

LETTERS

Radiation Hazards

The article *Radiation Hazards in Realistic Perspective* by Lauriston S. Taylor (*Physics Today*, June 1962) seems to me to be unrealistic in some respects.

I shall content myself with commenting on the following sentences about accepting the idea that there may be "practical thresholds" to radiation exposure: "Another example might be in the case of radiation-induced leukemia, for which there appears to be no information at the present time causatively relating a single case of leukemia to an exposure of less than 75 roentgens. For the time being, then, we might accept a practical threshold for leukemia of the order of, say, 50 roentgens. Certainly, if we use such a concept we would not be subjecting the population to any overt insult by setting the permissible exposure criteria so as to assure that their total dose did not exceed this value."

Unless some astounding and completely unexpected discovery is made, there will never exist information causatively relating a single case of leukemia to an exposure of less than 75 roentgens. It is impossible to distinguish between man-made high-energy radiation, such as x radiation, and natural high-energy radiation, in their biological effects. Every single patient dying of leukemia will have received a certain amount of natural high-energy radiation, and it is presumably justified to say that there will never be any way of stating whether any single case of leukemia was caused by the natural radiation (or some other leukemogenic factor) rather than by the additional exposure to high-energy radiation, although, of course, an estimate of probabilities might be given.

E. B. Lewis, Professor of Biology in the California Institute of Technology, presented an argument [*Science* 125, 965 (1957)] leading to the conclusion that full-body exposure to high-energy radiation increases the probability of incidence of leukemia by about 2×10^{-6} individual⁻¹ rem⁻¹ year⁻¹. His estimate may not be right, but it is not known to be wrong, and other scientists have independently made approximately the same estimate. The "practical threshold for leukemia" of 50 roentgens suggested in the article on *Radiation Hazards in Realistic Perspective* is one that might correspond to an added probability of induced leukemia of 0.2 percent during a twenty-year period following the exposure; that is, about one out of 500 persons receiving this exposure would from this calculation be expected to die of leukemia. I feel that such an exposure would involve subjecting the population to an insult. The article *Radiation Hazards in Realistic Perspective* may serve the purpose of helping to keep this a hidden insult rather than an overt insult.

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I found Dr. Taylor's article interesting and informative. Everyone concerned with this question of radiation and its effects on man is, I'm sure, appreciative of the work of the NCRP and its setting of current low safety levels. Dr. Taylor's article carries within it the concept that levels are set

very low—possibly too low?—and that this is based not on any real scientific evidence but "by a more acute awareness of the possibility of radiation hazard". In fact, Dr. Taylor even suggests that this leaning on the conservative side in the setting of exposure levels is based on sentiment and therefore is a dangerous position.

While I am personally gratified at the "emotional weakness" which has caused Dr. Taylor and his associates to set these low levels I feel constrained to ask whether any other course was scientifically logical in view of the fact that the effects for humans are so little known. With something so irreversible and which could take generations to show its effects fully, is any other course really defensible? It was always my understanding that the scientist is the one who always makes so much of the "we don't know" approach to justify cautious acceptance of an idea and he is the last one to take an irreversible action on the basis of incomplete information. Isn't the scientific attitude on radiation, then, to proceed with extreme caution until the answers are in? This is in fact what NCRP has done.

There is a constant reiteration throughout the article of the lack of proof, of the inability to detect deleterious effects, of excessive conservatism which tends to leave one with the feeling that Dr. Taylor believes radiation levels are in fact too low—that we are being too cautious. This attitude totally disregards the large body of evidence based on experiments with animals and insects—which are generally less sensitive to radiation than man—which suggests that we should be mighty conservative. I understood that animal experiments had shown statistically valid life span shortening. I also understood that there was a school of geneticists, led by Prof. Westergaard,¹ who believe that radiation is responsible for 50%, not 5%, of man's mutational load.

I would agree with Dr. Taylor that, while the medical use of x rays is vital and not readily questioned, the negligible and inadequate shielding of areas not being examined or treated is very questionable.

I'm afraid I cannot accept Dr. Taylor's tabular data, which lists fallout as approximately 1.6% of natural background levels, as giving perspective, because today the biological concentration of some fallout elements in bone and thyroid is a real worry. This 1.6% is definitely not what our children are now being exposed to by strontium-90 in their bones or by iodine-131 in their thyroid glands. In the *British Medical Journal* of October 28, 1961, it was reported that the average level in one-year-olds was 4 strontium units as of 1960. This is approximately equivalent to 10% of natural background, and predicted equilibrium levels are much higher than this. The same *British Medical Journal* article indicated that infants in their first year of life are exposed to iodine-131 levels approaching background—this is 100%, not 1.6%. These numbers do not take into account the USSR and US tests since the autumn of 1961. Nor do they take into account an estimated statistical distribution² reaching as high as five, or even ten, times the average values indicated above.

There are indications, not fully proven yet, that an increasing relative incidence of lymphoma (a leukemia-like disease) in cattle and swine correlates well with fallout.⁸ This is for large populations where other factors are reasonably well known and controlled.

I certainly agree that many decisions affecting radiation exposure will be made involving political and socio-economic factors rather than on the basis of scientific information alone. But let us at least be aware of all the scientific information which is available when getting a perspective.

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References

1. "Man's Responsibility to His Genetic Heritage" by M. Westergaard, *Bulletin of the Atomic Scientists*, vol. 11, no. 9, Nov. 1955, p. 318-328, 352.
2. US Congressional Hearings on "Fallout from Nuclear Weapons Tests," May 1959, vol. 2, p. 1118.
3. Nuclear Information, October 1960, 6504 Delmar Blvd., St. Louis, Missouri.

Information Tools

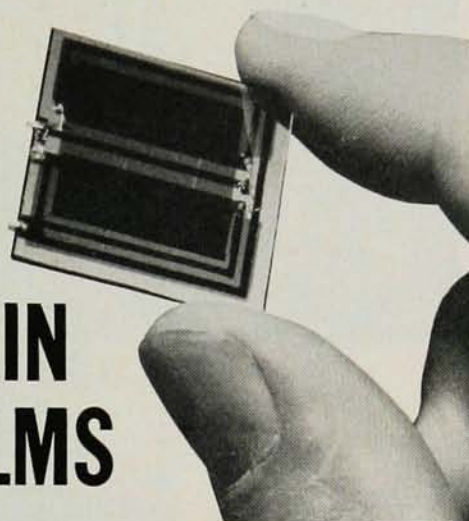
With reference to the article *Waiting For Mr. Know-It-All* (*Physics Today*, February 1962), page 23 contains a reference to an undesignated article entitled "Theories of Nuclear Moments", which was allegedly either not abstracted in *Physics Abstracts* or so badly indexed as to be beyond location by normal means. Would you kindly ask the authors to provide the exact reference of this article so that an investigation may be made?

It is possible that the article in question is *Theories of Nuclear Moments* by R. J. Blin-Stoyle (*Rev. Mod. Phys.*, Vol. 28, No. 1, 75-101, Jan. 1956). This particular article was abstracted in *Physics Abstracts* as Abstract 624 of 1957. The author's name appears correctly in the author index. The subject index contains entries under (a) "Nucleus/electric moment" and (b) "Nucleus/magnetic moments". If this is, indeed, the article referred to, the authors' statement is untrue and their comment, to say the least, irresponsible.

On page 26 of the same article, in "Tool 5", the authors advocate that abstracting journals should reproduce photographically the abstracts of forthcoming articles distributed with *Physical Review Letters*, in the interests of prompt publication. I should like to ask the authors what they propose to do about volume number, issue number, pages and date, information invariably provided with the abstracts in *Physics Abstracts* and any other abstracting journal. These details are not, and cannot be, supplied with the abstracts in *Physical Review Letters*. The earliest form in which they can be reliably supplied is the page proof of *The Physical Review*, and this is the form used by *Physics Abstracts* in preparing its abstracts, not only for *The Physical Review* but for all the leading physics journals.

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