

## LETTER TO THE EDITOR

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The lead article in the January, 2017 issue of the Journal of Nuclear Medicine (Siegel JA, Pennington CW, and Sacks B. Subjecting radiologic imaging to the linear no-threshold hypothesis: *A non sequitur* of non-trivial proportion) is brilliant, timely, and scientifically superb. Unfortunately, the Invited Perspective which follows it (Weber W, Zanzonico P. The controversial linear no-threshold model) is scientifically poor and inconsistent. The authors strive to hang on to the long-outdated ideas espoused by government bureaucrats by stating that we just don't know the truth yet, and they ignore a huge mass of valid scientific literature in doing so.

Calling the linear no threshold (LNT) model "controversial" is the first problem. A solid body of science is against it, and those who treat it as a religion or whose jobs, contracts, grants, or consulting positions depend upon acceptance of LNT are for it. That doesn't make it controversial. Weber and Zanzonico quote a few studies to support LNT which have been discredited because of biased statistics, insufficient data, wrong data, and faulty experimental design. They ignore a large body of credible data covered in part by the Siegel et al. paper.

Weber and Zanzonico admit that there is radiation repair. Absence of radiation repair is an essential assumption of the LNT. Right there they are inconsistent. You cannot admit to radiation repair and still be an LNT advocate without being scientifically inconsistent.

Weber and Zanzonico deny that any “prospective epidemiologic studies with appropriate non-irradiated controls have definitively demonstrated either the adverse effects or the hormetic effects of radiation doses under 100 mSv (10 rem) in humans, and current estimates of the risks of low-dose radiation indicate that very large-scale epidemiologic studies with long term follow-up would be needed to actually quantify any such risk or benefit; such studies may be logistically and financially prohibitive.” I disagree, and mention two examples. Thirty-one thousand, seven hundred and ten female patients with tuberculosis in Canadian sanatoriums from 1930-1952 were subjected to multiple fluoroscopies to monitor their disease status (1,2). Of these patients, 26.4% received radiation doses to the affected side of 10 cGy (10 rads) or more, and therefore most received lower doses. The relative risk of eventual breast cancer was studied in all these patients. Patients who received a total radiation absorbed dose in the range from 5-30 cGy (5-30 rads) had a breast cancer incidence up to one third less than the background incidence. Only at radiation absorbed doses above 50 cGy (50 rads) did the cancer incidence begin to increase above baseline. In these patients, the unirradiated breast was the “control”.

After World War II, patients with hyperthyroidism began to be treated with NaI-131 instead of surgery. There was a concern about late effects from the radiation. The

Cooperative Thyrotoxicosis Therapy Follow-Up Study of over 36,000 treated hyperthyroid patients looked at eventual leukemia rates in these patients, as leukemia is considered among the most radiosensitive of cancers and occurs faster than other radiogenic cancers. The total body radiation doses to these patients were 130-140 mSv (13-14 rem). The age-adjusted leukemia incidence rate was 11/100,000 patient years in the I-131 treated patients and 14/100,000 patient years in patients treated by surgical removal of the thyroid gland. While the authors concluded that there was no increased incidence of leukemia at this low whole body radiation dose (3), the 22% decrease in the I-131 treated patients suggests a possible hormetic effect. The surgery patients were the controls, the number of patients followed was large, and they all had hyperthyroidism.

The poor scientific quality of the Weber and Zanzonico commentary is perhaps the most important feature of their contribution. If this is the best the agnostics can do, it is certainly a plus for finally removing the LNT from radiation protection “science”. The earth is not flat, there is no ether, disease is not caused by miasmas, and the LNT is wrong because of our knowledge of repair and carcinogenesis mechanisms.

## REFERENCES

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