AEC Seeks Facts on Radiation

Commission, Supporting Half of the Research in U. S., Experiments at Oak Ridge With Effects on Mice

By Thomas R. Henry
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In the face of warnings from some of the world's most eminent geneticists that the human race may suffer great hereditary loss from atomic radiations, the Atomic Energy Commission is taking a by no means complacent attitude.

There is room, its biologists point out, for very considerable

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differences of opinion, from complete catastrophe to insignificant damage from any radiation increase. A major need, they point out, is to get more facts.

AEC Is Pushing Research.

That the commission is not unconcerned, they say, is shown clearly from the fact that it now is supporting at least half the genetics research in the country.

It also is making determinations of the actual radiation increase which, the latest calculations indicate, throughout the lifetime of the average individual is only about a 30th of what would be received anyway. Admittedly in the event of an atomic war the situation might become quite different. The amount varies quite considerably from place to place.

Still, according to Dr. Earle Green, who is directing genetics research, the problem is "one of the most important facing the country today."

Among geneticists, Dr. Green stresses, there is a "spectrum of opinion" ranging from the prophets of catastrophe to those who see nothing to worry about. As the case stands no positive answer can be given to any, although the commission's biologists feel that some predictions of disaster have gone altogether too far.

Mice in Experiments.

The biologists are working with mice, probably the closest animals to man which can be used in large numbers and about whose hereditary constitution something, although admittedly not very much, is known. "The mouse is a fast breeder, although not comparable to a fruit fly. Also it can stand somewhat more radiation than man.

The most far-reaching experiment under Atomic Energy Commission auspices at present is being conducted at Oak Ridge, Tenn., by Dr. W. R. Russell. He is using several hundred thousand mice of a strain which has been bred in laboratories for many generations.

In these mice the location and effects of seven genes are known. All are relatively unimportant, so far as the welfare of the animal is concerned. All but one cause slight changes in fur color.

The sex glands of all the males are irradiated very heavily—with 300, 600 and 1,000 roentgens. Then they are mated with non-irradiated females whose coat color gene constitution is known.

Results of Experiments.

The results to date are that on the average there is one gene mutation, among the known seven genes, of once in a hundred million times per gene per roentgen of radiation. Nobody knows the number of genes in a mouse. It is at least 5,000—probably several times 5,000. The number is not believed to be as great as in man.

Some genes among the seven are more likely, the experiments show, to mutate than others. Some of those unlocated and unknown may mutate much more, or much less, frequently.

Another experiment, started so recently that no results have yet been obtained, is being conducted by Dr. W. Frank Blair of the University of Texas. Dr. Blair has a 10-acre farm near Austin. It is infested by considerable numbers of "deer mice," curious, human-acting little animals who collect all sorts of things in their nests.

Around the farm Dr. Blair has placed nesting boxes. The pack mice tend to take these over, rather than build their own nests. Once a pair has taken over a nest the Texas zoologist captures the male and irradiates its sex glands. Then it is turned loose—a completely wild animal again. Each male is tagged. All the offspring of his mate, of whose genetic constitution nothing is known, are tagged. The purpose is to determine the effect of the relatively light radiation on the number, size and quality of the offspring.

Effect May Be Good.

Good, as well as bad, may come from genetic mutations. Presumably all the improvements in all kinds of life on earth since time began have been the result, over periods of milleniums, of changes in germ plasm which become fixed in hereditary lines.

This point has been raised in respect to possible mutations which are expected to result from increase in the earth's residual radioactivity, combined with preservation of somewhat unfit lines due to advances in medical science. It generally is agreed that at least 90 per cent of mutations are bad, but there is always the possibility that one good one may outweigh many bad ones.

There is a relatively new doctrine in the science of genetics known as the "selective advantage of hetrozygotes," Dr. Green points out. It holds that evolution tends to favor certain hereditary changes. The situation admittedly is quite confused.

The point was raised, for example, by Dr. Gordon Allen of the New York State Psychiatric Foundation at a recent conference at the National Institutes of Health at Bethesda in response to questions raised by Robert Cook, editor of the Journal of Genetics.

Effects Explained.

The effect of the advances in medicine, Dr. Allen pointed out, is a relaxation for the time being, so far as man is concerned, of the harsh law of tooth and claw. The somewhat unfit no longer are so rigorously eliminated by nature. A rough analogy, he pointed out, might be made with the pre-eocene period of the earth's history which followed the extinction of the great dinosaurs. At the start of this period mammals were relatively few, weak, and little differentiated. They had had great difficulty in surviving in competition with the reptiles. Then they found themselves without serious competition. All sorts of hereditary factors which previously would have meant elimination could operate.

At least partly as a result of this came a speeding up of evolution and the appearance of the remote ancestors of all the mammal species known on earth today. Then came the first dog-like creatures on the way to becoming dogs and the first monkey-like creatures.

Something remotely comparable might happen again, Dr. Allen stressed. Development of "previously impossible mechanisms of immunity or of brain function will improve the average of the species," he said.

No Opposing View.

A quite different viewpoint was expressed by Dr. E. R. Dempster of the University of California. The human race, he stressed, has an enormous investment of past suffering in the basic genes it possesses today, and cannot afford to take chances. Recovery of any lost through mutations would entail an equally heavy price from future generations.

Competent scientists who feel that an increase of mutations will be advantageous appear to be few and far between, although there is much disagreement as to precise effects.

The attitude of the Atomic Energy Commission is to get as much objective evidence as possible upon which sound opinions may be based, but without much hope of actually settling the problem.

Glossary of Genetic Terms

The following glossary will be found helpful in connection with Science Editor Thomas R. Henry's seven-story series exploring the effects of atomic radiation on the human race:

Gene—An invisibly minute particle of protoplasm which is the recognized unit of heredity. It has the unique property of "guiding and bonding together of raw materials around it into an exact duplicate of itself." Each of the trillions of cells which make up the human body contains the full human complement of thousands of genes. Those in the germs cells are passed on to the next generation.

Chromosome — A fine thread thousands of times longer than thick, differentiated along its length into hundreds or thousands of functionally distinct and individual self-reproducing regions—the genes. Every cell in the human body has 48 chromosomes.

Gamete—The mature germ cell of one individual, plant or animal.

Zygote—The union of two germs cells to constitute a new individual.

Homozygote—An individual who receives identical genes from both parents.

Heterozygote—An individual with parental chromosomes which do not completely match.

Mutation—A change in the gene structure of protoplasm which results in changed hereditary characters.

Half-life—The interval during which half of any radioactive originally present will disintegrate. Uranium has a half-life of several billion years. Radioactive iodine used in thyroid treatments has a half life of eight days. After six half lives, it is calculated, only infinitesimal traces of the original substance will remain.

Roentgen—The accepted unit of radiation defined as "the quantity of gamma or X-rays that will produce a certain electrical conductivity in a cubic centimeter of air under constant pressure and temperature.

Gamma Rays—Exceptionally potent X-rays, the principal radiation causing genetic damage.

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