

Abstract: The LNT Hypothesis: Ethical Travesties

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Event: Wingspread Conference, Racine, WI, August 1997

"When I was a child, I spoke as a child,
I understood as a child, I thought as a child.
But when I became a man, I put away childish things."
Paul to the Corinthians 13: 11

Slowly but inexorably, radiation scientists are recognizing that the LNT hypothesis -- at one time administratively useful in regulating radiation exposures during the infancy of radiation science -- has in its maturity become scientifically illegitimate and ethically indefensible. In his book, *Has Radiation Protection Become a Health Hazard?* Gunnar Walinder, a Swedish radiobiologist, states unequivocally: "The linear, no-threshold hypothesis is one of the greatest scientific scandals of modern times." Dr. Walinder's bold statement is indicative of a significant sea-change among radiation experts in their assessment of the validity of using the LNT hypothesis as a basis for setting standards in radiation protection.

Among prominent experts, Leonard Sagan now observes that the LNT model is based on "politics and social concerns," not science. Nobel Laureate Rosalyn Yalow writes that, "the literature and media overestimate radiation damage even if the overall effect does not differ from zero." Sohei Kondo at Osaka, Japan's Kinki University has conducted research into atomic bomb survivors which shows slight decreases in cancer deaths among those exposed to low doses -- suggesting that radiation-induced precancerous cells undergo self-killing or *apoptosis* which prevents later development of a cancer. An emerging consensus concludes that current regulations for radiation exposure are not only "based on quicksand," but have become pernicious obstacles to the ethical goal they purport to achieve: public health protection.

Radiation protection standards enacted by regulatory agencies have reflected ethical concerns based on two presuppositions:

- (1) that the linear, zero-threshold hypothesis derives from scientific data in radiobiology that are virtually conclusive; and
- (2) that it is "morally better" for health protection to assume that any radiation exposure, no matter how small, has some harmful effect which can and ought to be prevented.

These presuppositions have been reinforced by a popular unscientific belief that industrial man since World War II has introduced into the biosphere enormous quantities of synthetic toxic substances contaminating an otherwise benign natural world. These include "unnatural" radiation sources as well as huge quantities of "sinister" chemicals having no natural equivalents. Hence, official policy has enshrined a quasi-dogma: it is "morally prudent" to assume that "even the most minute dose, even a single molecule, may trigger a lethal change in a cell that will cause it to multiply malignantly."

Hypothetical Harm: An entire ethical framework for social criticism has been erected on the scaffolding of beliefs which are at odds with the actual status of scientific evidence. Professional ethics compels us to conclude that, despite a vast array of radiobiological data, there is no conclusive evidence to prove the existence or absence of a threshold. It is ethically dishonest to claim that the LNT hypothesis is an unassailable

scientific conclusion, when in fact it is only an inconclusive theory, an extrapolated hypothesis, an ultraconservative exercise of prudence. It ignores the fact that humans could not exist if the LNT hypothesis were applied to and enforced upon personal lifestyle exposures to natural terrestrial and cosmic radiation. Evidence of human exposure to wide variations in natural background radiation ought to compel regulatory standard-setting to be based on "standard deviation from background."

The absence of evidence of harm from low level exposures is not due to incompetence or lack of attempts to find effects. Lauriston Taylor is unambiguous: "No one has been identifiably injured by radiation while working within the first numerical standards set by the NCRP and then the ICRP in 1934. Let us stop arguing about the people who are being injured by exposure to radiation at the levels far below those where any effects can be found. The fact is, the effects are not found despite over forty years of trying to find them. The theories about people being injured have still not led to the demonstration of injury and, though considered as facts by some, must only be looked upon as figments of the imagination." The inconclusive scientific status of the LNT hypothesis renders ethical arguments dependent upon it inherently flawed.

Hormesis: Scientific evidence now exists for a hypothesis counter to -- yet equally worthy of attention given -- the LNT hypothesis. Just as there are net beneficial effects from low levels of exposure to otherwise toxic substances -- e.g. copper, selenium, fluoride, nickel -- there is also persuasive evidence of net beneficial effects from exposure to low-level radiation. Indeed it may be essential for the continued wellbeing of living organisms which have evolved in relation to wide variations in exposure to natural radiation sources. Both LNT and ALARA guidelines unjustifiably assume that any degree of reduction in radiation exposure will do some good. To the contrary, evidence suggests three possible hormetic outcomes: (1) increased growth and fertility in both plant and animal organisms, (2) increased longevity, and (3) reduction in cancer frequency.

Ethical Travesties: Fear of radiation has proved to be far more detrimental to public health than radiation itself. No actual deaths of U.S. citizens have been attributed to accidental releases of radiation from reactors. But fear of radiation has proved fatal: (1) fear of bearing a "nuclear mutant" led 100,000 European women to choose unnecessary abortions after Chernobyl; (2) thousands of people avoid life-saving medical procedures such as mammograms or radiotherapy because they involve radiation; (3) regulatory roadblocks preventing management of harmless low-level wastes are causing many hospitals to shut down radiomedical treatment centers; (4) thousands of deaths from pathogens infecting seafood, eggs, beef and poultry could be prevented by irradiating food. Moreover billions of dollars have already been spent on trivial radiation risks based on grotesque scenarios about (1) single atoms destined to migrate through miles of desert soil to contaminate a potential water source in some distant future, or (2) measurable radon producing sick buildings which require costly remediation or destruction. Fear endangers human health.

Because the LNT model is deeply entrenched in standard-setting procedures of UNSCEAR, BEIR, ICRP and NCRP (UBIN), their bureaucracies have neither cited, discussed, nor refuted the data and theory contradicting the LNT model. Eventually, politicizing and prostituting scientific principles will erode not only the credibility of scientists, but also public confidence in regulatory institutions. Risk-tradeoff analysis is an ethically necessary replacement for the regulatory vested interests now dominating bureaucratic incentives to "keep the hazard alive" -- namely, empire building, legalized plunder, research funding, sales of instruments, and indispensable services to a fearful public. An obsession with hypothetical health effects from but one technology siphons attention away from widespread harms claiming the lives of human beings daily.