# THERE HAS NEVER BEEN A TIME THAT THE BENEFICIAL EFFECTS OF LOW-DOSE IONIZING RADIATION WERE NOT KNOWN

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**SUMMARY**
Health and medical benefits of radon- and radium-health spas were known for centuries. After radioactivity was discovered, this link was documented.

In 1896, a few months after Röntgen published his x-ray paper, health benefits of low-dose x-rays were demonstrated; along with many reports of high-dose harm. We know now that the response described was primarily immune system stimulation. It cured and prevented diseases, especially infections and inflammations.

There were many successful applications. Careful medical work showed that "more dose" didn't help when such applications didn't work. But, to many, "more is better." Excessive doses produced late-effects (e.g., cancers). But, ignoring dose-response data, it was claimed that "radiation use produces cancer" in such applications

In 1932, Eben Byers died from ingesting radium. At age 51 he found it stimulated his health and well-being. But it produced bone necrosis, gruesome disfigurement, and death after 3 years. Time ran a full page obituary, with pictures. FDA obtained authority over radiation and, without studying health effects in thousands of radium users and workers, FDA limited radium and radiation use to medical/pharmaceutical industry.

In 1936, an NAS supported FDA, discounting known stimulatory effects of low-dose radiation. This continued after WWII. Data and research showing that low dose radiation is not, can not be, harmful, and even beneficial, were simply ignored by Federal agencies and their "advisory bodies." Their various rationales were to foster fear of nuclear weapons; to respond to medical and pharmaceutical industries; and for radiation protection funding and programs.

## I. DISCOVERY OF X-RAYS AND BENEFITS

The following news item was reported in "The Electrical Engineer," August 19, 1896: [1]

> **"EXPERIMENTS WITH X-RAYS UPON GERMS.**
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> **"Some experiments have been made by Dr. William Shrader, of the Missouri State University, to test the effect of the Rontgen rays upon various disease germs. In nearly every instance these are reported to have met with success and prove conclusively that the rays are invaluable in the treatment of these diseases. Among the first experiments were those made with the diphtheria bacilli; tubes were inoculated with the germs, one exposed to the rays and the other not exposed. In the former the germs were destroyed, while in the latter they lived.**
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> **Following these tests two guinea pigs were inoculated with a solid culture of diphtheria, prepared in the bacteriological laboratory of the university. These pigs weighed 210 and 185 grams respectively. One was exposed to the rays for four hours in a wooden box, having a rubber cover, and is alive today after eight weeks, and no trace of the disease can be found. The other pig, not exposed to the rays, died within 28 hours after the injection of the poison. The post-mortem examination showed that his death was due to the diphtheria germs."**

These effects were repeatedly confirmed over many years. They led successful applications of low dose radiation in stimulating the body to reject infections and inflammatory diseases. In the same issue, a report of the Rede lecture at the University of Cambridge in which Prof. J.J. Thomson states: "unfortunately, they do not exert any of those deleterious effects on bacteria which are fortunately associated with ultra-violet light." He states also that the energy is small. He finds no effects that "involve the expenditure of an amount of energy produced by a candle in one second;" and "no appreciable effect on the combination of hydrogen and chlorine, though this is a good test of the intensity of very faint light."

The editorial section of the same issue reported: [2]

"PHYSIOLOGICAL EFFECTS OF X-RAYS.

**"FROM the evidence of various experimenters, it is apparent that considerable more investigation will be required to determine what the physiological effects of X-rays are, or even whether any such effects are produced by them at all. The testimony on this subject is very conflicting, even taking only that of the highest authorities. Prof. J. J. Thomson, in the Rede lecture at the University of Cambridge, states that X-rays do not exert any of those deleterious effects on bacteria which are fortunately associated with ultra-violet light. In contradiction to this statement we print elsewhere a note concerning some experiments made by Dr. William Shrader, of the Missouri State University, on the effect of Rontgen rays on disease germs. In nearly every instance the germs were found to be destroyed by the action of the rays. The experiments with diphtheria bacilli appear to be conclusive, and from other sources we have heard of a number of equally successful experiments in treating consumptive patients with X-rays, but in the face of such contradictory evidence it is necessary to suspend judgment for a time, until more data on the subject is brought to light.**

**"In respect to one effect of these rays the evidence is pretty well united. Nearly all those people who have worked extensively in this field state that wherever the rays pass through the flesh the latter becomes apparently sunburned and the hair falls off the exposed surface. This whole subject opens up a field of the utmost interest and one from which highly important results from a medical standpoint may occur.**

**"We deeply regret to note here the death of Dr. Shrader, whose investigations are referred to above, and who died from the exhaustion caused by his unremitting study of the subject."**

Further confirmation and perspective was reported in the Dec. 1896 Electrical World, with a report on the Nov. 28 *La Nature* (France): [3]

***Effect of X-Rays on the Skin.*** **C. E. G. *La Nature*, Nov. 28. - After giving an account of the experiences of an X-ray demonstrator at a recent exhibition, he suggests that the cause might be due to the decomposing action of the X-rays on the gases which they traverse; if the action is the same on the liquids of our organism, acid or alkaline substances should be set free, the quantity of which would be very small, but their effect should be to completely disorganize the tissues; he thinks it may be due to this phenomenon on that the different actions of the X-rays if on bacilli may be attributed the rays act after inoculation it surrounds rounds the bacilli with a medium which or dilutes them, but in cultures these destructive media are not produced, and there is therefore no action; this might explain why some observers have found such actions, while-others have obtained negative results.**

This, of course, is the biological response to infections: stimulating the immune system to attack bacteria, in which macrophages engulf the "foreign bodies" of the bacteria.

Another 1896 report, although printed Jan. 9, 1897 in Electrical World while the editors waited two months to evaluate the credibility of the authors and their report, Caffrey and Wilson [4] reported on their experience with low dose x-rays, both with their own injuries and the treatment of patients. This report is reproduced as an Attachment.

### A. The "Next Phase" of Low-Dose Response Research in Biology and Medicine

However, despite these early indications, and similar reports in the biology and medicine literature, there was limited use of the evidence. The medical community had little "scientific ethic," and there was little correspondence between biologists and medical people. Also, the attention given to the rapid "improvement" of x-ray instruments, to produce much higher dose rates and doses; combined with primary medical interests in both the high-dose/dose-rate applications for therapeutic imaging and for cancer tumor therapies.

There was much more research with low-dose response in botany. A substantial summary of the initial research was reported in 1908 by Gager. [5] A more comprehensive review of botanical and physiological studies, is a 1915 Science cover paper by A. Richards [6] in which he summarized current knowledge, but with more attention to high-dose responses than low doses. But the clear knowledge and understanding of low-dose effects were noted. For example, Dr. Richards states:

"In general, it may be said that when living cells are exposed to action of radioactivity, the vital functions are retarded or depressed and a permanent injury may result; this depends on three factors, the strength of the radiating substance, the duration of the exposure, and the distance of the object from the source of the radiation, When the intensity of the radiation is great, owing to exposure at short range to a strong preparation (or strong current in the case of X-rays) for a long time, the effects are much more injurious than when the intensity is less. Indeed, numerous cases have been reported where a qualitative difference results from a slight radiation as contrasted with one of great intensity, for frequently stimuli which will retard growth if of high degree will be found to accelerate it if weak enough.

He also makes the following statement:

"In rapidly growing tissue, such exposure will cause a decrease in the rate of division as well as interfering with its regularity. On the other hand, an exposure of short duration and of slight intensity will in some cases stimulate growth, and accelerate regeneration, and may perhaps cause an increase in the rate of cell division."

Specifically on plant response, he confirms Gager:

"Gager reviews the literature on this subject up to 1908 and summarizes the state of knowledge at that time in his last paragraph as follows:

**"The broadest, and at the same time the most definite generalization warranted by the work so far done is that the rays of radium act as a stimulus to metabolism. If this stimulus ranges between minimum and optimum points, all metabolic activities, whether constructive or destructive, are accelerated, but if the stimulus increases from the optimum toward the maximum point it becomes an over-stimulus, and all metabolic activities are depressed and finally completely inhibited. Beyond a certain point of over-stimulus recovery is impossible, and death results." ...**

**"Cells contain a great many kinds of enzymes and it has been shown by a number of investigators that radium rays and X-rays have the property of modifying the action of some enzymes. Packard concludes that while many enzymes may be activated, 'the lytic enzymes are more stimulated than those which play a synthesizing role.' Where a slight radiation results in acceleration, the synthetic processes may be supposed to be stimulated more than the destructive activities."**

He reports on then current research, much in Germany, and competing theories of the biological actions of the x-rays. His own results attempt to explain the mechanisms behind the clear evidence of biological responses. These actual responses are ignored by review bodies for the last 60+ years, denying the evidence (to 'explain' why it doesn't exist), instead of explaining it.

"It has been found by numerous investigators that radium rays have the power to affect enzymes, and the writer[15] has shown that X-rays are able to bring about modification in the activity of certain enzymes Enzymes are derived from living tissues and if it is possible to cause their modification outside of the cell by the use of radioactivity it is not improbable that they also undergo change while within the cells. In fact, the writer working with Miss Woodward[16] was able to prove that X-rays can be used -to influence the activity of the cell extractive called fertilizin. ... Its behavior is in some respects comparable to that of an enzyme and it is possible that the substance contains enzymotic bodies. The experiments showed that radiation by X-rays is capable of changing the activity of fertilizin, and in general agrees with previous work that weak radiation is accelerative and strong inhibitive." [See refs 7, 8]

In his conclusions, he further refers to Gager:

"From Gager's conclusions that radioactivity is a stimulus to metabolic processes, it may be inferred that the functions, as cell division, which even remotely depend on these processes would also be affected by radiation. Such an inference is borne out by the observations[19] made by the writer on the rate of division in *Planorbis* eggs that had been exposed to X-rays, for in these experiments it was found that a light radiation served to accelerate the first one or two mitotic cycles that followed it; after that injurious effects gradually asserted themselves. A strong radiation was directly inhibitive." [See ref 9]

Finally, on low vs. high doses, Richards states:

"The facts, as they are at present known in regard to the effects of radioactivity on living matter, show that life processes are subject to marked changes under the influence of the radiation, a slight exposure being accelerative in most cases while a more intense treatment is inhibitive or destructive."

### B. The Early 20th Century

Hundreds of studies and reports of successful medical applications of low-dose radiation, especially for dramatic benefits in infections and inflammatory diseases were reported from the turn of the century to much more formal research and reports up to the 1040s, and beyond.

One dramatic effect is the immediate termination of gangrene. Where even amputations had largely failed, with 80% mortality rates, irradiation before and well into gangrene progression halted its progress. After the disease was halted, damaged tissue was clearly demarcated and could be removed, not as with amputation, an attempt to "get ahead" of its progress; and the early general failures of the serum and sulfanilamide drugs except very early in the disease. J.F. Kelly wrote several reports. See especially his 1941 paper. [10]

Also during the early part of the century, evidence of longer life, better health, wound healing, and improved fertility, along with reduced cancer and other chronic and fatal diseases, were reported. It was found that many "health spas," long known for beneficial health effects (for hundreds to thousands of years), were radioactive.

There was renewed interest in their use, and even to transport radioactive materials to people, overcoming limited access to these facilities, e.g., bottled water labeled 'radioactive'. Radium extraction made both radium and its radon gas product available in local facilities for medical use.

Today, hundreds of such facilities have been developed around the world, with many now closed, but many new ones are opening. Medical insurance provides such treatments in some countries.

However, research on the mechanisms of such exposure is severely limited by the research establishment that is funded by the government "radiation protection" agencies.

### C. Current Reviews

The most comprehensive current review of the biological responses to radiation health effects at low-doses have been conducted by Dr. T.D. (Don) Luckey, Prof Emeritus of the U. Missouri-Columbia School of Medicine. His two monographs on the subject [11] incorporated virtually all of the significant literature in the various relevant fields of biology.

Unfortunately, this does not include very much of the extensive work done in radiobiology and toxicology, which have a limited connection with biology. These fields have drifted into mechanistic studies with little substantial contribution to, or assessment of, the biology literature, especially in the last 40 years in which the influences of physics have led to largely irrelevant but large, costly, experiments.

Dr. Luckey continues to contribute to assessing the data, with papers and the data being developed and reported by Radiation, Science, and Health in a "Data Document," available on its web site: http://cnts.wpi.edu/rsh/

In studies with appropriate dose ranges and research on relevant factors, the results are not considered by the responsible institutions (government, industry, and research).

Another substantial effort to examine the issues and the literature is led by Dr. Edward Calabrese at the University of Massachusetts at Amherst, and the science group, Biological Effects of Low Dose Exposure (BELLE), formed in 1990. This group addresses both low-dose chemical and radiation exposures. However, it is primarily a toxicology group on the significance of "bi-phasic effects" at low doses, and the potential policy implications to toxicology if the effect were to be acknowledged by the regulatory agencies.

BELLE's web site, http://www.belleonline.com/ includes its Newsletter. A paper series by Dr. Calabrese and Linda Baldwin examines: the historical foundations of the science; the demise of the hypothesis; and the "marginalization" of the science.[12] It is clear that this was not an "accident."

## II. CONCLUSIONS

The suppression of the evidence of the beneficial health effects of low-dose radiation started in the 1930s, led by medical and pharmaceutical interests, and later by the "protection" bureaucracies.

We must allege science misconduct, and sue the agencies to affect change, since otherwise the science will continue to be suppressed and falsified.

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