Editorial

Hormesis: A peep in to the human nature

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Hormesis is a term to denote biphasic dose response to an agent which reveals a stimulatory or beneficial effects at low dose and an inhibitory or toxic consequence at a higher dose or concentration. Hormesis is a concept which is involved to biphasic dose response effects of environmental agents including ionosing radiation. Proponents of anti-nuclear lobby brand the idea of hormesis as the privilege of the cranks, and the ill informed. UNSECAR in 1958 and 1 CRP in 1959 adopted linear non threshold theory (LNT) in contrast to hormetic or biphasic relation. These organizations based their recommendation by extrapolation of the studies done on atomic bomb survivors who had received higher doses of radiation. According to LNT theory (a) The effect of low doses or radiation can be estimated by linear extrapolation from effects observed by high doses, and (b) There are not any safe doses as even very low doses of ionizing radiation produce some biological effect (Mortazan).

Science dislikes any vacuum of ideas, experiments, and evidence. It is generally assumed that science is based on specific results which is independent of personalities; in other words, the interpretation is secular. However, in reality, interpretation of results may to an extent, depend on the position of the interpreter. The frenzied debates about hormesis in radiation or global warming attest to the above assertion. Jamea Miller observed mutation following radiation of *Drosophila*. He assumed a linear relation between radiation and mutation though his experiments did not include very low doses of radiation. Catastrophe following nuclear war on Hiroshima and Nagasaki has resulted in radiophobia and an aversion to the concept of hormesis. The evidence for hormesis is accumulating. According to UNSECAR (1994), amongst A-bomb survivors from Hiroshima and Nagasaki, who received doses below 200 mSv, there was no incidence of cancer deaths. And deaths due to leukemia in the sub group who received less than 100 mSv was less than age matched controls. Nambi and Soman in 1987 have demonstrated a significantly reduced death due to cancer in high back ground areas versus areas of low background radiation in Kerala. In a Canadian survey the mortality caused by cancer at nuclear plants was 58% lower than national average. (Abbat 1983). Thus, there is no evidence of harmful effects of radiation at lower doses. Yet, most people tend to go by LNT model including regulatory authorities.

There are instances in the history of medicine where intuitive decision have been disastrous. It took a while to establish a link between administration of saturated oxygen and retrolenticular fibroblasia in neonates. It was felt that life sustaining oxygen can never harm human life even at higher concentration. Thus, establishing a casual link between retrolenticular hyperplasia and saturated oxygen took considerable time by which time innumerable neonates were affected. The biphasic action of chlorpromazine as protector and senstiser at various concentrations is yet another instance of concentration dependent behavior. There are innumerable such examples of biphasic phenomenon.

Hormesis is integral to the normal physiological function of cells and organisms (Mark Mattson) Adaptive responses evolve due to biphasic response to many physical and chemical stimuli. Hormesis also has played a crucial role in the evolution of life. Life had to evolve despite the harsh environmental conditions, including higher cosmic radiation that is seen now. Cellular mechanism including signaling pathways responsible for adaptive pathways are emerging. Now, there is a mechanistic explanation for a possible hermetic response for a wide range of stimulants, including that for ionizing radiation.

Radiophobia has propelled many a nuclear activitists and scientists in to a narrow tunnel vision, obscuring the evidence, as well as disabling a congent thinking. Men are no *Drosophila* or cells in the Petri dishes. Complex biological systems behave much differently than most people concede. Failure to acknowledge hormesis is also a failure to realise essential realities of biological complexity.

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