Science scares: fact or fiction?

As midnight on 31 December 1999 approached, many people dreaded a worldwide disaster because of the so-called ‘Millennium Bug’. In the preceding months some companies did a roaring trade in preventative measures, and supermarkets ran out of food and emergency supplies. It turned out to be the biggest non-event for years – virtually no computer systems crashed because of the date change – but it shows how a limited understanding of science and technology issues can cause fear and how this can be exploited.

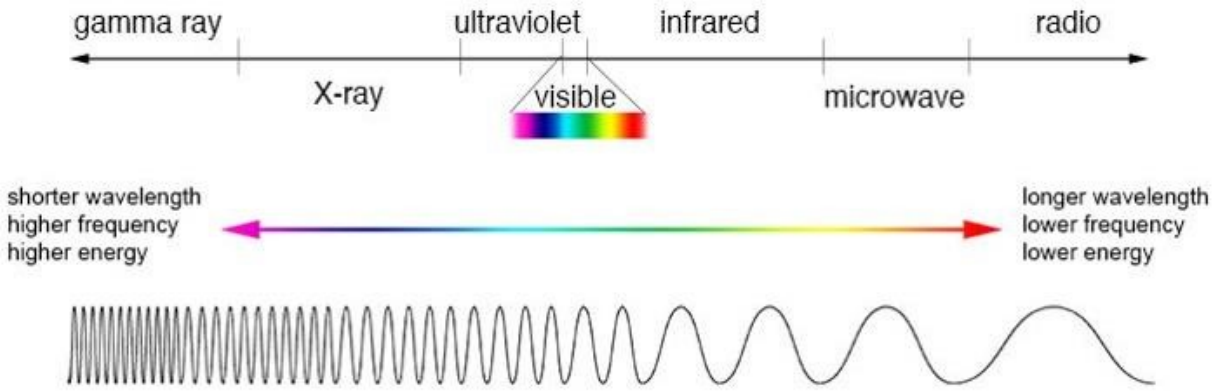
Similar concerns were expressed when the Large Hadron Collider, the world’s biggest machine underground below Geneva, was prepared for major experiments looking for evidence of the Higgs Boson, also known as the ‘God Particle’ about 10 years ago. The panic theories included the creation of a black hole that would swallow up the earth or even the whole universe, despite the lack of anything remotely approaching enough energy for this.

Perhaps the biggest scares relate to medicine. This isn’t surprising when you remember the tragedy of thalidomide leading to major birth defects in the late 1950s, and the frequent, and too often contradictory, advice given on diet and health; these can make it difficult for ordinary people to distinguish real concerns such as obesity and smoking from more debatable points such as the impact of small-scale alcohol consumption. One of the most notorious cases was the 1998 claim that the triple MMR vaccine could cause autism, which led to a marked drop in vaccinations and subsequent dangerous outbreaks of disease, especially measles, in the following years. Careful investigation showed that Dr Andrew Wakefield, responsible for the autism claim, based his conclusions on faulty research, probably deliberately, and all other studies have completely discredited them. Although he was banned from medical practice in the UK, he continues to promote his unfounded views in the USA, where he is regarded as a hero by anti-vaccination campaigners.

It doesn’t help that relatively few people with scientific training work in the non-specialist media, and some newspapers publish complete nonsense in such stories. Even the more respectable BBC seems to think it necessary to give equal time to both sides of an argument even when the reliable evidence points overwhelmingly in one direction (they’ve done the same with climate change until a very recent policy change); that’s how Wakefield managed to get his voice heard so much and people believed him.

More recently a scare story went round, reporting that Gateshead Council’s new street lighting was run on 5G technology, with a risk of causing cancer in the local population. In reality there was no such plan. 5G technology is indeed on its way as a faster and more efficient means of communication for mobile phones and other devices, and every advance in this field brings its cancer scares.

All wireless digital communication relies on some form of electromagnetic radiation, which consists of waves of oscillating electric and magnetic fields that transmit energy. The very small section of the electromagnetic spectrum (the full range of possible radiation) that we can see is, of course, visible light in its various colours. What distinguish different colours, and different parts of the spectrum in general, are different wavelengths and different frequencies of oscillation of the waves; frequency goes up as wavelength goes down across the spectrum. The energy of radiation, which determines what effect it can have on substances including our bodies, depends directly on the frequency. Going up in frequency and energy from visible light we have ultraviolet (= beyond violet), X-rays and gamma rays (a form of radioactivity). These have enough energy to remove electrons from atoms and so change materials chemically, including modifying DNA in our biological cells; such high-energy radiation can cause skin and other cancers.



Lower in energy than visible light we have infrared (= below red, which we experience directly as heat from the sun), microwaves, and a wide range of radio waves. These cannot cause significant chemical reactions and so are incapable of inducing cancer. Existing and planned future communications are limited to certain regions of radio and microwave frequencies. Many studies have been made of their possible impact on human and animal bodies, and there is no evidence whatsoever of anything other than a very tiny heating effect with some of the higher frequencies, and even these are not significant. Apart from frequency/energy the other important property of electromagnetic radiation is intensity or power (measured in watts: an electric kettle uses 3000 watts, a low-energy light bulb around 10 watts). The power of a typical mobile phone signal is less than 1 watt, a small fraction of the heat output of a single human body, and lower than any light bulb. Any notion that mobile phone usage can fry or scramble the brain can be completely dismissed. In fact, advances in technology mean increasing efficiency, and each new generation of devices actually becomes safer in this respect, not more risky.

More scary science stories next time!

Bill Clegg

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