

PUBLIC HEALTH

No "Safe" Radiation Dose

Experiments with mice indicate that some radiation effects are long-lasting and that, insofar as future generations are concerned, there can be no safe radiation dose for man.

► THERE IS no period of safety after exposure to harmful radiation, a geneticist reports.

Radiation has been found to affect the primitive germ cell from which the sperm develops. Chromosome abnormalities may be transmitted to offspring in dangerous numbers for a long time after irradiation of the male.

This also is important evidence that there is no such thing as a "minimum permissible dose of radiation," says Dr. A. B. Griffen of the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

Until now many scientists had believed the effects of irradiation on the male sex organs were not long-lasting. Past experiments with mice seemed to indicate that after the supply of all the directly affected mature sperm had been exhausted, changes in chromosomes will not be passed on to the offspring.

A pilot study using mice indicates, however, that "for the mouse, and presumably for man, there is no period of safety after

irradiation" and visible, detectable breaks in chromosomes or aberrations, can be passed on to offspring, Dr. Griffen reports in the *Proceedings of the National Academy of Sciences* (July).

He points out that of 20 irradiated male mice studied for a period of six to 11 months, 18 produced a total of 706 offspring that lived through the testing period. Almost one-third of the offspring showing semisterility (26 of a total of 95) were born six months or more after the parent had been irradiated.

Semisterility means that one-half the offspring are dying before birth. Examination of the female will show evidence of the aborted fetus.

Apparently, the sperm carrying chromosome aberrations were produced from germ cells that had been irradiated in their very early and primitive stages, Dr. Griffen explains.

The damaged chromosome or chromosomes persisted through the development of the mature sperm. An earlier assumption

had been that irradiation of the primitive germ cells did not result in many aberrations in the sperm itself.

The chromosomes of "grandchildren" of one irradiated mouse show that a major chromosome change, a translocation, had occurred. Large pieces of chromosomes had switched places.

Further studies are underway, Dr. Griffen reports, to determine how long "translocations and perhaps other aberrations in dangerous number" may be transmitted after irradiation. Although the experiments are conducted with mice, it may be possible to estimate the effects of irradiation in man and his children.

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ASTRONAUTICS

Test Use of "Pinch Effect" To Make Mars Flight

► USE OF the "pinch effect" employed in experiments for controlling thermonuclear fusion to propel an unmanned vehicle on a one-way flight to Mars is being tested.

Alfred Kunen of Republic Aviation Corporation reported initial development of such an outer space engine to the western regional American Astronautical Society meeting at Stanford University. His interplanetary reconnaissance vessel would be equipped to photograph Mars from a height of 300 miles, then relay the pictures to earth.

Mr. Kunen said the engine would turn liquid oxygen into a plasma, the so-called fourth state of matter in which molecules are broken up into negative electrons and positive ions but the whole is nearly electrically neutral, although capable of conducting electricity. He said the magnetic pinch plasma engine would provide tremendous power for a comparatively small amount of fuel.

An electric current shot through the oxygen or other fuel starts the break-up of molecules, finally creating a cylindrical magnetic field surrounding the plasma. This magnetic cylinder pinches the plasma into a tiny area that is so designed the plasma shoots out the rear of the engine at very high velocities.

The electricity necessary to produce the magnetic pinch would come from a turbine generator that converted nuclear heat into electrical power.

Mr. Kunen suggests that the space ship would be accelerated through the earth's atmosphere into orbit with either conventional or nuclear rockets. Once in space, the plasma engine would propel the vehicle into interplanetary flight. A payload of 6,000 pounds could be sent on the unmanned trip if the take-off vehicle weighed 35,500 pounds.

Thermonuclear fusion experiments aim at fusing some of the basic particles of the pinched gas, Mr. Kunen noted. Comparisons between his space propulsion engine and thermonuclear experiments "cease" once the pinch has been effected. Mr. Kunen has designed the electrodes with disk shapes in order to direct the high velocity gases out through a nozzle.

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SPACE SHIP ENGINE—In a control room behind a protective glass wall Mr. Alfred Kunen (right) and associates at Republic Aviation Corp., Farmingdale, N. Y., run a test on the experimental apparatus of a "magnetic pinch plasma engine." In the high vacuum chamber (top, left), an electrical current, generated in the lower section, acts on a heavy gas and turns it into a plasma which is "pinched" and shot out of a nozzle outlet at very high velocities.