tests.

What are mutations and what effects will they have on the human population? In its broadest usage, the word mutation is used to designate any inherited change in the genetic material. This may be a chemical transformation of an individual gene that causes it to have an altered function. Or the change may involve a rearrangement, or a gain or loss, of parts of a chromosome. This kind of change is often visible by ordinary microscopy. We shall use the word gene or point mutation to designate changes of the individual gene and speak of those changes which involve the larger chromosomal units as chromosome aberrations. In many experimental systems, these are easily distinguished, but in human studies, classification of an individual defect, as to whether it is due to a point mutation or a chromosome aberration, is not always possible.

Mutations may occur anywhere in the body. Frequently, the result is the death of the particular cell in which the change occurs. Most of the time this causes only local and transient damage, for most individual cells are quite dispensable. But if the change is of such a nature as to change the genetic functioning of the cell while still permitting it to divide, this change may be transmitted to descendant cells and the damage is then less localized. The effect may be cancer or it may be teratogenic; particularly if the change takes place during embryonic development. We are especially interested, of course, in those changes that occur in the germ cells—cells that are the progenitors of future generations. A mutation or chromosome change that is transmitted *via* the sperm or egg to the next generation can effect every cell in the body of the descendant individual, with consequences that may be disastrous.

What kinds of effects on the human being do mutations produce? Perhaps the most important fact to emphasize is that there is no single effect. Since every part of the body and every metabolic process is influenced by genes to a greater or lesser extent, it comes as no surprise that the range of effects produced by gene alterations includes every kind of structure and process.

At one extreme are consequences so severe that the individual cannot survive, so-called lethal effects. If the death occurs very early in