GENERAL SCIENCE

Effects Of Radiation

National Academy of Sciences after year-long study of the biological effects of atomic radiation warns that any radiation is harmful to life and urges recording each exposure.

The following is the text of the brief digest of findings and recommendations contained in the National Academy of Sciences report to the public on "The Biological Effects of Atomic Radiation."

➤ IT IS GENERALLY agreed that, in the peacetime development of atomic energy, man has been lucky. He has been dealing with an enormous new force whose potential effects he has only dimly understood.

Thus far, except for some tragic accidents affecting small numbers of people, the biological damage from peacetime activities (including the testing of atomic weapons) has been essentially negligible. Furthermore, it appears that radiation problems, if they are met intelligently and vigilantly, need not stand in the way of the large-scale development of atomic energy.

The continuing need for intelligence and vigilance cannot be too strongly emphasized, however.

The problems of radiation fall naturally into two main classes: (1) the effects on human beings (2) the various ways in which radiation can reach human beings through the environment.

Effects on Humans

The inheritance mechanism is by far the most sensitive to radiation of any biological system. Any radiation which reaches the reproductive cells cause mutations (changes in the material governing heredity) that are passed on to succeeding generations.

Human gene mutations which produce observable effects are believed to be universally harmful.

Everyone is subjected to the natural background radiation which causes an unavoidable quantity of so-called spontaneous mutations. Anything that adds radiation to this naturally occurring background rate causes further mutations, and is genetically harmful.

There is no minimum amount of radiation which must be exceeded before mutations occur. Any amount, however small, that reaches the reproductive cells can cause a correspondingly small number of mutations. The more radiation, the more mutations.

The harm is cumulative. The genetic damage done by radiation builds up as the radiation is received, and depends on the total accumulated gonad dose received by people from their own conception to the conception of their last child.

So far as individuals are concerned, not all mutant genes or combinations of mutant genes are equally harmful. A few may cause very serious handicaps, many others may produce much smaller harm, or even no apparent damage.

But from the point of view of the total and eventual damage to the entire population, every mutation causes roughly the same amount of harm. This is because mutant genes can only disappear when the inheritance line in which they are carried dies out.

In cases of severe and obvious damage this may happen in the first generation; in other cases it may require hundreds of generations.

Thus, for the general population, and in the long run, a little radiation to a lot of people is as harmful as a lot of radiation to a few, since the total number of mutant genes can be the same in the two cases.

It is difficult to arrive at a figure showing how much genetic harm radiation can do. One measure is the amount of radiation above the natural background, which would produce as many mutations again as occur spontaneously. It is estimated that this amount is 30 to 80 roentgens.

(The roentgen is a unit of radiation. To give an idea of its value, the average dental X-ray delivers five roentgens to the patient's jaw, but only five thousandths of a roentgen of stray radiation to more remote parts of the body such as the gonads.)

It is also estimated that a dose of ten roentgens to every person in the United States would cause something on the orde of five million mutant genes which would then be a part of the population's inheritance pool. This figure is subject to considerable uncertainty.

At present the U. S. population is exposed to radiation from (a) the natural background, (b) medical and dental X-rays, (c) fall-out from atomic weapons testing The 30-year dose to the gonads received by the average person from each of these sources is estimated as follows:

(a) background—about 4.3 roentgens

(b) X-rays and fluoroscopy—about 3 roentgens

(c) weapons tests—if continued at the rate of the past five years would give a probable 30-year dose at about 0.1 roentgens. This figure may be off by a factor of five, i.e., the possible range is from 0.02 to 0.5 roentgens. If tests were conducted at the rate of the two most active years (1953 and 1955) the 30-year dose would be about twice as great as that just stated.

If the exposure of the general population to radiation is limited to levels which the genetics committee believes reasonable (see

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BACK SEAT FLYING—In a cockpit installed in the main cabin of a T-29 airliner, a second pilot takes over control of the airplane once the regular pilot has taken it aloft. Hughes Aircraft Company engineer R. E. Moore is shown in the "plane within a plane" where test pilots can fly as though they were in an F-102 jet interceptor while ten Hughes engineers can simultaneously check operation of the electronic control system.