

# What Physicians Should Know About the Biological Effects of Ingested Fission Products

by Gary Null, Ph.D., Ernest Sternglass, M.D. and Jay Gould, Ph.D.

As the Cold War that spawned the nuclear arms race and the attendant need for secrecy is ending, the long hidden story of the enormous effects of nuclear weapons production and testing that has devastated US health and productivity can finally be told. Moreover, without a nuclear threat from a dismembered Soviet Union, we can now hope that a new generation of political leaders, scientists, physicians, and public health officials will be able to face the tragic facts emerging from the studies of the millions exposed to the fallout from Chernobyl and other large releases dating as far back as 1944. It is imperative to end the enormous rise in the incidence of low birth weights and cancer now driving the cost of health care and threatening the economic well-being of the nation.

We now know from recently declassified documents, that in 1945, in the rush to produce plutonium for the initial atomic bombs detonated in 1945, some 555,000 trillion picocuries of radioactive iodine were released into the biosphere from the Hanford nuclear weapons complex in Washington. We also now know that there was an immediate increase in the percentage of underweight births as far away as New York State. This phenomenon began in 1945, accelerated rapidly with the first A-bomb explosions by the US and USSR in the following years and reached peak levels in the mid-1960s, along with corresponding peaks in the level of strontium-90 levels measured in human bone.

After declining from its highest levels after the atmospheric test ban came into effect 30 years ago, within the last seven years, the percentage of low birthweight babies has again begun to rise in the U.S. We are now experiencing an unprecedented rise in the number of people requiring medical care and disability payments that have been driving state and local governments, particularly in the Northeast regions of the U.S., into insolvency, increasing the federal deficit, and threatening the nation with bankruptcy if not brought under control.

Recent studies now suggest that one hitherto neglected factor is the unexpectedly severe biological action of radioactive releases from aging nuclear reactors into the milk and water supplies of major metropolitan areas. These releases act as a secondary insult to the immune systems initially damaged by the fallout from atmospheric bomb tests in the period extending roughly from 1944 to 1965, equivalent to some 40,000 Hiroshima bombs.

We have assembled 9 exhibits that document the unexpectedly large effects produced by inhaled or ingested nuclear fission products on the immune system, leading to premature birth, to low birthweight, and renewed rises in infectious diseases and cancer, as first anticipated by Andrei Sakharov in 1958 and recounted in Chapter 14 of his recently published *Memoirs*. The biological mechanism involved was discovered in 1971 by Dr. Abram Petkau. A physician trained in biophysics, working for the Canadian Atomic Energy Establishment in Pinowa, Manitoba, he performed a simple experiment on a lipid membrane that completely overturned conventional ideas on the biological damage produced by extremely low levels of radiation.

All of the research and experience of the scientific and medical community since the discovery of X-rays and radioactivity just before the turn of the century did not warn us of the seriousness of low doses of radiation from internally deposited fission products. As explained in *The Petkau Effect*, by Ralph Graub, and just recently published by Four Walls Eight Windows in New York, the successful experience with the medical uses of X-rays without side effects

convinced the nuclear scientists who developed the atomic bomb that its principal effects would be produced by blast and fire. Fallout from drifting radioactive fallout was believed to produce very low doses, far below the levels of background radiation from cosmic rays, natural sources and diagnostic X-rays and therefore considered to present no significant danger.

Petkau's discovery was first published in the March 1972 issue of *Health Physics* under the innocuous title "Effect of Na-22 on Phospholipid Lipid Membranes." In it he describes how he found that cell membranes immersed in water which had had withstood X-ray doses as large as hundreds to thousands of rads without breaking, ruptured at less than one rad when subjected to low intensity, protracted radiation such as that produced by radioactive salts immersed in water.

This finding was completely contrary to all previous observations of biological damage by radiation such as genetic effects, and cancer induction in laboratory animals or humans, which had shown almost no dependence on the rate at which radiation is delivered to tissue.

As Petkau and his associates discovered, the cell membrane damage due to low level radiation was the result of a completely different biological mechanism than the direct hit on the DNA molecules in the nucleus of cells exposed to high doses of radiation. They found that the cell membranes were destroyed by the action of negatively charged oxygen molecules or "free-radicals," produced by the absorbed radiation from the life-giving oxygen dissolved in the surrounding fluid. This highly toxic form of oxygen diffused to the outer surface of the membrane, where it initiated a chain reaction that dissolved the membrane in a matter of minutes to hours, causing the cell to leak and die.

It became clear that a single free-radical molecule was sufficient to destroy an entire cell, so that only a handful was needed to be produced per cell-volume at very low dose rates. But at high dose rates, many millions would be formed in the same volume in the lifetime of the molecule. This results in a form of "overkill," much like the case of a balloon, where a single dart is enough to destroy it, and throwing millions of darts is wasteful. In fact the more free-radicals are created in a given volume (as from higher levels of radiation intensity), the more they tend to collide with each other, causing them to become deposited in living tissue; high doses given at the rate of 10,000 rads per minute were found to be 100 billion times less efficient in destroying a cell than at one ten-millionth of a rad per minute, the rate at which we experience background radiation.

The consequence of the enormously greater efficiency of internal radiation at low dose rates is that the dose response curve rises very rapidly at the small doses and dose rates near background radiation, and flattens out at high doses and dose rates, so that the risk per unit dose declines with increasing dose rates.

Thus we have what appears to be a perverse situation in which low doses protracted over periods of days, months or years are far more dangerous, per unit of absorbed radiation, than high doses from external sources. Mathematically, this turns out to be of the form of a concave downward or logarithmic relation between dose and the biological response for individuals exposed to different amounts of radiation during a given time period, as in the case of releases into the environment that enter the diet and concentrate in critical organs such as the bone marrow, the thyroid and the pituitary gland.

Thus the so-called "Petkau Effect" explains why man-made fission products such as strontium-90 concentrating in the bone,

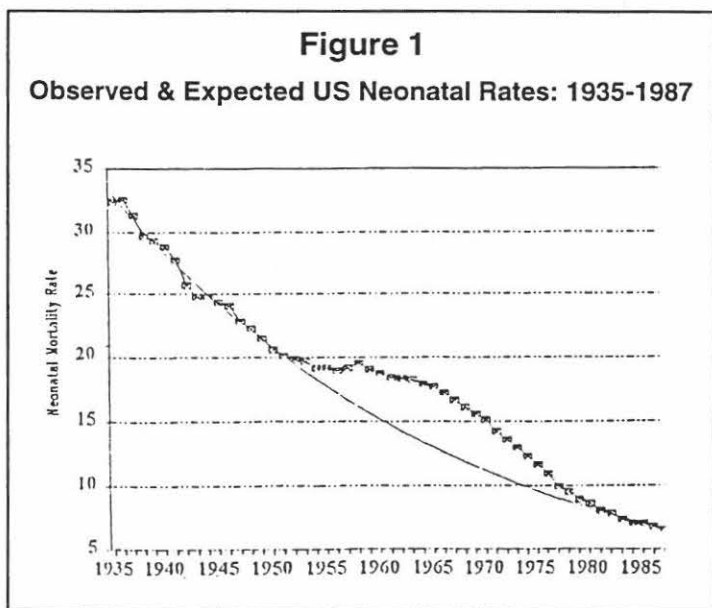
introduced into a pristine biosphere in the earliest years of the nuclear age did so much more damage to the immune system cells than had been believed possible based on our experience with medical X-rays or the study of animals exposed to high radiation doses.

The damage to the immune system of young women of childbearing age leads both to a higher risk of pelvic infections and a greater likelihood of an immunological rejection of the fetus as a foreign body, thus producing a rise in premature and underweight births. Moreover, the fission-produced bone-seeking isotopes such as strontium-90 and 89 emit powerful beta rays with a large enough range to reach the marrow where the cells of the immune system originate, making them far more toxic than the naturally occurring radium which emits heavy alpha particles of such short range that most of them remain in the bone.

In summary, we have found that the most immediate biological effect of the introduction of man-made fission products into the environment was an enormous increase in miscarriages and the birth of premature and underweight infants at high risk of birth defects and subsequent neurological, hormonal and immunological problems. This results in greatly increased medical expenditures to keep each infant alive, and correspondingly high subsequent educational and welfare costs to society. This problem was most acute in the atmospheric bomb test years when the U.S. and the USSR exploded the equivalent of 40,000 Hiroshima bombs, according to the Natural Resources Defense Council, but it has continued as a result of reactor accidents and large daily releases due to cracking of fuel elements and the corrosion of heat exchangers. These problems are compounded by another effect of fallout that Sakharov anticipated in 1958, namely the increased mutation rate of microorganisms, which is greater at low rather than high dose rates because of the Petkau effect.

Recent articles in *Science* delineate the enormous public health crisis set off by the increasing resistance to antibiotics of those mutating microorganisms responsible for AIDS, tuberculosis, shigellosis, salmonella, toxic shock syndrome, Lyme disease and many other newly emerging and old infections. Thus in addition to causing immune deficiency, fission products would accelerate the mutation rate of microorganisms leading to new epidemics on a world-wide basis, and the new strains would be far more deadly.

The 9 statistical exhibits shown below are taken from a forthcoming book on *Fallout and Immune Deficiency* by J.M. Gould and E.J. Sternglass.



## Ingested Fission Products

### Radiation and Low Birthweights

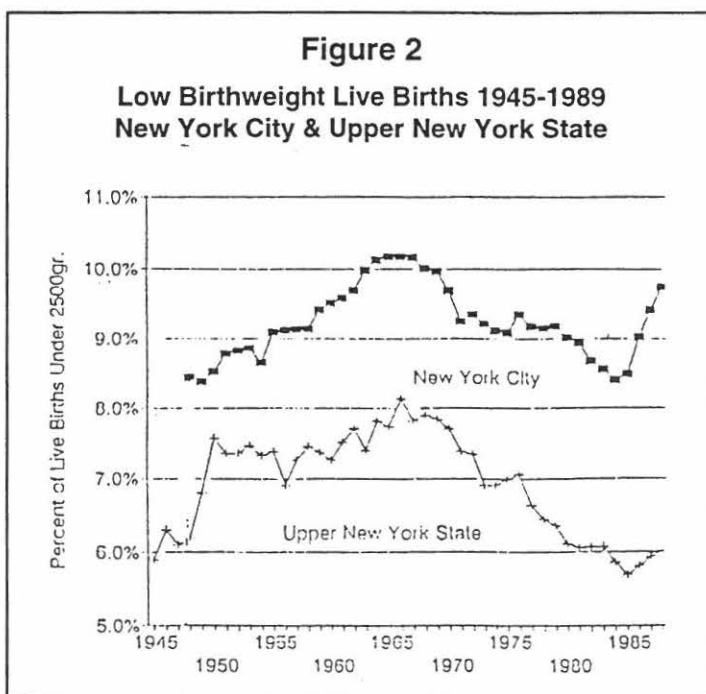
As shown in Figure 1, in an article published in the *British Medical Journal* (Feb. 1992) Dr. R.K. Whyte, a Canadian Professor of Pediatrics, found that falling rates of neonatal and first day infant mortality since 1935 were interrupted in the early 1950s, reaching a maximum upward deviation in the mid-1960s. The hypothesis that the observed infant mortality could be attributed to restrictions of oxygen for premature infants was ruled out by the fact that the same rise and decline occurred for stillborn infants, and only fallout could account for the excess.

As shown by Figure 2 an even more sensitive indicator of the damage to the developing fetus is the increase in the percentage of live births weighing less than 5.5 lbs. In upper New York State, this percentage rose from 6% in 1945 to an all-time peak of 8% in 1966, when the radioactive strontium build-up in the bones of New Yorkers also reached an all-time peak. Since 1945 13 million underweight babies have been born in the U.S. For New York City, the decline is seen to have halted in the early 1970s, but rose sharply after 1985, as will be discussed below.

The causal link of the rise in low birthweights to fission products is dramatically illustrated in Figure 3, as indicated by a 70% rise in Nevada in 1951 in the low birthweight percentage when above-ground testing began at the Nevada Test Site, and winds carried radiation clouds over Las Vegas. While later more care was taken to avoid densely populated Las Vegas, the low birthweight percentage in Nevada remained above average until well after testing was shifted underground after 1963. Note the recent rise in U.S. low birthweights, especially for non-whites, which can be attributed to increased underground tests and fallout from Chernobyl and U.S. reactors.

### Nuclear Emissions Since 1970

As indicated in Figure 4, official NRC data shows that civilian power reactors in the period 1970-87 released into the atmosphere 370 curies or 370 trillion picocuries of radioactive iodine, strontium, cesium and other fission products. This amounts to 1.7 million



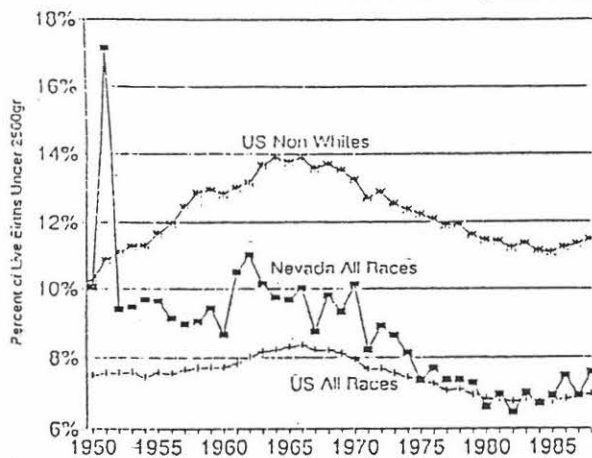
# Ingested Fission Products

picocuries for every person in the U.S., in the units in which dangerous levels of radioactivity in milk and water are measured.

Figure 5 shows that since civilian nuclear power reactors are largely concentrated in the New England, Middle Atlantic, and East North Central regions, per-capita releases of radioactive iodine, strontium etc. in these regions is some 25 times greater than in the three regions that have only a few reactors, namely the 16 states in the Mountain and East and West Central regions. We show below that in these relatively "nonnuclear" regions there are statistically significant lower rates of cancer, including especially breast cancer. We have found that along with low birthweights, the most sensitive indicators of the delayed damage that ingested nuclear fission products does to human immune systems, are breast cancer incidence and deaths due to infectious diseases.

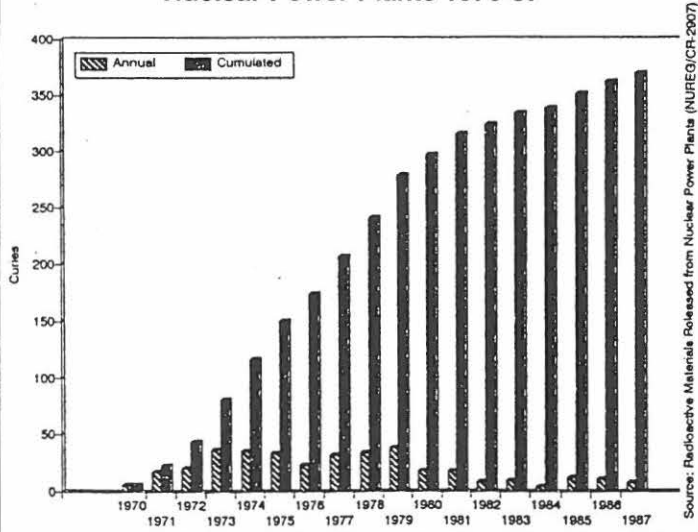
**Figure 3**

**Percent of Live Births Weighing Under 2500 Grams  
US All Races and Nevada All Races, 1950-88**



**Figure 4**

**Iodine 131 & Particulates Released from  
Nuclear Power Plants 1970-87**



Source: Radioactive Materials Released from Nuclear Power Plants (NUREG/CR-2807)

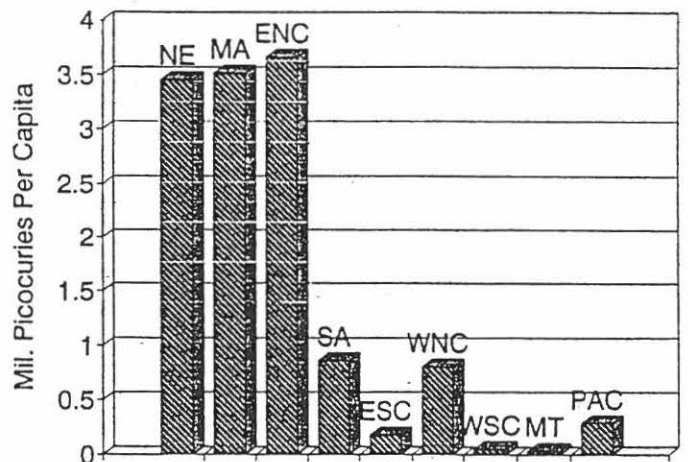
Figure 6 shows that in 1985 and 1986 the Indian Point reactors close to New York City released 14 curies of I-131 and other fission products, as did Three Mile Island in 1979, while the Millstone reactors had equally large releases in the early 1970s. The Indian Point releases may have sufficiently contaminated the nearby reservoirs to explain the recent disturbing increase in NYC low birthweights after 1985 shown in Figure 2. The epidemic rise of breast cancer incidence in Connecticut and Long Island can be shown to be highly correlated with emissions from Millstone, beginning in 1970.

## Radiation and Female Cancer

As shown in Figure 7 after the start of large reactor releases in the early 1970s and since the 1979 Three Mile Island accident, breast cancer incidence rates have soared, along with the incidence rates for all types of female and prostate cancer just about seven to nine years after the large releases from Three Mile Island. Mortality rates have increased less rapidly, thanks to advances in diagnosis and therapy. But it is clear that the real explosion of the medical costs of treating cancer are associated with the rising trend in cancer incidence.

**Figure 5**

**Regional Per-Capita Exposure to I-131 & Particulates  
Million Picocuries, cumulated from 1970-1987**



**Figure 6**

**Airborne Emissions of Radioactive Iodine, Strontium  
Indian Point & Millstone Reactors**

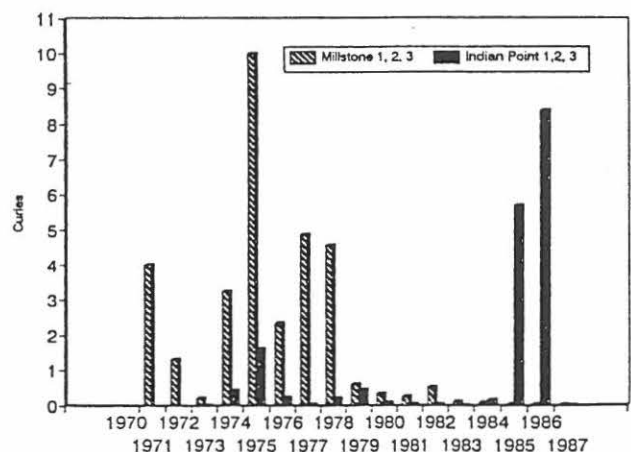


Figure 8. Here we have taken the age-adjusted breast cancer mortality rates for 1984-88, as calculated by the National Cancer Institute for each state, weighted them to secure averages for each of the nine Census regions, and then correlated them to the log values of the per-capita releases to radioactive iodine and strontium for each region, as shown in Figure 5. The correlation is seen to be very high and could not be the product of chance, and is a good example of the Petkau Effect. The risk per unit dose is seen to be highest at low doses.

Figure 9 shows breast cancer incidence in Connecticut for the period 1935-79, taken from the Connecticut Tumor Registry. Here we have fitted a straight line to the breast cancer incidence for women age 50-74 from 1935 to 1970, just before the Haddam Neck and Millstone reactors began operations. The extraordinary upward divergence since 1970 from the trend line has never before been explained. Counties most affected include nearby Middlesex and New London, along with Nassau and Suffolk, directly opposite of Millstone, all having the highest breast cancer mortality rates in the nation, exceeding even that of New York City.

### Conclusion

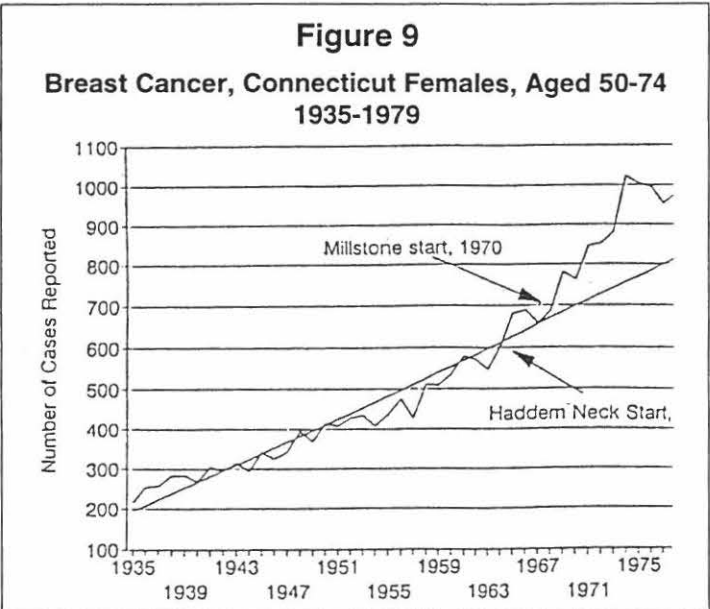
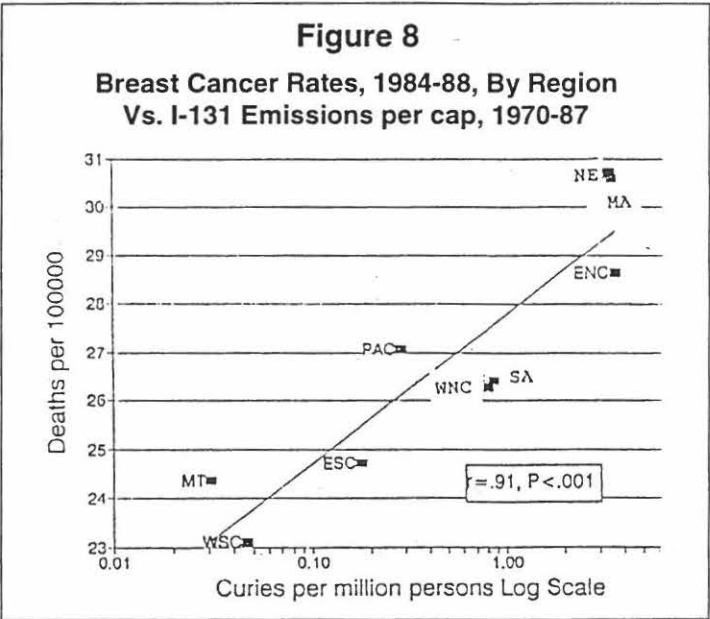
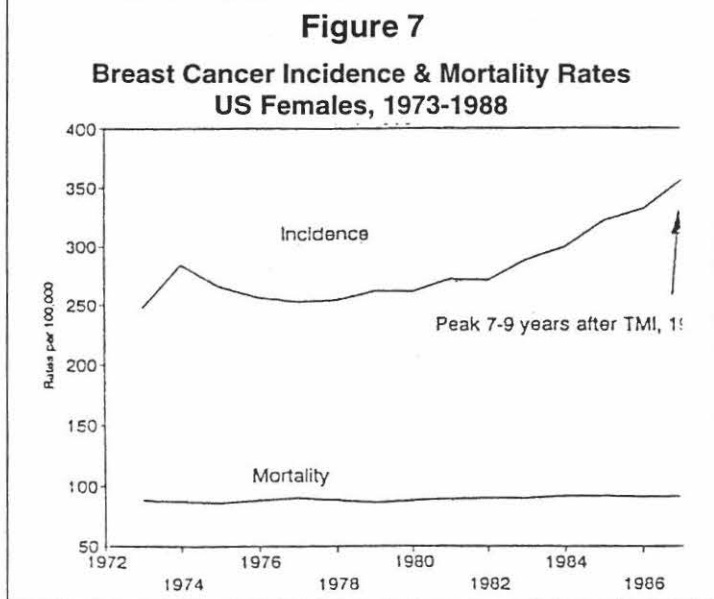
The data presented above indicate that it is the unanticipated large effect of fission products released into the environment during the last 50 years that appears to be a previously neglected factor in the present health-care crisis. Neither the medical profession, the hospitals nor the pharmaceutical industry is responsible for the increase in low weight births, the rise in the number of individuals with weakened immune systems or the high rate of mutation of microorganisms that increasingly resist antibiotics and other drugs, thereby contributing, in part, to the physio-pathology of new infectious diseases such as AIDS, a resurgence of other immune system related diseases such as tuberculosis, and a renewed sharp rise in the incidence of cancer.

From 1980 to 1988, the age-adjusted rate of newly diagnosed cases rose by 8.9%, while the age-adjusted cancer death rates rose by only 1.8%. Thus the ratio of cancer deaths to newly diagnosed cases declined considerably, indicating an improvement in the effectiveness of our medical care system which could only have taken place as a result of advances in early diagnosis and treatment achieved by the medical community in the face of the long hidden contamination of the milk, the food and the drinking water by bomb tests and the releases from aging military and civilian nuclear

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reactors. But this effort required a huge rise in the total cost of medical care due to the combined effect of rising incidence and rising cost of advanced forms of diagnosis and treatment. Since the rise in poor health also reduces human productivity, we have a situation that spells disaster for any modern society, as is shown by the impact of nuclear pollution in the former Soviet Union. Only an end to the release of fission products into the environment can prevent economic collapse.

Dr. Sternglass is Emeritus Professor of Radiological Physics of the University of Pittsburgh Medical School. Dr. Gould is the Director of the Radiation and Public Health Project sponsored by the Commission for Racial Justice of the United Church of Christ. A member of the EPA Science Advisory Board in the Carter Administration, he is the coauthor of *Deadly Deceit: Low-Level Radiation High Level Cover-up, Four Walls Eight Windows*, New York, 1991.



# SHORTS

briefed by Jule Klotter

## Food Irradiation

Proponents of irradiation used the recent outbreak of *E. coli* in fast-food hamburgers to publicize its benefits. Irradiation exposes foods to radiation doses 100,000-60 million times the strength of a chest X-ray. The process kills bacteria, bugs, and fungi, and extends food shelf life. The FDA first approved irradiation for wheat and wheat flour in 1963. Pork, spices, fruits and vegetables, and most recently poultry also have approval. Despite this approval and the backing of the International Atomic Energy Agency, the U.S. Department of Energy, and the nuclear industry, irradiation isn't as widespread as its supporters would like. Sensitive to the public's antipathy, several food companies including H.J. Heinz, Quaker Oats, Ralston Purina, McDonald's, Campbell's and the top 13 poultry producers refuse to use irradiated foods. Alaska has rejected irradiation of Alaskan seafood. Maine, New York, and New Jersey prohibit the sale of irradiated food – and with good reason.

Irradiation transforms food as it kills the organisms that lead to spoilage. Nutrients are reduced. Fats in the foods turn rancid. Toxic chemicals, such as acetaldehyde, benzene, formaldehyde, hydrogen peroxide, methyl vinyl ketone, and toluene, form, as do – what the FDA calls – “unique radiolytic products.” These unidentified products have never been encountered before, so their toxic effects are unknown.

Animal studies have shown that irradiated food causes chromosomal damage, mutagenicity, testicular tumors, high infant mortality, kidney damage, and autoimmune diseases. Dr. J. Verrett, a biochemist at the FDA for 15 years, said that the studies she reviewed showed that irradiation destroyed vitamins and minerals in food, caused reproductive problems, and shortened lifespan. The negative studies were so convincing that they caused the FDA to rescind its initial approval for selling irradiated bacon and led to the withdrawal of petitions to nuke ham, poultry, strawberries, and peaches. Then in 1980, the FDA decided to exempt irradiated food from standard safety testing; “theoretical analysis” indicated that the amounts of unknown radiolytic products in the food were too small to worry about. (*Newsweek*, January 27, 1992)

Not only does irradiated food pose a health risk, the radiation plants themselves can be hazardous. Thirty-seven radiation

facilities use nuclear waste to sterilize medical equipment, tampons, and sanitary napkins. The minutes of the 1988 Nuclear Regulatory Commission Irradiator Workshop in Arlington Texas, May, 24, 1988, include over 50 pages of documented accidents, equipment failure, operational errors, fires, spills, radiation exposure, death, ground and water contamination, mis-management, and cover-ups in license revocations.

*E. coli* outbreaks can be prevented by following sanitary food handling and cooking procedures. Irradiation is not even a guarantee against such outbreaks because irradiated food can be re-infected from unsanitary food handling procedures and chemical contamination just as natural food can. One hopes that the public will continue to refuse the products that the nuclear food industry has been trying to sell for the last 30 years.

For more information, call Food and Water, Inc. at 904-377-1336.

## Immune Restoration Conference

Thirty-five immunologists and other AIDS researchers attended the Immune Restoration Conference on April 25-26, 1992 in Washington, DC. Project Inform sponsored the conference in the hope of encouraging researchers to focus on restoring the immune system, especially for people with very low T-helper counts. Martin Delaney, co-founder of Project Inform, said: “About two years ago Project Inform made an internal decision to direct its research efforts on late-stage disease and restoration of immunity...not out of any disbelief in the virus, but because everyone else was working on that, and there wasn't enough attention given to the immune-restoration area.” Once the researchers began to consider therapy for persons with T-cell levels of 50-100, they were surprised to find far more resilience in the immune systems than expected.

The conference encouraged free discussion and collaboration by allowing the researchers to speak without fear of being quoted or having their data published without permission. Researchers represented seven fields of study: cell line expansion (cryopreservation); gene therapy; passive immunotherapy; soluble factors; stem-cell research; transplants; and vaccines. One issue they discussed was how to measure a response to a drug. The government uses T-cell level as a marker, but “everyone knows there are many exceptions to that – for example, people with zero T-cells who are healthy.” One researcher from Walter Reed Army Institute of Research strongly advocated the use of an improved version of the skin test, which uses a variety of

randomly selected antigens, as a test of functional immunity. The researchers agreed that monitoring T-cells was not enough.

One of the collaborations that resulted was between cell preservation (cryopreservation) and CD8 cell-line expansion. CD8 cells are immune system cells which apparently produce a factor that inhibits HIV & KS. CD8 expansion grows a patient's CD8 cells outside the body, in order to inject them back into the patient as therapy. With the help of cryopreservation, blood or bone-marrow cells could be saved early in the disease. Later, cell-line expansion could use them to create many more as therapy for that individual.

The researchers also discussed expanding CD4 cells, loosely synonymous with T-helper cells. Although some are infected with the virus, the researchers decided that “if you grow the cells, the worst you could do would leave the ratio of infected to uninfected cells the same, which would not hurt – and you might be able to do better than that by treating the growing culture with anti-virals.”

Therapeutic vaccines have been used on people for over 3 years. Vaccine experts say, contrary to fears, the vaccines have not accelerated the disease. They seem to be aiding long-term stabilization and act as safe, anti-viral agents. Vaccine researchers at the conference agreed to consider therapeutic vaccines for people with very low T-cells.

Both stem-cell and gene therapy have faced regulatory and public-policy obstacles. Stem-cell research was originally intended to rebuild the immune system using stem cells from bone marrow which grows into many types of immune-system blood cells. The immunologists at the conference were divided upon whether it could work. Now, stem-cell research is joining forces with gene therapy. Gene therapy involves adding new genes to cells (such as T-helper cells) which make them immune to infection. Gene-therapy needs a vehicle, a primitive cell, to deliver it into the body. Stem-cell research may fit the bill.

This information was excerpted from *AIDS Treatment News* (May 15, 1992), P.O. Box 41 1256, San Francisco, CA 94141. The newsletter is published twice monthly and reports on experimental and standard treatments.

