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SPECIAL ISSUE INTRODUCTION

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> *"At the early stages of evolution, increasingly complex organisms developed powerful defense mechanisms against such adverse radiation effects as mutation and malignant change. These effects originate in the cell nucleus, where the DNA is their primary target. That evolution has apparently proceeded for so long is proof, in part, of the effectiveness of living things' defenses against radiation."* Zbigniew Jaworowski 1999

> *"Chernobyl was indeed an historic event; it is the only nuclear power station disaster that ever resulted in an occupational death toll, albeit a comparatively small one. A vast environmental dispersion of radioactivity occurred that did not cause any scientifically confirmed fatalities in the general population. The worst harm to the population was caused not by radiation, and not to flesh, but to minds."* Zbigniew Jaworowski 2010

This Special Issue which focuses on ionizing radiation benefits and risks is in honor of Zbigniew Jaworowski (1927–2011) whom the above two quotes relate. The reference in the second quote to the worst harm from Chernobyl being "to minds" relates to *radiation-phobia-caused harm* which is indirectly related to the linear-no-threshold (LNT) hypothesis. Scientist and scientific groups that rely on the LNT hypothesis for low-dose-radiation risk assessment have convinced the general public that any amount of radiation could cause harm no matter how small the dose. As pointed out by Dr. Jaworowski, this led to "senseless relocations" of people related to the Chernobyl accident that were distant from the dangerous area near the nuclear power plant (Jaworowski 2010).

Enormous societal losses related to the Chernobyl evacuations pointed out by Dr. Jaworowski include the following: ostracisms and pauperization of evacuees, exclusion from use of vast areas contaminated with low-level radioactivity, and losses of property and infrastructure

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(Jaworowski 2010). He also highlighted the epidemic of the following non-radiation-related psychosomatic afflictions among the evacuees: diseases of the digestive and circulatory systems, frequent headaches, depression, anxiety, escapism, learned helplessness, unwillingness to cooperate, overdependence on others, alcohol and drug abuse, and suicides. An additional radiation-phobia-related tragedy was the reported loss of more than 100,000 babies because of abortions (Ketchum 1987).

Like for Chernobyl, LNT-related radiation phobia has led to societal losses (e.g., losses of homes and properties) and to psychosomatic afflictions and deaths among those relocated from around Fukushima nuclear power station in Japan. As of March 31, 2012, more than 1000 disaster-related premature deaths that are not due to radiation-induced damage or to the earth quake or to the tsunami have been identified (Reconstruction Agency 2012). An evaluation of the deaths revealed that about 80% were for persons above 70 years of age. Of these deaths, about eighty percent occurred within the first three months of the evacuations. The premature deaths were mainly related to the following: (1) somatic effects and spiritual fatigue brought on by having to reside in shelters; (2) stress to fragile individuals related to being relocated from their homes; and (3) delays in obtaining needed medical support because of the enormous destruction caused by the earthquake and tsunami.

Dr. Jaworowski published more than 300 scientific papers, four books, and a score of popular science articles including articles related to the Chernobyl and Fukushima radiological emergencies. This issue includes 13 peer-reviewed papers along with this introduction paper.

The paper by Dobrzyński *et al.* (2012) discusses Dr. Jaworowski eventful and prolific life, including his opposition to claimed anthropogenic global warming and to the LNT hypotheses as it relates to low-dose radiation risk assessment. The first quote above (Jaworowski 1999) is a reflection of Dr. Jaworowski's view on why the LNT hypothesis should be challenged. He often pointed out that present LNT-based rules of radiation safety are draining national budgets disproportionately to real radiation risks, whereas the wasted money dedicated to hypothetical lives saved could be used to actually save lives in third-world countries.

The commentary by Cuttler (2012) reviews the international radiation protection policy that resulted in unnecessary and very costly evacuation of more than 90,000 residents near the Fukushima nuclear power station in Japan to protect them from hypothetical (LNT-hypothesis-related) health risks. The author discusses what he considered more appropriate levels for evacuations.

Wilson (2012) also addresses the Fukushima evacuation. The author makes the very important point that the risk of casualties associated with evacuation can be significantly larger than the expected number of radiogenic cancers when based on the LNT hypothesis. *In such cases, evacua-*

tion is likely unnecessary and unfortunately this was not realized by those that had to make a decision within hours in Japan. The author points out that *important changes are needed worldwide in the guidelines for radiation protection in radiation accident situations.*

Nowosielska *et al.* (2012) discuss experimental evidence for low doses of low linear energy transfer (LET) radiation stimulating anticancer immunity in both radioresistant and radiosensitive mice. The researchers show that repeated small X-ray doses increased the efficiency for destroying tumor cells by macrophages and natural killer cells.

Bruce *et al.* (2012) present data showing that repeated low doses of gamma rays prevent lung tumor induction in mice by injected benzo(a)pyrene, a cigarette smoke carcinogen. This finding contradicts the LNT model which predicts an increase rather than a decrease in tumors.

Scott *et al.* (2012) presents mouse studies data from two research groups showing that low doses of gamma rays prevent spontaneous hyperplastic foci in the lung and spontaneous lung adenomas. A radiation benefit model (rather than a radiation risk model) is used to describe the adenoma data along with similar data for lung cancer prevention in humans by chronic exposure to radon in the home.

Fornalski and Dobrzyński (2012) provide evidence from an ecological study showing that the relative risk for cancer mortality is lower in higher natural background areas of Poland than for lower natural background areas. The findings also contradict the LNT model in that the *relative risk for cancer deaths decreased by 1.17% /mSv/year* ($p = 0.02$) when all types of cancer death were included. With the LNT model relative risk can only increase as the radiation exposure level increases.

Doss (2012a) provides evidence for *radiation hormesis in atomic bomb survivor data* when the data are corrected for a systematic bias related to the assigned baseline cancer mortality rate. The paper highlights the difficulty of obtaining scientifically sound results from epidemiological studies of atomic bomb survivors.

In a second paper Doss (2012b) points out that both *low-dose radiation and exercise elevate anticancer immunity and this may reduce the risk of cancer.* He further indicates that by not recognizing the importance of the immune system in cancer prevention and not exploring exercise intervention, *the current reliance on the LNT risk assessment paradigm may have caused missing opportunities to reduce cancer deaths among atomic bomb survivors.*

Ulsh (2012) compares strength and weakness of the epidemiological (top-down) and biological-mechanisms (bottom-up)-based approaches to low-dose-radiation risk assessment. He points out that the growing body of evidence for nonlinear biological responses after low doses delivered at a low rate is casting more doubt on the validity of the top-down, LNT-

hypothesis-related approach of extrapolating cancer risk from high doses and dose rates to environmental and occupational exposure.

Sanders (2012) *explores the promising idea of using harmless ultra low doses and dose rates of ionizing radiation to treat both inflammatory and proliferative diseases*, via activating the body's natural defenses. He points out that anecdotal evidence indicates that ultra low radiation dose rates (microgray per hour) from radon in mines and spas, thorium-bearing monazite sands and enhanced radioactive uranium ore obtained from a natural geological reactor may be useful in treating many inflammatory conditions and proliferative disorders, including cancer.

Calabrese and Dhawan (2012) provide an historical assessment of the highly successful practice of treating gas gangrene with low-dose radiation that ended in the early 1940s because of the advent of antibiotics.

Fliedner *et al.* (2012) provide evidence that *even large doses of low-LET radiation delivered at low rates can be tolerated by the hemopoietic system.* The data presented indicate stem-cell tolerance and adaptation which are compatible with the "injured stem cell hypothesis." The hypothesis states that radiation-injured stem cells, depending on dose rate, may continue to deliver clones of functional cells that maintain homeostasis of hemopoiesis throughout life.

The inclusion of papers in this Special Issue should not be taken to imply that the indicated authors agree with all of the views of Dr. Jaworowski. For example, one author thinks the LNT model has useful application in situations such as Fukushima, while Dr. Jaworowski as well as some other authors publishing in this issue consider the LNT model inappropriate and think that its application could promote avoidable radiation-phobia-related casualties as have already been documented.

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REFERENCES

Bruce VR, Belinski SA, Gott K, Liu Y, March T, Scott B, and Wilder J. 2012. Low-dose gamma-radiation inhibits benzo[a]pyrene-induced lung adenoma in A/J mice. Dose-Response 10(4): 516-526

Calabrese EJ and Dhawan G. 2012. The role of X-rays in the treatment of gas gangrene:
A historical assessment. Dose-Response 10(4): 626-643

Cuttler JM. 2012. Commentary on the appropriate radiation level for evacuations. Dose-Response 10(4): 473-479

Dobrzynski L, Waligorski MPR, and Janiak MK. 2012. Professor Zbigniew Jaworowski–in memoriam. Dose-Response 10(4): 467-472

Doss M. 2012a. Shifting the paradigm in radiation safety. Dose-Response 10(4): 562-583

Doss M. 2012b. Evidence supporting radiation hormesis in atomic bomb survivor cancer mortality data. Dose-Response 10(4): 584-592

Fliedner T, Graessle DH, Meineke V, and Feinendegen LE. 2012. Hemopoietic response to low dose-rates of ionizing radiation shows stem cell tolerance and adaptation. Dose-Response 10(4): 644-663

Fornalski KW and Dobrzyński L. 2012. The cancer mortality in high natural radiation areas in Poland. Dose-Response 10(4): 541-561

Jaworowski Z. 1999. Radiation risk and ethics. Physics Today, September: 24-29

Jaworowski Z. 2010. Belarus repopulating Chernobyl exclusion zone. 21st Century Science & Technology, Summer 2010: 46-47

Ketchum LE. 1987. Lessons of Chernobyl: SNM members try to decontaminate world threatened by fallout. Newsline 28(6):933-941

Nowosielska EM, Cheda A, Wrembel-Wargocka J, and Janiak MK. 2012. Effect of low doses of low-LET radiation on the innate antitumor reactions in radioresistant and radiosensitive mice. Dose-Response 10(4): 500-515

Reconstruction Agency. 2012. Report on the Disaster-Related Deaths due to the East Japan Gigantic Earthquake. August 21, 2012 (available only in Japanese): http://www.reconstruction.go.jp/topics/240821_higashinihondaishinsainiokerushinsaikanrenshinikansuruhoukoku.pdf. Translated text provided by Genn Saji

Sanders CL. 2012. Potential treatment of inflammatory and proliferative diseases by ultra-low doses of ionizing radiations. Dose-Response 10(4): 610-625

Scott BR, Bruce VR, Gott KM, Wilder J, and March T. 2012. Small gamma-ray doses prevent rather than increase lung tumors in mice. Dose-Response 10(4): 527-540

Ulsh BA. 2012. The new radiobiology: Returning to our roots. Dose-Response 10(4): 593-609

Wilson R. 2012. Evacuation criteria after a nuclear accident: A personal perspective. Dose-Response 10(4): 480-499