



# LNTgate: The ideological history of cancer risk assessment

Edward J Calabrese

## Abstract

This commentary summarizes a spate of recent papers that provide historical evidence that the 1956 recommendation of the US National Academy of Sciences Biological Effects of Atomic Radiation I Genetics Panel to switch from a threshold to a linear dose–response model for risk assessment was an ideologically motivated decision based on deliberate falsification and fabrication of the research record. The recommendation by the Genetics Panel had far-reaching influence, affecting cancer risk assessment, risk communication strategies, community public health, and numerous medical practices in the United States and worldwide. This commentary argues that the toxicology, risk assessment, and regulatory communities examine this issue, addressing how these new historical evaluations affect the history and educational practices of these fields as well as carcinogen regulation.

## Keywords

LNT, carcinogen, dose–response, radiation, risk assessment, X-rays

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## Introduction

A series of papers published over the past few years have revealed that the June 12, 1956, recommendation of the US National Academy of Sciences (NAS) Biological Effects of Atomic Radiation (BEAR) I Committee, Genetics Panel, to switch from a threshold to a linear, nonthreshold (LNT) dose–response model was the most significant risk assessment policy change ever made.<sup>1–12</sup> This recommendation was soon generalized from genetic to cancer risk and rapidly adopted by highly influential national and international advisory committees and would determine the setting of exposure standards for ionizing radiation and chemical carcinogens in the United States and throughout the world down to the present.

The report of the Genetics Panel provided the underlying scientific credibility and public health urgency that helped to create the precautionary principle that influences politicians, regulators, the biomedical community, the media, and the general public. In fact, the report of that BEAR I Genetics Panel was released to an eager media that sensed its importance, rewarding the Panel and the NAS with extremely positive front-page stories on June 13, 1956, in the *New York Times* and *Washington Post*. Many stories would follow in other highly influential outlets such as *US News* and *World Report*, *Life*, *Time*, and others.<sup>11</sup>

The Genetics Panel report is the founding document for modern cancer risk assessment, a veritable Cannon of the environmental movement in the United States. The authors of this Cannon were also the elite of American science, with two Nobel Prize recipients, and others of similar stature, all working under the leadership of the prestigious US NAS and the funding of the Rockefeller Foundation. Appeal to authority has always had an important role in society, but the setting for the BEAR I Genetics Panel was truly exceptional in that regard. Even though all the principals have died, all were known well by many leading scientists alive today.

It has now been revealed that this momentous report of the Genetics Panel was not only profoundly ideologically motivated, it was also based on falsification and fabrication of the research record involving the entire Panel.<sup>3–7</sup> This Panel would even refuse to provide scientific

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documentation to support their recommendation when challenged to do so in the months after the major publicity associated with their LNT recommendation.<sup>6</sup> It has also been revealed that the then NAS President, Dr. Detlev Bronk, was made aware of this decision of the Panel and did nothing to prevent it, and as a result failed in his duty as NAS president.<sup>6</sup>

My interest in the history of the LNT is fairly new, starting about 5 years ago as part of research on the history of the hormetic dose–response. During the course of writing a paper on the origins of the LNT, a preliminary draft was criticized by a senior genetic toxicologist who suggested that I had neglected the role of Hermann Muller in shaping the field in this matter. Taking this advice, I devoted considerable effort to learn about Muller, his life, career, publications, controversies, achievements, and final years. It was during the detailed historical assessment of Muller that unexpected irregularities in the scientific record on mutation risk assessment began to emerge,<sup>8,9</sup> all potentially troubling and yet feeding interest to get to the bottom of the story. Thus, there was no inherent desire to challenge Muller, his radiation geneticist colleagues, or the NAS. In fact, most of what has been recently reported is material in the historical record, citing their own words, via correspondence, memos, and similar documents. In other words, these reports tend to let the subjects of this historical tale tell the story in their own way.

### Falsifying the research record

With the above as the backdrop to the story, let me share the specific allegation of scientific misconduct by the NAS BEAR I Committee, Genetics Panel. In June 1956, the Panel published a paper summarizing their activities and conclusions in the journal *Science*.<sup>10</sup> I was very familiar with the details of their activities and had acquired substantial materials, such as meeting transcripts, draft reports, many letters between the Panel members, and related material. In my rereading of the *Science* paper, I was struck by the statement indicating that the 12 geneticists on the Panel (actually there were 13 but 1 withdrew from the Panel) were challenged by the Panel Chairman Warren Weaver to estimate genomic risk to the US population from gonadal radiation exposure, but that only 6 took up this challenge and provided detailed estimates. These six estimates were then summarized in the *Science* paper. What troubled me was I had the detailed reports of 9 of the 12 Panel members. I wondered why the *Science* paper would state 6 rather than the 9 geneticists who took up the so-called challenge. Why were three omitted and how was the decision made?

A detailed review indicated that nine substantial reports were submitted by Panel members to Chairman Weaver, within the time period requested (i.e. February 1956 to early March 1956).<sup>11</sup> These were independent assessments by some of the most prominent geneticists in the world. The Panel members represented a broad range of expertise,

including bacterial, paramecium, insect, mammalian, and human genetics. The goal of these assessments was to learn how closely these independent analyses would converge on the estimates of population-based genetic damage. It was hoped that there would be close convergence as this would strengthen any recommended policy change to linearity. However, findings revealed that the experts were very uncertain in their own estimates and also offered strikingly divergent estimates when compared to each other. Thus, the estimates lacked confidence and anything resembling a convergence or consensus . . . in fact, the opposite.

The chair of the Panel assigned panelist James Crow to collate the material and make tables that could be shared with all Panel members. However, in the course of this administrative function, Crow became very concerned that the uncertainty among the expert geneticists was quite substantial, expressing his concerns in a series of letters to the chairman (March 7, 12, 29, 1956). He expressed in writing that if their uncertainties became known, then it would strongly undercut the chances of acceptance of the Panel's recommendations. For example, in the March 29, 1956, letter to Weaver (Crow, 1956a), Crow stated, "The limits presented on our estimates of genetic damage are so wide that the readers will, I believe, not have any confidence in them at all." Without any authority to do so, Crow excluded the reports of three geneticists. My analysis indicated that he eliminated the reports with the lowest estimates of risk. This had the effect of substantially reducing the appearance of Panel uncertainty. Thus, the *Science* paper conveyed deliberately false information. It should have stated that 9 of 12 geneticists provided detailed written estimates of genetic damage, but that 3 were excluded, telling how this decision was made. However, as noted above, the paper deceptively and incorrectly stated that only six estimates were provided. This act by Crow that was permitted by the Panel and the NAS president constituted research misconduct by omitting data from the research record.<sup>6</sup> The story actually gets worse, in fact, far worse as the estimates of the remaining six geneticists were dishonestly reported. The *Science* paper indicated that there was reasonably good agreement among the six geneticists, with their collective uncertainty being  $\pm 10$ -fold around a mean. However, the actual reports reveal that the 100-fold uncertainty was 750-fold, a gross distortion.<sup>7,11</sup> Adding to this series of deceptions was that the Panel actually voted not to share their findings with the scientific community and the general public, thus implicating all the Genetics Panel members in what I now call LNTgate.<sup>6</sup>

### LNT: An historical problem

The LNT saga thus all began with the BEAR I Genetics Panel and their influence continues to the present. However, their 1956 report is far more than "an influence" but rather the influence morphed into a dogma (i.e. radiation-induced genetic damage was cumulative and irreversible

and the dose–response was linear). Their dogma has become the “creed” for regulatory agencies such as the US Environmental Protection Agency and others. Now we have learned that this creed was based on ideological biases and multiple scientific falsehoods, all with the intention to convert the scientific community, world governments, the medical communities, and others to their views. The Genetics Panel would ensure that such actions were successful by keeping control of the reins of major advisory groups at the national and intentional levels over the next two decades.<sup>12</sup> For example, James Crow, a member of the BEAR I Genetics Panel (1956) chaired the Biological Effects of Ionizing Radiation (BEIR) I (1972) Genetics Subcommittee. This leadership would also effectively discourage any detailed exploration of their historical dishonesties.

So the question is what does it mean to the scientific community, the regulatory agencies, elected officials, and the general public that the belief in LNT and our regulations were founded on deliberate scientific misconduct at this high level? It is certainly time for the toxicology, risk assessment, and regulatory communities to explore, reassess, and rewrite their history and to squarely face how this deliberate deception has impacted the education of generations of scientists, the public, current regulations, and beliefs about the nature of the dose–response in the low-dose zone.

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#### References

1. Calabrese EJ. The road to linearity: why linearity at low doses became the basis for carcinogen risk assessment. *Arch Toxicol* 2009; **83**(3): 203–225.
2. Calabrese EJ. Origin of the linearity no threshold (LNT) dose–response concept. *Arch Toxicol* 2013; **87**(9): 1621–1633.
3. Calabrese EJ. Key studies used to support cancer risk assessment questioned. *Environ Mol Mut* 2011; **52**(8): 595–606.
4. Calabrese EJ. How the US National Academy of Sciences misled the world community on cancer risk assessment: new findings challenge historical foundations of the linear dose response. *Arch Toxicol* 2013; **87**(12): 2063–2081.
5. Calabrese EJ. The genetics panel of the NAS BEAR I Committee (1956): epistolary evidence suggests self-interest may have prompted an exaggeration of radiation risks that led to the adoption of the LNT cancer risk assessment model. *Arch Toxicol* 2014; **88**(9): 1631–1634.
6. Calabrese EJ. An abuse of risk assessment: how regulatory agencies improperly adopted LNT for cancer risk assessment. *Arch Toxicol* 2015; **89**(4): 647–648.
7. Calabrese EJ. Cancer risk assessment foundation unraveling: new historical evidence reveals that the US National Academy of Sciences (US NAS), biological effects of atomic radiation (BEAR) committee genetics panel falsified the research record to promote acceptance of the LNT. *Arch Toxicol* 2015; **89**(4): 649–650.
8. Calabrese EJ. Muller’s Nobel lecture on dose–response for ionizing radiation: ideology or science? *Arch Toxicol* 2011; **85**(12): 1495–1498.
9. Calabrese EJ. Muller’s Nobel Prize lecture: when ideology prevailed over science. *Toxicol Sci* 2012; **126**(1): 1–4.
10. BEAR I Genetics Panel, NAS. Genetic effects of atomic radiation. *Science* 1956; **123**: 1157–1164.
11. Calabrese EJ. On the origins of the linear no-threshold (LNT) dogma by means of untruths, artful dodges and blind faith. *Environ Res* 2015; **142**: 432–442.
12. Calabrese EJ. LNTgate: how scientific misconduct by the U. S. NAS led to governments adopting LNT for cancer risk assessment. *Environ Res* 2016; **148**: 535–546. DOI: 10.1016/j.envres.2016.01.039.