Shadow of the Atom

Genes as Radiation Targets

Minute Particles of Human Matter Offer Key To Biological Effects of Grim Experiments

By Thomas R. Henry
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The threatened "genetic poisoning of mankind" by atom and hydrogen bombs involves invisible, by and large undetectable, forces working slowly, insidiously but perhaps inevitably toward a final chaos. To many there is something semimystical about the elements involved but they are just as real as the equally invisible atoms and molecules. Their reality has been established by a century of biological research since they first were postulated by the Bohemian monk, Gregor Mendel.

Editor's Note—An invisible, slow-acting, largely undetectable poison may be acting on the human race. This poison consists of the radiations from radioactive materials released by experimental bomb explosions. The danger it is stressed, is not to individuals per se, but to the race itself. This is the second of a series of six articles in which Thomas R. Henry, The Star's science editor, explores the situation.

There must be at least an elementary understanding of them, say the prophets of racial doom, before mankind can appreciate its danger.

The Function of Genes.

Presumably most physical forms and functions of both fruit flies and men are regulated by "genes" and combinations of "genes." These are invisibly minute particles of protoplasm bound together in chainlike structures. If the nature of one of these genes is altered its influence will be different. In a human, for example, the influence of a certain combination of genes might activate the physiological process of forming a certain type of blood cell. If the gene is chemically changed this particular type of blood cell will not be formed.

A human being, according to Dr. Herman J. Muller of the University of Indiana, has at least 15,000 genes and probably double that number. There is no way of counting them. It is known that 30 genes, acting in combination, determine the color of eyes in fruit flies. Double that number may function in determining the eye color of man. The genes of two parents combine to form the gene structure of an individual. A gene from [illegible] may be dominant [illegible] or partly dominant and partly recessive. If a gene determining some function is dominant some function is process of this function in the offspring as against a recessive gene for the same function from the father. But the offspring still will carry in his germ plasm the recessive gene. It will remain in the germ plasm stream of this hereditary line for generations, possibly forever. Perhaps it never will become manifest. Perhaps, sooner or later, two parents will have the same recessive gene and the dominant one will disappear from their offspring.

This, Dr. Muller says, is an oversimplification, although widely taught in genetics courses. It is quite unlikely, he believes, that there are many absolutely recessive genes. As long as one of them remains in the germ plasm it exerts some influence—perhaps a 20th the effect of a dominant. This means that a person who receives a recessive gene which happens to be detrimental is not quite so well off, so far as the particular purpose it serves is concerned, as if he didn't have it.

Everybody's genes constantly are undergoing changes, or "mutations." It is a general, although by no means absolute, rule that disadvantageous changes in one parent will be recessives—that is, a gene in the normal parent will take over control in the offspring. But the [illegible] tends to assert itself when an opportunity arises and it almost always will exert some influence.

Long Delay in Effects.

The hereditary effects may not appear at all for several generations. If the mutations are immediately lethal, these may never appear. Thus, Dr. Muller points out, the study of the first generation offspring of individuals who got heavy doses of radiation in the bombings of Nagasaki and Hiroshima has very little meaning. The mutations caused in the germ plasm would be largely recessives. No great increase in "monsters," or otherwise obviously abnormal people, can be expected in a generation. But there may be more of them in the still unborn second generation and still more in the third and fourth. The recessives have been added permanently to the genetic heritage of mankind. There is no way of getting rid of them arbitrarily.

It is generally agreed that about 99 per cent of mutations in men, or fruit flies, are harmful. Some of them are only mildly harmful. These are known as "sub-lethals." There are enormous numbers of these, says Dr. Muller. They are in the germ plasm of every human being. They often affect only obscure mechanisms of the enormously complicated process of living.

They are responsible, Dr. Muller believes, for many of the [illegible] in later years, failures in some sort of metabolism, lack of functioning of certain physiological chemicals, and the like.

Everybody is loaded with them but there is no way to detect their existence.

Tomorrow: Mutations and the part played by radiation in gene changes.

Glossary of Genetic Terms

The following glossary will be found helpful in connection with Science Editor Thomas R. Henry's six-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 germ 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 26 chromosomes.

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

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

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

Hetrozygous—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 principle radiation causing genetic damage.

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