

ARE WE ENDANGERING OUR CHILDREN'S CHILDREN?

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Dr. Puck believes these observations explain many of the heretofore baffling effects of radiation on human tissue. Dr. Puck thinks that exposure to a dangerous dose of radiation from any source causes invisible damage in cells in all parts of our bodies but that the damage shows up first in the tissues that multiply the most rapidly. Body functions that require constant cell reproduction during a human lifetime are affected first and so cause damage to the entire system.

This may explain the extreme vulnerability of human blood cells to radiation and also why children are much more sensitive to radiation damage than adults. It may also explain why unborn babies, in the fastest-growing stage of human life, are the most terribly vulnerable of all. Moreover, according to this theory, if radiation's effects don't show up until the cells divide, damage done in less than a trillionth of a second today may cause crippling illness or death many years later—or, through defective genes, create "inborn errors" to be passed along to future generations.

How Does This Damage Menace Future Children?

In human beings mutations caused by defective genes may bring about the development of a defective baby which is miscarried or stillborn; or they may result in the birth of a child with any one of a number of deformities, such as harelip, cleft palate, clubfoot, mongolism, malformations of the heart, brain, or other organs, or congenital diseases such as diabetes. Or they may result in a child who appears to be normal but who carries the damaging mutations in his reproductive cells so that the deformities may show up in still later generations.

It is estimated that there are now about 80,000 children born with genetic defects in the U.S. each year. As a result of a rise in birth rate and drop in infant mortality, the mounting number of children with congenital malformations of the heart and extremities, or with mental deficiencies is creating a problem for U.S. medicine. There has been a steady national rise in the number of children admitted to hospital wards for the treatment of these conditions, and there is a grave risk of a further rise because of excessive and unnecessary radiation.

Geneticists, who have made a specialty of the study of cells, are convinced that there probably is no "safe threshold" below which radiation does not produce mutations in human reproductive cells. Each dose, no matter how small, carries some risk to future generations.

Some doctors and scientists, including myself, believe that this fact presents the greatest threat to our society as a whole because, in addition to outright abnormalities, radiation-

induced defects might create much more subtle damage in the earth's populations in the form of increased susceptibility to disease or general premature aging. It is not possible to notice these effects in one individual or perhaps not even in one generation. Instead, the change could be more insidious, affecting human society by eventually producing a more sickly race of people, or perhaps lowering human intelligence and increasing mental disease.

How Does Radiation Affect the Human Body?

In large total-body doses, radiation kills a human being in a matter of hours. In smaller localized doses, it can burn the skin, ulcerate the digestive tract, cause hair to fall out, and damage the bones, eyes, blood, and reproductive organs, and bring about temporary sterility, nausea, and weakness. So subtle are its injurious effects on human tissues that it may take not just months, but years and even decades, before the individual subjected to an overdose is stricken with a crippling or fatal illness.

Doctors and scientists who work with X rays and radioactive materials have lost fingers, toes, and arms. Some have died from excessive doses of X rays to which they carelessly or unwittingly exposed themselves. One survey suggested that the total incidence of miscarriages, stillbirths, and birth deformities was higher in the families of radiologists than in another group of doctors who did not use radiation in their medical practice.

There is not the slightest doubt that radiation can cause cancer. The earliest cases were noted among scientists who first handled X rays at the turn of the century. Later, miners working in a radium-ore mine succumbed to lung cancer. Since then, many people have developed cancer in various forms after being treated for all sorts of diseases with heavy doses of X rays. Large amounts of radioactive materials that concentrate in the human skeleton, for example, may cause anemia, leukemia, and bone cancer as late as 20 years after exposure. More recently, experiments have shown that bone cancer can be produced in animals by subjecting them to X rays or injecting them with radioactive substances including strontium-90. Among Hiroshima survivors exposed to heavy radiation, the incidence of malignant tumors has been found to be twice as high as in the rest of the population, including cancers of the lung, stomach, breast, ovary, and uterus.

Proof of radiation's role in causing leukemia is now overwhelming. In Japan, the increase in deaths from leukemia among persons subjected to atom bombing in Hiroshima and Nagasaki began to occur within two years after the war and is still increasing. The degree of risk, according to scientific reports, appears to be clearly related to the amount of radiation received.

In England, scientists studying children who died of leukemia and other cancers checked the radiation records of their mothers and found that there was a strong correlation between mothers whose abdomens had been X-rayed during pregnancy and the children who developed fatal leukemia. Similar studies in this country and New Zealand have shown the same increase among children whose mothers were subjected to X-ray examinations of the pelvis during pregnancy.

What is most disturbing is that the overall incidence of leukemia in this country and elsewhere is rising. In a comprehensive study in England and Wales, British scientists found a steady increase in the fatal disease between 1945 and 1957. And they pointed out that radiation appears to be the only known leukemia-causing agent to which most of the population of the world is exposed.

Getting closer to home, it has become increasingly evident that exposure of American children to excessive X-ray treatments may be a major factor in producing cancer in young people. Within the past few months, Dr. Milton Edgerton of Johns Hopkins University presented evidence that in eight out of every ten cases of thyroid cancer in children under 17 years of age, the child had previously received substantial X-ray treatment to the head, neck, or chest region for some nonmalignant condition such as acne or sinusitis.

The interval between the X-ray treatments and the development of the thyroid cancer ranged from three to 12 years. The study suggested that the thyroid gland of children and infants is much more susceptible to cancer-producing effects of radiation than that of adults, and it raised this question: is the radioactive iodine in the fallout from bomb tests, which is absorbed into the milk supply drunk by many children, also increasing this kind of cancer?

There Are Many Questions to Be Answered

It is because no one really knows the answer to such questions that the National Academy of Sciences recently stated: "In some respects the estimation of human radiation hazards is more difficult than it appeared to be in 1956."

We have been thoroughly warned about the hazards of radiation by biologists, radiologists, geneticists, and surgeons. Dr. Lauriston Taylor, chairman of the National Committee for Radiological Protection, has said:

"We have a deep moral responsibility to make certain that the (radiation) problem does not become a critical one for those who follow us. We are thus inescapably compelled to consider, and consider carefully, the question of the long-range use of all radiation sources to be certain that any level we set is not seriously exceeded and, secondly, to be certain that no one source causes us to use up our (radiation) exposure allowance at the expense of other uses, which may in fact be more essential to over-all health and well-being."

As we face the mounting peril from radiation, as it comes to play an increasingly critical role in the lives of all men and the children of generations to come, it is important to remember that ever since the human race sought to undertake to harness man-made radiation, we have always gravely underestimated its injurious effects and thus have brought tragedy to an individual, a family, or even huge groups of people.

Now we can no longer continue believing in "safe" levels of radioactivity. We must face this danger squarely—but how?

(In the next issue of *Family Weekly*, Dr. Senn will present a frank examination of the sources of mankind's greatest menace—and tell how medicine, science, government, and you yourself can help curb the growing danger of radiation.)