Radiation matters

The **linear no-threshold (LNT)** hypothesis has it that radiation damage to the body is cumulative over time, and linear to zero exposure. Simply: it doesn't matter when you receive ionizing radiation: the only thing that matters is your lifetime dose to date. The hypothesis was put forward in the 1950's and has been the default position for health authorities in most countries for 70 years. The idea was adopted by CND (the Campaign for Nuclear Disarmament) in the 1960's and was the driver of public opinion that ended nuclear bomb testing in the atmosphere. We were told they were slowly killing is all and damaging future generations. We were told that the 1% increase in background radiation (confined to the northern hemisphere) was a danger. In hindsight, was it?

I distinctly remember being doubtful about that at the time, but we wanted the testing stopped and the argument was powerful, even if not backed up by evidence of any kind. Fear is a wonderful weapon in politics and economics. Fear has kept the nuclear industry as a minor player in power generation in most oil-burning countries (except France). That same fear has stopped countries like New Zealand from greatly extending the shelf-life of exported food by irradiation, at a cost of millions upon millions of dollars in lost revenue. If we found that our fear was not justified, would we tell anyone? Would we quickly change the way we live? Would we willingly realign countless jobs and restructure industries? Think about that carefully: a brief summary of what we now know follows.

The background and its effects

Background ionizing radiation delivers an average dose world-wide of 2.5 mSv per person per year. (The milli-Sievert is a unit of dose equivalent: look it up). The background includes gamma radiation from cosmic rays, beta emission from potassium 40 in our own bodies, and alpha emission from atmospheric radon derived from uranium in rocks. Bananas are high in potassium and more radioactive than other fruit. There is even a suggestion that the *Banana Equivalent Dose* from eating one banana be adopted for popular reference. That is about 0.0001 mSv [1]. All this is alarming, largely because we can detect the radiation with a ticking Geiger counter and are afraid of cancer.

We have an immune system to deal with 99% of bacterial, viral and fungal invasions. Is it likely that we're completely defenseless against ionizing radiation? Radiation that has been there for all of our history? Organisms *evolve*. They become optimized for the conditions in which they live [2]. Normal physical and chemical biological damage does not follow a LNT regime. Music at 120 decibels for six months will make you deaf, (agreed), but songbirds in trees for a hundred years will do nothing at all to your ears.

Severe sunburn when young might cause skin cancer in later life, (agreed), but a little sunlight in childhood is important for vitamin D production and is not damaging.

If the LNT hypothesis is correct for ionizing radiation, we are vulnerable in our long term environment. That would be an exception to a well-established rule.

What evidence do we now have?

Most people in Hiroshima and Nagasaki recovered, even though they had received up to ten times the average lifetime dose in one single gamma ray burst. They are not now mostly dead from cancer as expected. Lives have been reduced by a small amount: up to two years for the most severely irradiated, and a month or less for the rest. Their children have suffered no measurable effects. There is thorium in the rocks and beach sand in Kerela (southern India), Citizens of Kerela live with 10-20 times the average background radiation, They have half the cancer rates of Japan and a third of the rates of the US[3].. Radiation is not a factor. Studies of people in stone houses for generations in Europe have shown that their incidence of lung cancer is not related to increased radon levels in those houses, and airline pilots are not dying young from increased lifetime exposure to cosmic rays, as some people predicted.

Cancer is a common disease, A slight increase in the incidence is difficult to detect, but all the available evidence does not indicate enhanced cancer risk, or other effects, at doses below 100 mSv per year[4], (forty times the average natural background). A CT scan that delivers 15 mSv in a hospital is not considered dangerous, but by current regulation, the acceptable exposure of the general public above natural background is limited to 0.3 mSv/yr from NORM [4] activities. That restriction, not supported by evidence, has a lot to do with preventing the nuclear replacement of oil burning power stations. Perhaps with accelerating climate change we need to rethink that. To quote Wade Alison in *Radiation and Reason* "*…. civil nuclear technology is the only possible approach that is sufficient to cut the main driver of escalating climate change. We need it to maintain the world economy while avoiding the discontent and unrest that could lead to discord and war on a world scale."* We, all of us, need to think carefully about this.

References

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