THREE MAN-MADE ECOLOGICAL FACTORS AND THEIR IMPLICATIONS ON HUMAN HEREDITY AND HEALTH

by Jack B. Bresler

In the past few months, a number of things have occurred to me which have contributed greatly to the conceptual framework of this presentation. I should particularly like to identify three contributing influences —the first a conversation with my youngest son, the second a David Susskind television show, and the third an article by John Platt in *Science*.[1]

Kenneth, our twelve-year-old, asked whether ecological problems were minor in the light of all the major problems confronting the world today. I assured him that problems relating ecology to health, beauty, and tranquillity were of enormous importance to us, but somehow this statement superficially condenses many hours of conversation. The David Susskind show which had such impact on me featured a number of so-called radical professors. I was particularly impressed with one comment made by Howard Zinn in which he said, and I paraphrase, "that we must teach our young a sense of proportion." This Zinn comment gave me further insight into a growing personal awareness of the proportions of man-made ecological factors.

The last contributing influence which helped "set" this presentation was an article in *Science* by John Platt that appeared in November 1969. In the article, Platt assigns estimated rankings of seriousness to a number of present or potential social, physical, biological, and moral crises.

Bearing in mind these influences, I should like to develop a classification of intensity or sense of proportion of three man-made ecological influences as they relate to human health today in the United States. The first is man-made radiation, which I regard as a clear, present, and future threat of major proportion to human health. The second

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is cigarette smoking, which, when compared with radiation, I believe has a moderate effect on health. The third is noise pollution, which when compared with the previous two ecological influences ought to be regarded as a minor problem.

The condition of medical and scientific literature on the effects of ecological factors on health is not as good as we should like, and it is necessary to make numerous estimates.

In indicating that man-made radiation is a major influence, cigarette smoking a moderate influence, and noise a minor influence, I am guided by admittedly incomplete evidence available to me on the effects of the environmental situation on (*a*) mortality, (*b*) the development of physically and mentally subnormal individuals, (*c*) the projected loss of life in future generations, (*d*) the formation of serious debilitating tensions, and lastly (*e*) the increase of uncomfortableness. For example, I would rank the environmental influence which gives a single child the inadvertent exposure to an additional X-ray dose from a color television set higher in an assignment scale than the exposure of one hundred people to a moderate increase in noise near an airport.

Radiation—a Major Environmental Threat

Man-made radiation is very likely the severest ecological factor affecting Americans today. As expected, there are many subdivisions within the overall category of man-made radiation, but medical and dental X-rays unfortunately appear to contribute the most harm.[2]

What is the evidence for this concern? On November 8, 1895, William Conrad von Roentgen discovered the existence of X-rays. Almost immediately, deaths from unrestricted use of X-ray equipment were recorded. Thomas Edison invented the fluoroscope in 1896. His assistant, Clarence Dalley, working with the then new machine, acquired lesions on his hands, arms, and head which became cancerous. Dalley soon died from Roentgen's X-rays. One also need only scan medical and dental journals to note the rapidly expanded uses and, unfortunately, abuses of X-rays for medical and dental diagnoses and therapy.[3]

Many women in the United States today are receiving routine pelvic exposure to X-rays during their pregnancies. Simply too much evidence is available relating X-ray exposure to the increased incidence of leukemia and other forms of cancer in the mother and in the developing child.

For years, X-rays were used as the standard scalp-ringworm treatment. There is now alarming evidence that individuals who received this treatment, abandoned about ten years ago, currently show a sharply

increased rate of schizophrenia and other mental illness as well as increases in leukemia and other cancers. This is but one instance where X-rays appear to be causal factors in the development of behavioral changes and difficulties.[4]

Another shocking phenomenon is the excess of X-ray treatment given patients. The machines are defective and/or the operators of the machine are inadequately trained. It is unusual for the physician himself to give the X-rays. There are too many cases where the doctor's wife, or secretary, or typist gives the X-rays and, frequently, on a faulty machine. Licensing of X-ray technologists and multiyearly inspection of X-ray machines are long overdue.

One health specialist estimates that almost 90 percent of man-made radiation in the United States is provided by medical and dental diagnostic X-rays, although this estimate may be on the high side.[5] James T. Ramey, commissioner of the U.S. Atomic Energy Commission, states that "X-rays are by far the largest source of radiation in humans. Yet, X-rays when medically used, are not covered by Federal regulations and some states have no regulations."[6]

As in all situations, the socially redeeming factors of each ecological influence must be given due weight in an evaluation of its overall effects on health. On a nationwide scale, there is general, but not complete, redemption in disease detection and treatment to justify the nationwide harm through medical and dental X-rays. However, there still appears to be a fine line between necessary versus unnecessary, and thus detrimental, exposure to this type of radiation. We have one word for medical and dental colleagues: caution.

Currently, about 1 percent of the nation's electricity is manufactured from fifteen nuclear plants. The 1 percent will increase many times in the next ten years, as there are about ninety more plants under construction or being planned. There is every reason to worry about the radiation consequences. Although no major explosions have occurred, a number of near misses are known. In 1966, according to one report, a power plant thirty miles from Detroit was near the nuclear-explosion stage. A few worried plant officials thought seriously of evacuating all individuals from the city. Equally serious problems have been found in nuclear reactors in Minnesota and South Dakota.

The AEC plant northwest of Denver is reputed to represent a major potential threat to that city. Denver residents are probably not safe from exposure to radon gas, a by-product of radium.

The discharges of power plants also cause concern. The Metropolitan District of Boston, in planning ahead for greater water usage, is con-

sidering the use of a Connecticut River water source. As planned, the river water would be diverted fourteen miles downstream from the Vernon, Vermont, atomic power plant. Dr. John W. Gofman, codiscoverer of the nuclear-energy isotope uranium 233, stated what must certainly be an axiom by this time: "There is no safe amount of radiation and hence no safe amount of radioactivity to add to the water."[7]

The last category of man-made radiation on which I shall comment can be loosely collected under the term "consumer product." This is hardly a unique problem for the 1970s, as it has been with us for some time.

In 1967, the *New York Times*[8] reported that a General Electric Company official had stated that the company had held back public announcement of a possible radiation danger from some of its color television sets due to an insufficient supply of replacement parts. The official further said that an announcement would have disturbed many people and that the company would not have been able to keep up with the demand for replacement tubes.

This, mind you, was approximately forty years after H. J. Muller's Nobel Prize–winning radiation work and twenty years after the atom bomb.

More recently, the magazine *Consumer Reports*[9] indicated concern about radiation from color television sets. The fact that such sets are sold openly on the market in the United States should shock us.

A recent survey conducted by the Department of Health, Education, and Welfare found radiation-producing electronic equipment in high school science classes around the country. This equipment is used for scientific demonstrations, but far too much of it is considered unsafe. How many roentgens it is pouring into young bodies is difficult to establish.

In a series of reports, via press releases, the Department of Health, Education, and Welfare has indicated the magnitude of ill health brought about by radiation-producing consumer products.[10]

For the foregoing reasons, I am obliged to rank man-made radiation as an ecological factor causing major harm to Americans today. It could well be the ecological factor causing the greatest harm to Americans today.

Cigarette Smoking—a Moderate Environmental Threat

The evidence of additional deaths through smoking has been well documented and presented to the American public. It certainly represents a moderately severe environmental threat created by man.[11]

Recent studies now indicate that behavioral changes can be engendered by smoking. The carbon monoxide level inhaled by cigarette smokers apparently impairs mental as well as physical functions, according to a recent analysis.

Noise—a Minor Environmental Threat

In urban areas of the United States, noise levels, measured in decibels, appear to be increasing too rapidly to be ignored. A decibel is a unit of measure generally representing the smallest difference in loudness that the human ear can ordinarily detect between two sounds. As a convenient index, conversation in a relatively quiet setting can be recorded as around sixty decibels, while the roar of traffic or the sound of a factory machine can be checked at eighty decibels. Eighty decibels is a convenient bench mark, since most humans begin to feel a little uncomfortable at that level, and ninety decibels is close to the level at which physicians and scientists feel there are some effects on health. The typical food blender may be measured at ninety to ninety-five decibels and fortunately is on for only a few moments.[12]

There is no question that modern urban living has become noisier. It has been shown that a newly developed business district, when tested, emits sounds at least ten decibels above the rural background noises that this same area previously exhibited.

The evidence is quite convincing that noise produces short-term physiological responses in the body. With sudden high levels of noise, the heart will beat more rapidly, the blood vessels will constrict, the pupils of the eyes will dilate, skin will pale, and some of the internal organs may even be seized by spasms. Long-range exposure to high decibel levels in experimental animals apparently also brings on high cholesterol levels in major arteries. Data from both animal and human studies are available supporting the contention that prolonged exposure to extreme noise will definitely result in hearing loss.

There is also some disturbing, although preliminary, evidence that the endocrine balance, including the hormones controlling uterine activity, can be significantly altered by exposure to loud noises. One researcher feels that the effects of sound heard by a mother can reach the womb and perhaps adversely affect the fetus.

While there is sufficient evidence for concern, there is not, however, enough "hard" data that noise has caused large numbers of deaths and/or unbearable stress to thousands and millions of Americans.

Table 1 attempts to show the differences in the magnitude of the threats posed by these three environmental factors. Even allowing for

TABLE 1

ESTIMATED COMPARATIVE EVALUATIONS RELATING ENVIRONMENTAL FACTORS TO HEALTH

Ecological Influence	Estimated Cases per Year	
	Mortality	Physical and Mental Handicaps
Radiation.....	>10,000	>50,000
Cigarette smoking	> 5,000	>10,000
Noise.....	< 100	< 5,000

difficulties in assessing incomplete data, we should understand that not all environmental problems were created equally.

This presentation represents perhaps a first comparative attempt to construct a sense of proportion relating the environment and health of Americans today.

NOTES

1. John R. Platt, "What We Must Do," *Science* 166 (1969): 1115–21.
2. "Radiation," *Medical World News,* October 31, 1969, p. 23.
3. Ibid.
4. "Deep Trouble from Scalp X-Rays?" *Medical World News,* March 21, 1969, p. 25.
5. "Case Grows for Curbing Curbside X-Rays," *Medical World News,* April 17, 1970, p. 18. See also "Diagnosis: X-Ray Excess," *Time,* September 8, 1967, p. 69.
6. James T. Ramey, "Radiation Protection—Past, Present and Future," in *Universities, National Laboratories, and Man's Environment* (U.S. Atomic Energy Commission, CONF-690705), pp. 52–70.
7. See James B. Ayres, "Scientist Says N-Plant Could Poison Water MDC [Metropolitan District Commission] Wants," *Boston Globe,* May 6, 1970, p. 3.
8. "G.E. Defends Failure to Warn TV Owners of Radiation Peril," *New York Times,* August 1, 1967, p. 67.
9. "Color TV Consoles," *Consumer Reports* (January 1970), p. 18.
10. See U.S., Department of Health, Education, and Welfare, Radiation Press Releases, April 16, 1969 (HEW-W58), September 16, 1969 (HEW-X77), October 13, 1969 (HEW-X91), October 16, 1969 (HEW-X94), October 16, 1969 (HEW-Y17), January 22, 1970 (HEW-Y32), January 30, 1970 (HEW-Y38), April 11, 1970 (HEW-Y78), April 23, 1970 (HEW-Y85), May 13, 1970 (HEW-Y97), and May 28, 1970 (HEW-Z11).
11. See U.S., Department of Health, Education, and Welfare, *Chart Book on Smoking, Tobacco, and Health,* Public Health Service Publication, no. 1937, June 1969; National Center for Health Statistics, ser. 10, 1970; and E. Cuyler Hammond, "Smoking and Death Rates," *American Scientist* 46 (1958): 331.
12. See "How Today's Noise Hurts Body and Mind," *Medical World News,* June 13, 1969, p. 42; U.S., Department of Housing and Urban Development, *Noise in Urban and Suburban Areas: Results of Field Studies,* FT/TS, 1968; and Massachusetts Audubon Society, *Noise Pollution* (Lincoln, Mass.).