

A short article written for the benefit of all, including those who have not yet realised how the cultural history of the past 70 years has given a seriously distorted view of nuclear power.

Fear of nuclear power is an unnatural relic of the late 20th century

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In nature when tall grass moves, it may hide an approaching tiger - or perhaps it's the effect of the breeze. Animals flee potential danger, but mankind has learnt to ask questions, think and study.

None more successfully than Marie Curie over 100 years ago. She mastered the science of radioactivity and wrote *Nothing in life is to be feared. It is to be understood*. She went on to use high doses of radiation to cure cancers. And so in clinics today such treatment plays a major part in extending life for many people. Everybody has a friend or relative who has benefited from her legacy.

But if she were alive today she would be depressed to find how her understanding of the natural world is neglected and doubted, just at the time that it is most needed to mitigate the effects of energy production on the environment.

The mischief began at the close of World War II when the words *atomic* and *radiation* became linked in the public mind with secrecy rather than truth, fear rather than understanding. In the Cold War that followed the lack of trust was exploited ruthlessly for political purposes, such that nuclear technology was seen as incomprehensible to most and evil to many.

Being fearful, people looked to public policy for protection by safety regulation and international accord. This demand continued for many decades, in the process generating careers and job opportunities for some and incurring extra costs for everybody.

However there is no scientific justification for this fear-driven appeasement. Medical evidence shows that life is resilient to the impact of radiation doses much larger than those received by the public, or even the workers, at Fukushima, for example.

But, you may say, how can life, based on those frail DNA molecules, possibly be protected in nature against the far more powerful quanta of ionising radiation? Good question! The answer lies in the Darwinian struggle that began when life appeared on Earth aeons ago.

Competition between forms of life is endless - other organisms, bacteria, viruses - each alive and busy switching strategies of defence and attack, with rare outright winners and perpetual battles, life against life.

But in this war game the attacking strategy of non-living agents is different: it never evolves and so may be out-witted. In three billion years life has had time to evolve defensive strategies to cope with such physical threats if they are always present.

Ionising radiation can break molecules, a process called *oxidation*. Both oxygen and radiation are pervasive in the environment. Radiation comes from soil, rocks, the Sun, distant space and within living tissue too. In fact it was rather more intense when life began than it is today, and protection from oxidation was vital to life from its first day on Earth.

Every living organism has a certain comfort zone of radiation dose rate. The physician, Paracelsus (1493-1541), expressed this more generally when he wrote *Poison is in everything and no thing is without poison. The dosage makes it either a poison or a remedy*.

How does this work? Repair and maintenance is the business of biology and much is now known about the details. Any such business needs resources; failure occurs for an acute attack for which those resources become exhausted - though biology is remarkably clever and quick to replenish with extra supplies in the light of experience.

So natural protection against radiation is virtually complete, unless resources fail or unless the individual *thinks* there is a real danger. The *nocebo* effect, the opposite of the *placebo* effect, is the well known negative medical effect of a harmless agent to a person who believes it is harmful. That can generate a basket of actual symptoms and painful suffering too - an example is the real effect of a curse on a believer, witchcraft in fact.

At a social level the effect can cause panic. At Fukushima this was readily amplified by the media, but the wildlife there, having no such fear and innocent of its modest contamination, has thrived in the absence of humans, just as it did at Chernobyl.

Collective fear is a political force, as potent today as it was in the era of the mediaeval witch hunt. Military weapons have been used throughout history, not only as instruments of death and destruction, but more effectively to engender fear. Losses to men and materials are least if the enemy loses its nerve and retreats.

Nuclear weapons are no exception - they cause blast and fire over several square miles, locally. But it is the fear of global nuclear radiation, a collective *nocebo* effect, that has gripped world opinion for 70 years.

This primitive reaction continues to infect acceptance of civil nuclear power and inflate its cost. We need this cheap environmental solution today and the ghost that haunts it should be exorcised. We should re-educate ourselves, and then the politicians, media, financiers and safety authorities too. They are worried about the money supposedly needed to appease this harmless natural resource. Currently they are running away from nuclear straight towards the likely real dangers of a changing climate. They should realise that nuclear power is not the tiger.

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Fundamental Physics for Probing and Imaging (OUP, 2006), a textbook on Medical Physics and related applications;

Radiation and Reason (2009), an accessible book for all to study <http://www.ypdbooks.com/26-radiation-and-reason-YPD00164.html> ;

Nuclear is for Life (2015), a further book for the non-expert who is keen to understand the evidence <http://www.ypdbooks.com/science-and-technology/1369-nuclear-is-for-life-a-cultural-revolution-YPD01574.html>;

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