letters

is that their pious wish is probably, to as great an extent as they would want, the deed itself.

O'Neil A. Poree
Eugene, Oregon

8/83

Radiation and cancer

I wonder why PHYSICS TODAY felt compelled to publish still another review of J. W. Gofman's *Radiation and Human Health* (by Karl Morgan, June, page 68), some two years after publication of the book. Of the many published reviews, only two (to my knowledge) have been favorable: Morgan's and one whose author (based on the wording in his review) had little background in radiobiology. The remainder have ranged from benign to attacking in tone.

Secondly, I wonder about some of Morgan's statements in his review: "the . . . challenges Gofman presents to the claims of leaders in the nuclear industry, who will have to come up with some specific data if they are to meet these challenges—general criticisms will not suffice." Gofman's book certainly lacks objectivity; its inflammatory language is unnecessary, unscientific, and clearly uncalled for. Even Gofman's basic tenets (which he calls generalizations—but which are definitely not such in the usual scientific sense) are subject to attack. Morgan asked for specifics. Gofman's first "generalization," upon which most of his conclusions are based, states that "the per cent excess in cancer rate per rad would be either the same for all kinds of cancer, or very nearly the same"—that is, those cancers with the highest spontaneous incidence would show the greatest absolute increases in incidence in irradiated populations. This notion does not withstand even superficial scrutiny. For example, carcinomas of the prostate and uterine cervix are two of the most common cancers of spontaneous origin; yet no increase in incidence has ever been demonstrated in any irradiated population. Conversely, thyroid carcinoma rarely occurs spontaneously, but is among the most common of tumors in irradiated populations.

This letter is not intended to support the notion that radiation is totally safe. Instead, it supports the reason to believe that small doses of radiation may carry small risks. Further, it behooves us to attempt to quantify those risks, even if their existence cannot be conclusively proven. Such attempts, however, must be consistent with quantitative data now available. Gofman states

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that he will stick to the facts, excluding radiobiologic theory—such as animal experiments, microdosimetry, data from cultured cells and so on that do not support his conclusions. Instead, he supports his conclusions with unsubstantiated if not totally erroneous speculations.

JULIAN GIBBS
Vanderbilt University
Nashville, Tennessee

6/83

THE AUTHOR COMMENTS: Julian Gibbs wonders why PHYSICS TODAY felt compelled to publish my review of Gofman's book, *Radiation and Human Health* in June about two years after the book was published. Maybe he should address this same question also to the editor of the Bulletin of Atomic Scientists which published Edward P. Radford's review of this book in its June issue. The answer is simply that the mechanics of reviewing a book by busy persons is a long, drawn-out process and this book is a valuable compendium of a vast amount of useful data on the effects of human exposure to ionizing radiation that is of interest and concern to many physicists. Also, Gofman's interpretation of the data leads to the conclusion that the cancer coefficient (cancers/person rem) is greater than that given in the BEIR-III report (a report of the advisory committee on the Biological Effects of Ionizing Radiation of the National Academy of Sciences) and, as Radford points out, BEIR-III is now outdated because it gave a cancer coefficient that is too low in view of recent revisions in the radiation dosimetry of Hiroshima and Nagasaki. Maybe all the scattered estimates of this coefficient as espoused by various members of the scientific community are coming much closer together? In any case, this book of 908 pages contains a wealth of information and a challenge to those who believe the risk of exposure to low levels of ionizing radiation is negligible—a challenge that our journals should place before such critics.

Gibbs notes that I have stated that leaders in the nuclear industry will have to come up with some specific data if they are to meet Gofmans' challenge and that general criticisms will not suffice. Then Gibbs responds by making a specific challenge of one of Gofmans' basic generalizations, "the per cent excess in cancer rate per rad would be either the same for all kinds of cancer, or very nearly the same" as for spontaneous cancers. He points out that this generalization "does not withstand even superficial scrutiny" because "carcinomas of the prostate and uterine cervix are two of the most

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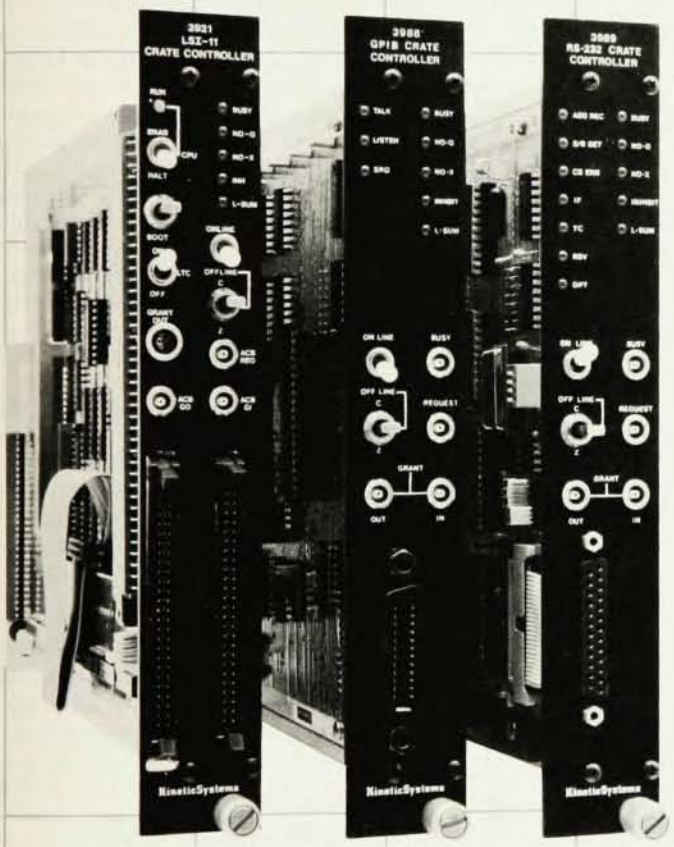

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common cancers of spontaneous origin; yet no increase in incidence has ever been demonstrated in any irradiated population. Conversely, thyroid carcinoma rarely occurs spontaneously, but is among the most common of tumors in irradiated populations."

I believe Gibbs has chosen a poor example to criticize Gofman's book. BEIR-III in Table V-14 gives values of age-weighted average of dose coefficients (cancers/10^6 persons per year per rad) for a number of common malignancies for the period 1969–71. I plotted these BEIR-III values against the crude rate of spontaneous cancer incidence in the US for the period 1973–77 as published by the National Cancer Institute and observed there is a scattering of points as noted by Gibbs. However, for most of the cancers there is strong support for Goffman's generalization. All but 8 of 22 points on the two plots (1 for males and 1 for females) follow very closely Gofman's General Law. The 8 that are exceptions are, for males: cancers of the thyroid, stomach, liver and prostate, and, for females: cancers of the thyroid, intestine, cervix and lymphoma.

Surely Gibbs does not demand that a general law have no exceptions. Variations from a generalization often serve as a clue, suggesting where we should look for new ideas, important discoveries and errors in our data. For example, stomach cancer has a much higher natural incidence in men in Japan than in the US and so there it would not be an exception to Gofman's Law as it is in the US. Why? Why is the thyroid gland so radiosensitive—or why are the prostate and cervix so insensitive—to radiation-induced cancer. Had the BEIR-III report given stronger weight to the hepatic tumors per rem (using a quality factor of 20 for the alpha radiation of Th^{232}), liver cancer among the males would not be an exception. I believe this generalization of Gofman is a plus to his credit and not a minus as Gibbs suggests.

KARL Z. MORGAN
8/83 *Appalachian State University*

Directed-energy weapon

President Reagan's appeal to American scientists to help develop weapons to nullify nuclear weapons has induced controversy in the mass media as well as in the scientific community. Arguments, both pro and con, have been based on political, technical and even emotional reasons. However, few arguments have been based on principles. I, as a scientist, support the President's