Nature Abhors a Vacuum

Or: A Very Dangerous Assumption

Grahame Blackwell, June 2009

It's a well-known truism that nature will exploit every ecological niche, however small and unlikely. Life is to be found in the deepest darkest trenches of the oceans, the coldest Arctic wastes, the smallest crevices in rocks deep underground. Even in the most abundant and densely-populated environments, if there is a potential food source or habitat unclaimed then some species will arise or adapt to make the fullest possible use of it.

In respect of physical phenomena, likewise, nature is infinitely resourceful. Temperature, sound, colour variation, electrical, magnetic and atmospheric effects are all used in different ways by various species for self-defence, for seeking out prey, for attracting a mate, for migration, for spreading seeds. If there is a physical effect that could in any way be useful to a living organism, no matter how obscure that use may seem, then the twin processes of random mutation and natural selection will bring that effect into play somewhere.

More to the point, in respect of conditions that have pertained on this planet for billions of years, nature will already have done so long ago. The phenomenon of quantum tunnelling was discovered in the middle of the last century and has since been widely used in microelectronics, notably in detection of magnetic fields in the order of millionths of a millionth of a microtesla. Yet less than four years ago it was discovered that some enzymes use quantum tunnelling at a high level of sophistication and have presumably been doing so for millions, possibly billions, of years.

One of the most widely-used naturally occurring phenomena is of course electromagnetic radiation, in the form of visible light. This is used in at least three ways by living organisms:

1. Nearly every animal species (including birds, insects, fish etc) has some form of visual receptors – eyes – through which it acquires significant information on its environment;
2. Plants are able to assimilate energy directly from sunlight by the process of photosynthesis;
3. Ten years ago it was discovered that mammalian eyes include photoreceptors that regulate the organism's circadian rhythms ('body clock') – totally distinct from visual receptors.

It's significant to note that some creatures are able not only to sense electromagnetic radiation in the visible frequency range but also to generate and emit such radiation to deter predators, to lure prey, to attract a mate. Fireflies, glow-worms and quite a number of species of fish have this capability.

So what of radiofrequency electromagnetic radiation?

In the billions of years over which life has evolved on this planet the level of naturally-occurring radiation in the biosphere within the radiofrequency/microwave range has been so low as to be virtually zero in comparison with radiation in the visible spectrum. It's precisely for this reason that these frequencies are used for telecommunications (including radio and tv) – man has exploited what appears to be a vacancy in the environmental framework, no serious 'interference' to worry about.

So has nature missed a trick here and failed to take advantage of a massive gap in the environmental market, by just not making any use of potentially beneficial electromagnetic spectrum availability?

Well, we know that cells are innately responsive to electromagnetic radiation, otherwise eyes could not have evolved in response to that environmental stimulus. To suggest that they're only responsive to *visible* radiation misses a fundamental point – evolutionary adaptation occurs as a response to specific environmental conditions, the general capability for that response must be there first. Remember, too, the snake's ability to detect infrared radiation with an organ that is quite separate from its eyes.

We also know that living organisms are capable of generating electromagnetic radiation: the firefly, glow-worm, bioluminescent fish tell us that. That capability would have started as a random 'spark' (as a result of a random mutation) and then been enhanced by its beneficial consequences in respect of particular frequencies. It's most unrealistic to assume that such random sparks would only have been emitted in the visible frequency range, that presumes a very specific intention in the evolutionary process rather than natural selection of randomly-generated survival traits.

Given the capability to both emit and sense electromagnetic radiation, it's far more likely than not that this capability would have evolved, at a very early stage in the evolutionary process, into some form of signalling mechanism – quite possibly internal to individual organisms, since range may be a significant consideration.. If that is the case, artificial radiation with characteristics that in any way mimic such a signalling mechanism could prove seriously detrimental to those organisms.

The generally accepted mechanism by which cell receptors are considered to identify molecules and so respond to them, positively or negatively, is the so-called 'keyhole-and key' mechanism. This operates on the premise that a cell receptor is shaped so as to accommodate a molecule suitable for acceptance by that receptor but not one that does not qualify for acceptance. Whilst on the surface this appears to be a reasonable proposition, careful consideration of the logistics involved raises a number of questions.

Fitting a key into a keyhole requires that it is presented in exactly the right orientation: attempts to insert the key upside-down, backwards or even sideways are doomed to failure even if the key is a perfect fit when inserted correctly – and most keys have a very limited number of possible orientations. If a complex molecule is to fit correctly into its appropriate receptor it will presumably only do so if it presents at the correct orientation.

The question then arises: how does this happen? Does the cell receptor have the capability to juggle a molecule around and attempt to fit it in all sorts of ways? Does the molecule automatically present itself in a succession of ways until every possible fitting has been tried? How long would this 'trial and error' process go on? What of the molecule structure at the open end of the 'keyhole'?

Jacques Benveniste, at the time the highly respected head of the Immunology and Allergy department at INSERM (the French National Institute for Health and Medical Research) was pilloried by the scientific establishment for claiming scientific evidence that cell receptor sites work rather by recognition of the electromagnetic signatures of molecules that they are programmed to accept. Some of his research in this field was originally published by 'Nature', after satisfying a requirement for a number of independent replications, but this provoked a strong attack by so-called 'quackbusters' who later claimed to have discredited his findings. Those findings rested strongly on the concept of 'water memory', which is related to principles of homoeopathy (and so strongly out of favour with the pharmaceutical industry).

Since that time Benveniste's findings on 'water memory' have been replicated under stringent double-blind conditions in a number of independent laboratories, notably at Queens's University, Belfast, by a team whose leader was initially extremely sceptical, even to the extent of insisting on repeating the experiment under conditions that allowed no possible trace of human error to influence the outcome. Although there have been significantly more successful than unsuccessful replications according to published results, the concept of water memory is still widely reported as discredited pseudo-science.

Clearly electromagnetic recognition of molecules, both by cell receptors and by antibodies, offers a more plausible and efficient mechanism than the keyhole hypothesis (for which no evidence has been seen). If that is in fact the mechanism used by living cells and immune systems then that would predicate a wide range of cell malfunctions and auto-immune disorders as a consequence of exposure to radiation with characteristics similar to that signalling system – disorders consistent with those attributed by some to mobile telecommunications emissions.

The mobile telecommunications industry and the pharmaceutical industry both feature among the five largest commercial interests on the planet. Both stand to suffer significantly in business terms if such a mechanism is shown to apply.

There are indications that 'quackbuster' groups and websites are in many cases set up and well funded by commercial interests. There is a definite possibility that in this crucial area the best interests of open, objective science are not being served – and so neither are the best interests of the public, nor of any other living organism.

It is very dangerous to assume that nature has missed an opportunity – it never does.