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# Correspondence

## On-Call Stress

Dr. Huntoon's article[1] stated eloquently one of the nagging problems of medical practice—after-hours call. Like Dr. Huntoon, I took call no less frequently than every third night and every third weekend, and on many occasions, weeks or even months at a time. As a resident I took call every night on the neurology service for a solid year, so I know firsthand whereof he speaks.

I also have a strong interest in the effects of stress on neurological function, including depression, anxiety, dysfunction in decision-making, and the relationship between stress and deterioration of health. The problem is that no one other than the practicing physician seems to care.

We all appreciate that the "system" cares nothing about the health of physicians. If a physician dies from the stress or is forced into early retirement, it matters little to the hospital administrators or government health bureaucrats, because the world is filled with physicians eager to take his or her place. One might expect some concern about the patients, but there is little or none.

Physicians need to band together and put a stop to this harmful system once and for all, and to protect themselves from arbitrary abuse by hospital administrators and government bureaucrats.

**Russell L. Blaylock, M.D.**
Ridgeland, Miss.

[1] Huntoon LR. Is being on call driving you crazy and making you sick? *J Am Phys Surg* 2008;13:35-36.

## Low-dose Radiation

My thanks to Dr. Luckey for his article documenting the healthful effects of low-dose ionizing radiation. He has devoted much of his life to investigating these effects.[1]

I do not, however, understand the extrapolation he makes in Figure 4, where he summarizes and plots biopositive radiation effects on cancer mortality from several studies. "A weighted average for total cancer mortality rates at 2 cSv allows extrapolation (the heavy line) to zero cancer deaths" at about 50 cSv (essentially the equivalent of 50 rad or 50 rem for humans, at 1 cSv/rad). Natural background averages about 0.3 cSv in the U.S.

On p. 40, Luckey writes, "Using a weighted average exposure of 2 cSv, extrapolation of these data indicated an average body burden of 50 cSv would reduce cancer death rates to zero. When this dose was divided by the weighted average of 34 years exposure, the data suggest that 18 mSv/y would reduce cancer incidence so much that it would become a minor cause of death."

In his books and other publications, Dr. Luckey compiled evidence proving the linear no-threshold hypothesis (LNT) false. A false, straight-line interpolation of bionegative health effects from high dose effects was the basis for this hypothesis. As Luckey notes on p. 41, "small and large doses produce opposite effects. This can also be referred to as a biphasic dose-response curve." Every biologic dose-response curve that I'm aware of is S-shaped, not a straight line.

Given the demonstrated false results from interpolation in the linear no-threshold hypothesis (LNT), why does Dr. Luckey seem to give weight to the extrapolation to zero cancer deaths in Figure 4?

**Robert J. Cihak, M.D.**
Brier, Wash.

**In reply:** It is good that medical people will consider low-dose irradiation for the prevention of cancer.

The following should clarify Dr. Cihak's reading of the paper:

Most people equate the biologic effects of ionizing radiation directly with dose. This produces a sigmoid curve.

However, the biologic effects of ionizing radiation depend upon the logarithm of the dose. This plots as a straight line. The log dose presentation provides predictions by extension of the straight line, as in Figure 4.[1]

The data presented are consistent with a straight line from below ambient levels (an acute deficiency of ionizing radiation) to an optimum level. At the optimum level the data clearly show a decreased beneficial effect with increasing levels. This produces the LAMBDA (all caps) curve as shown in figure 1.

The linear-no-threshold hypothesis is wrong when it begins at ambient levels, leaving no place for hormesis. The data, however, support a linear-no-threshold concept when it begins at the threshold, where the dose is more than a thousand times the ambient level.

Thank you for this opportunity to clarify these concepts.

**T.D. Luckey, Ph.D.**


[1] Luckey TD. The health effects of low-dose ionizing radiation. *J Am Phys Surg* 2008;13:39-42.

[2] Luckey TD. *Radiation Hormesis*. Boca Raton, Fla.: CRC Press; 1991.

[3] Luckey TD. Documented optimum and threshold for ionizing radiation. *Int J Nucl Law* 2007;1:378-409.


### Atmospheric Carbon Dioxide and Nuclear Energy

Robinson et al.[1] make an extremely strong case for rejecting the view that the rising atmospheric $CO_2$ concentration is a grave danger and that the carbon emission from fossil fuel combustion should be drastically reduced regardless of cost. The authors go astray, however, in the section "Environment and Energy."

The authors point out that spent nuclear fuel can be recycled into new nuclear fuel. This is being done in several countries. But reprocessing spent fuel does not mean that there is no high-level nuclear waste. The production of high-level waste—mainly strontium-90 and caesium-137—is inseparable from nuclear fission. This waste must be stored safely for at least 600 years. Transuranic elements with long half-lives are also produced, but it may be possible to render them innocuous; until this can be done, they will have to be stored. This is not an objection to nuclear energy, but waste depositories are unavoidable.

The authors propose that U.S. nuclear generating capacity be increased from 90 GWe to 650 GWe. It is most unlikely that nuclear reactors can be deployed in the U.S. at a rate faster than 20 GWe per year; the program would therefore take more than 30 years to complete, and cannot start earlier than 2015, as design and construction takes 7 years. It is probable that U.S. electricity demand in 2050 will be higher than it is today, for example if gasoline-driven automobiles are replaced by electric vehicles. It is therefore far from certain that there would be 230 GWe of nuclear capacity available for production for export.

The authors state that "with plentiful, inexpensive energy, seawater desalination can provide essentially unlimited supplies of fresh water." But even nuclear energy is much too expensive. Desalinated seawater costs approximately $1.50 per cubic meter, and maize requires 450 cubic meters of water per ton harvested grain (wheat and rice require much more). The use of desalinated water for irrigated maize cultivation would thus raise the price of maize by approximately $700 per ton. There will not be "unlimited" supplies of fresh water until the cost of nuclear energy has fallen to a small fraction of its present cost. Whether this will ever happen is problematic.

The authors allege that "energy-intensive hydroponic greenhouses are 2,000 times more productive per unit area than are modern American farming methods." This probably holds the world record for exaggeration. Supplementing sunlight by electrical illumination in greenhouses would be far more costly than desalinated seawater.

The belief that technological breakthroughs can compensate for human irrationality and stupidity is wishful thinking. Remember General Patton's remark: "War makes all other forms of human endeavor shrink to insignificance."

**Bernard Gilland**
Espergaerde, Denmark

**In reply:** Commenting on the writer's points:

1. While there is some waste left over after reprocessing, the physical amount is reduced to such a great extent that it is an irrelevant problem.

2. Insofar as it being impossible to build the nuclear power plants we propose in less than 30 years, this is armchair technology limitation. Design and construction would take this long only if paper shufflers were allowed to use most of the time. Only 4 years were required to invent, build, and use the technology that won World War II—an enormous technological undertaking that far surpasses 50 nuclear power installations.

There are excellent designs for nuclear power plants now—that are being used to build nuclear power plants outside the United States.

Moreover, our proposal is for identical plants in 50 locations, so only one basic design is needed. Construction could proceed simultaneously at all 50 locations. All 50 of the plants could be coming on line 5 years from now, if the free market—freed from taxation, regulation, and litigation—decided to build them.

3. The writer assumes that desalinated water would be used to grow grain in an ordinary way. Grain can be grown with use of much less water or in localities with lots of natural water. Water is used for many things other than growing grain—human use, for example, in urban areas. California just approved a new desalination plant—with a power source far less economical than nuclear power.

4. As far as hydroponics is concerned, we give our reference,[2] which Simon based upon an actual working installation.

**Arthur B. Robinson, Ph.D.**
Cave Junction, Ore.


[1] Robinson AB, Robinson NE, Soon W. Environmental effects of increased atmospheric carbon dioxide. *J Am Phys Surg* 2007;12:79-90.

[2] Simon JL. *The Ultimate Resource 2*. Princeton, N.J.: Princeton University Press, 1996.