

*In their early years children are knowledge junkies,
questioning everything in their view, though exhibiting
little skepticism. Most never learn to distinguish between
inquisitiveness and credulity. Those who do either come to
a bad end or become professional skeptics.*

Michael Shermer

An antidote to pseudoscience?

Forecasting earthquakes

Pseudoscience for profit

2011 Bent Spoon Award

Skeptics Conference report

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'Natural health' due for a shakeup

THE Natural Health Products Bill passed its first reading in Parliament in September. It appears to have wide support across most political parties, and those who follow such things expect it to pass into law next year without significant amendment (www.lawfuel.co.nz/releases/release.asp?NewsID=2763).

The bill proposes regulation of a wide range of alternative health modalities including traditional treatments, herbal and homeopathic remedies, and dietary supplements. Therapies based on manipulating 'energy flows' or spinal subluxations are not covered, nor are any ingredients intended for administration to the eye or ear, or by injection. Leaving aside that some of what is covered would be better described as supernatural rather than natural, the new legislation brings a degree of control over a sector which until now has been something of an afterthought in the Dietary Supplements Regulations 1985 or the Medicines Act 1981; these are now considered out of date in any case. It provides for a list of prohibited ingredients, and an open-ended list of ingredients that can be used.

There is plenty about the bill that skeptics would probably support. Natural health products are an industry estimated to turn over about \$760 million annually in this country, so they definitely deserve greater oversight. There have been horror stories of, for example, so-called traditional Chinese medicines containing dangerous levels of potent drugs, and more stringent controls on permitted ingredients and labelling should reduce this risk.

But it remains to be seen how the law will work in practice. One issue is that there will be no restrictions on the nature of therapeutic claims that may be made for a product. Sponsors must declare they hold evidence to support the claims made (and supply it if requested), but one wonders how this is supposed to work for homeopathic remedies, which contain little or no trace of any allegedly therapeutic product, and which have consistently failed to be substantiated in properly run trials. What standards of evidence will actually be required? The new Natural Health Products Regulatory Authority may exempt an entire category of products from the requirement to have a product notification (needed before they can be distributed), and it will be interesting to see how this clause is applied.

The bill also requires the Authority to establish an advisory committee of up to eight persons to provide them with expert advice. Each member must have expertise in an area relating to natural health products, so will this committee be stacked with practitioners, who may have rather generous interpretations of the law's provisions? This story will be something for skeptics to keep a close eye on as it unfolds over the next few years.

David

Chemistry: an antidote to pseudoscientific thinking?

Michael Edmonds

Having a basic knowledge of the principles of chemistry can help one evade the pitfalls of many pseudosciences – but it's not infallible. This article is based on a presentation to the 2011 NZ Skeptics Conference.

2011 is the International Year of Chemistry and as such I have been involved in a number of activities to celebrate the many contributions chemistry has made to our world. It has also been a time of reflection, during which I have asked myself, can an understanding of chemistry act as an antidote to pseudoscientific thinking? But first let us start with a definition of what chemistry is.

Chemistry is the study of matter, where matter is the material in our universe which both has mass and occupies space. Matter includes all solids, liquids and gases, and chemistry explores not only the properties and composition of matter but also how it behaves and interacts. Therefore chemists also have to understand how matter and energy interact.

While in theory chemistry can be described as an isolated discipline, in its practice and application it often contributes to, and is supported by, other scientific disciplines including biology (pharmacology, molecular

biology) and physics (materials science, astrochemistry).

Core Chemical Concepts

At the heart of chemistry are some central concepts which form the foundation of this discipline. Let us examine some of these.



Michael Edmonds at the 2011 NZ Skeptics Conference.

1) Matter is made up of atoms

The most basic structural unit in chemistry is the atom. The

atom itself is made up of a nucleus containing particles called protons and neutrons, around which smaller particles called electrons orbit.

2) Atoms with different numbers of protons give rise to the different elements

Atoms exist with different numbers of protons (neutrons and electrons). These different atoms afford the different chemical elements which are usually represented in the form of the periodic table (see diagram following page). Each element has different properties and is represented on the periodic table by a one or two-letter symbol. Ninety of the elements occur naturally and these elements can combine to form the fantastically diverse types of matter that make up our universe.

The atomic number (the number above each element) signifies the number of protons each atom has in its nucleus. You will see as you read across each row and then down the number of protons in the nucleus increases.

3) Atoms are really, really small

Atoms are so incredibly small that it can be hard to visualise how very small they are. For example, our lungs hold approximately 1,000,000,000,000,000,000,000 gas atoms, while a grain of sand contains approximately 100,000,000,000,000,000,000 atoms.

4) Matter cannot be created or destroyed, it can however be rearranged

All of the atoms in existence were created billions of years ago in the heart of stars early in the formation of the universe. I find this an extraordinary concept – that the atoms which make up our bodies have existed for billions of years during which time some of them may have formed part of the last *Tyrannosaurus rex*, the first flowering plant, or occupied the bodies of various historical figures. Carl Sagan puts this more eloquently

and succinctly when he explains that “we are made of star stuff.”

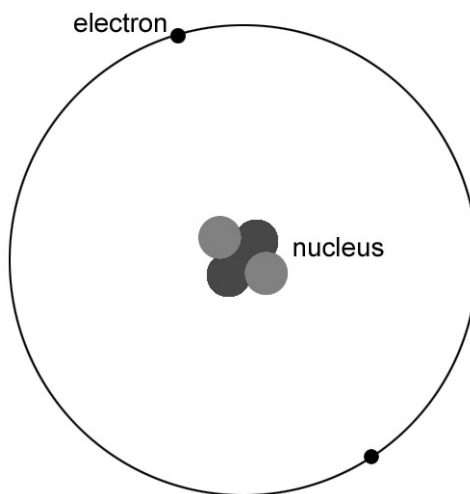


Figure 1: A Helium atom – consisting of a nucleus containing 2 protons and 2 neutrons surrounded by an electron cloud

5) Atoms combine to form molecules

The true diversity of the matter in our universe comes from the ability of atoms to combine to form molecules. Molecules can be simple, for example water, which is made up of one oxygen atom and two hydrogen atoms, or complex, such as DNA, which

can be made up of billions of atoms of the elements carbon, hydrogen, oxygen, nitrogen and phosphorus.

Molecules are also incredibly small – a single aspirin tablet contains approximately 1,000,000,000,000,000,000 molecules of the active ingredient, acetylsalicylic acid.

6) The shape of a molecule is key to its properties

The shapes of molecules have a fundamental effect on their properties. Water molecules, for example, have a V-shape which allows water to exist as a liquid at room temperature and to dissolve many different compounds. Without these fundamental properties, life as we know it would not have been able to evolve on Earth.

The shape of molecules is a key consideration in the development of new drugs. Many drugs work by interacting with specially shaped receptor or active sites in the body. To activate or

Group →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓ Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
Lanthanides				57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
Actinides				89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Figure 2: The Periodic Table (sourced from en.wikipedia.org/wiki/File:Periodic_table.svg)

deactivate these sites, a molecule of complementary shape must be able to fit into the site. And by making subtle changes to the shapes of such molecules it is possible to tune the effect of the drug molecule.

7) Matter moves

It may not be obvious to the naked eye or even under a microscope but all matter moves. In liquids such as water, the individual molecules move relative to each other, only fleetingly and temporarily interacting with other water molecules. This can be observed by adding a drop of food colouring to a still glass of water. The movement of the water molecules alone slowly mixes the colouring throughout the glass without any need for external agitation.

What do these concepts tell us about homeopathy?

Homeopathy was developed just over 200 years ago and is based on three principles:

a) that diseases can be treated by using substances that produce the same symptoms as the disease;

b) that the greater a substance is diluted the more potent it becomes; and

c) that homeopathic solutions are 'activated' by physically striking them against a solid surface.

If one considers these principles against the core chemical concepts discussed so far they make little sense. How can less of a substance be more potent? How could the variable striking of water solutions have any effect on water molecules which

are already in motion relative to each other, and which are therefore unable to form any collective memory of an active substance? For homeopathy to work, key chemical concepts which underlie and explain much of what we know about the physical world would have to be turned on their heads. Such a challenge to well-established chemical concepts would require extraordinary evidence.

To date, no such evidence has been provided by homeopaths. Instead, over the past 200 years, repeated attempts to prove that homeopathy works have demonstrated little more than the placebo effect and the human propensity for confirmation bias.

More Chemical Concepts

8) The Earth is a closed system in terms of mass

Apart from the launch of the occasional deep space probe, the loss of helium into space, or the addition of the occasional meteor, the Earth retains a constant mass. Thus, our physical resources are limited.

9) Matter is continuously recycled

Although we have a limited resource in terms of matter, this matter is continuously recycled as these ancient and indestructible atoms are converted from one chemical compound to another. For example, the carbon in coal when burnt is converted to carbon dioxide which may then be converted by plants into sugars. Such recycling occurs for many elements, particularly in the biosphere of our planet.

10) Chemical compounds can store and release energy

Some chemical compounds are rich in energy and this energy can be released to produce energy-poor compounds. For example, when we burn coal or oil we release energy and produce energy-poor carbon dioxide, or when we consume sugars we use the energy released in our bodies and again produce carbon dioxide. This carbon dioxide can be recycled through photosynthesis in plants to produce more sugars and other energy rich compounds for food. The same is not possible for coal or oil, and as such these are limited resources.

11) Systems are in equilibrium

The systems by which matter is continually recycled are very complex and interrelated. Such complex systems are usually in equilibrium – this means that if we change one variable the system will adjust itself to compensate. For example, as the amount of carbon dioxide has increased in our atmosphere, some of it has been removed by dissolving in the oceans.

The idea of system equilibrium is used by some to claim that an increase in carbon dioxide concentrations in our atmosphere is harmless as the system can re-balance itself. This is potentially dangerous thinking. Most systems, particularly complex ones, can only buffer a certain amount of change, beyond which the system may undergo significant change as it attempts to re-balance itself. Such changes would not necessarily be conducive to human life.

What do these concepts tell us about our environment?

Fossil fuels are a non-sustainable source of energy that also release pollutants and increase carbon dioxide levels in the atmosphere. Humanity would be better served developing alternative sources of energy which harness the power of the sun more directly, for example, through solar panels, hydroelectricity, wind turbines or biofuels. More attention needs to be paid to the effects of increasing carbon dioxide levels in our atmosphere, and its effect on the equilibrium of the Earth's biosphere.

Chemophobia – Causes and Consequences

There are millions of different chemical compounds in existence and chemists use a standardised naming system in order to better catalogue and compare these fascinating compounds.

Unfortunately, amongst non-chemists this chemical jargon can create concern and even fear. For example, most people when asked would turn down an offer to eat a mixture containing methylmethoxypyrazine, phenylacetaldehyde and β -tocopherol, at least until it is revealed that the aforementioned mixture is a chocolate bar, and all of the compounds are natural components of chocolate.

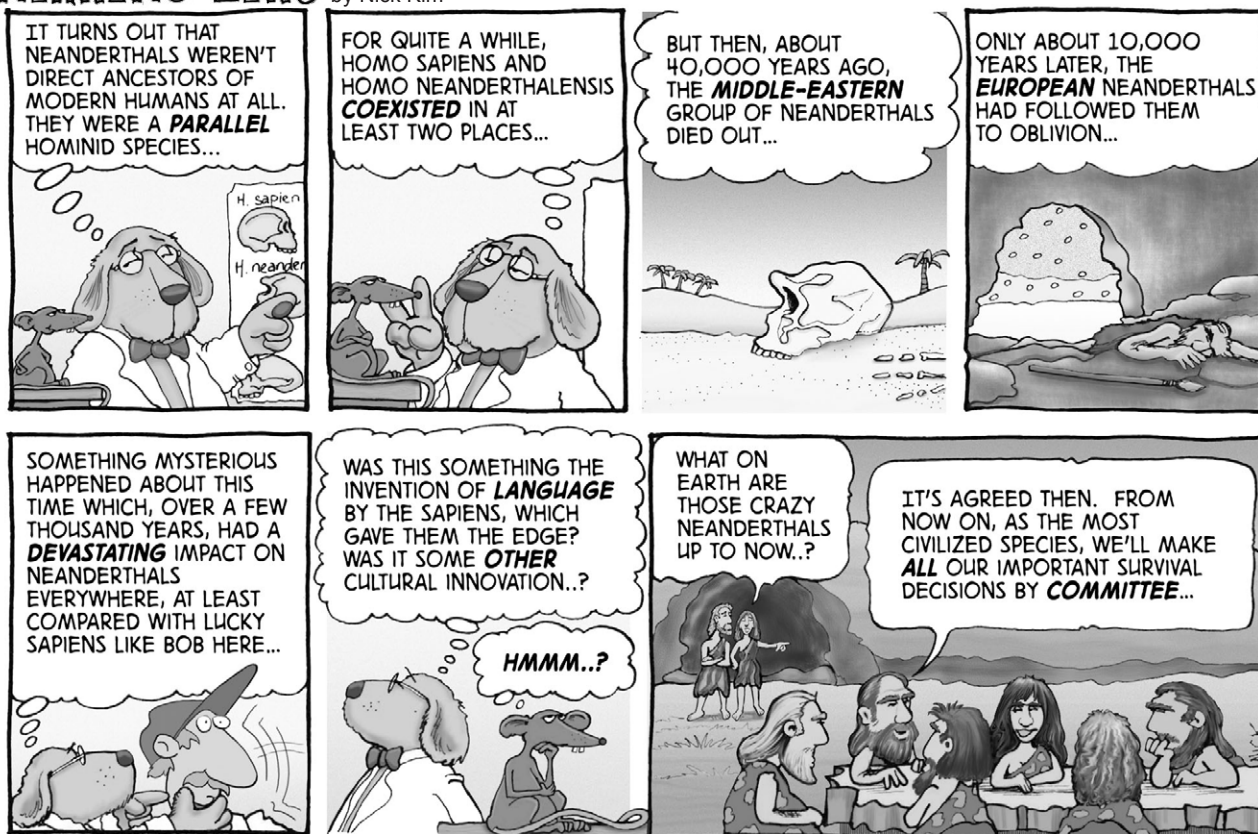
This caution or fear of the unknown is a natural instinct which has served human beings well throughout our evolution – allowing us to avoid poisonous foods and dangerous predators. However, in the modern world it can be used against us. Referring to compounds by their chemical names is a ploy used by various interest groups including alternative health gurus and anti-vaxers to try and create fear of mainstream medicines.

Furthermore, it has allowed the development of the myth of the 'chemical-free' product. To a chemist, the only thing that is chemical-free is a vacuum.

The term 'chemical-free' appears to be an invention of the marketing industry: an attempt to sell products by suggesting that if they contain only natural compounds they must be safe, healthy and/or environmentally friendly. This is, of course, very flawed reasoning. Nature produces a wide range of compounds that are toxic to humans. Tetrodotoxin from poorly prepared puffer fish, ricin from castor beans (used to assassinate a Bulgarian dissident in 1978), digitalis from foxgloves and arsenic in groundwater are all just as capable of knocking us off as any synthetic compound.

Indeed, when it comes to toxicity it is not whether something is natural or synthetic that is

NEARING ZERO by Nick Kim



important. Rather it is the dose. Any substance is capable of being toxic. Consuming four litres of water in two hours can prove fatal, as can several hours' exposure to a 100 percent oxygen atmosphere.

The idea that toxicity is dose-dependent is not new. In the 16th century the Swiss physician Paracelsus stated that "all things are poison, and nothing is without poison; only the dose permits something not to be poisonous." However, it remains a concept that is not well understood today. Special interests groups have used this to create fear around issues such as water fluoridation, vaccines, and environmental issues. For example, when DDT started to be detected in the environment at part per million levels, the resulting knee-jerk withdrawal of DDT from the marketplace resulted in a resurgence of malaria in many vulnerable populations. Following the introduction of DDT in Sri Lanka, by 1963 the number of cases dropped to 17. A few years after DDT use was banned, the number of cases increased to 2.5 million cases in 1968 and 1969.

Another consequence of chemophobia, is that it can encourage people to embrace 'alternative' treatments, such as homeopathy. An example of the terrible consequences of such erroneous thinking was the death of Gloria Thomas, aged nine months, in Australia in 2002, when her homeopath father refused to treat her eczema with conventional medicine. Instead, she was given homeopathic remedies until she died of septicaemia and malnutrition.

Absurd Chemical Therapies

One of the incredible hypocrisies of some alternative medicine practitioners is that they may also embrace absurd chemical therapies. Anti-vaxers who claim autistic children are really suffering from mercury poisoning sometimes promote the use of chelation therapy. Chelation therapy involves the intravenous use of chemical agents which bind to heavy metals in the blood. It is an invasive technique which can also strip the blood of important metal ions such as calcium. Indeed, there are examples of patients who have died because too much calcium has been stripped from their blood.

Other alternative treatments have included 'miracle mineral solution' as a treatment for everything from Aids to Irritable Bowel Syndrome. Such wide-reaching claims are an immediate warning sign, as is the revelation that 'miracle mineral solution' is, in fact, a 28 percent solution of bleach! Dilute solutions of dimethylsulphoxide (DMSO), an industrial solvent, have similarly been promoted as a cure-all, supported by, of course, only vague anecdotal evidence.

When challenged, those peddling these absurd therapies will often cry 'conspiracy', and claim they are being victimised by the all-powerful pharmaceutical industry.

Consequences of not understanding chemistry

We live in a world where important public debates are becoming contaminated with non-science and nonsense. Knowledge of chemistry can help us

identify and challenge some of the non-science and nonsense when exploring important issues such as climate change, environmental issues, water fluoridation and vaccination.

Is chemistry an antidote to pseudoscientific thinking?

At the beginning of this article I posed the question, "Is chemistry an antidote to pseudoscientific thinking?" And while I hopefully have demonstrated that knowledge of chemistry can help identify and challenge pseudoscientific thinking, I cannot claim that it, alone, is an antidote. I know this because there are those who despite a background in chemistry still embrace pseudoscientific beliefs. These include:

- David Rasnick – after training as a chemist and working in medicinal chemistry for 20 years Dr Rasnick became an Aids denialist and proponent of vitamin 'therapies'.
- Kary Mullis, Nobel prize-winning biochemist, is an Aids denialist, a believer in astrology, and claims to have met an extraterrestrial disguised as a fluorescent raccoon.

- Lionel Milgrom, research chemist for 30 years, is now a practicing homeopath and prominent advocate of homeopathy.

The idea that those who have trained to an advanced level in chemistry (or any other science) can go on to embrace pseudoscience has always intrigued me. I've often wondered how such a transition could occur, and would suggest that perhaps one or more of the following factors may be involved:

1) Frustration with science

Progress in science is often slow and frustrating. The temptation to find an easier, albeit fallacy-based career may be appealing when faced with the many frustrations of laboratory work.

2) External bias

Religious and moral beliefs may introduce bias. For example, a number of Aids denialists are blatantly homophobic.

3) No understanding of the scientific method

While most scientists pick up the principles of the scientific method during their training, few that I am aware of are explicitly taught the scientific method.

4) Need for attention/ notoriety

5) Financial motives

The peddling of pseudoscience can be quite lucrative, particularly when you can use academic qualifications to lend the appearance of legitimacy to one's claims.

I suspect that in most cases, the embracing of pseudoscientific beliefs by scientists is a gradual process, where step by small step, they move away from the scientific method until eventually they find themselves no longer bound by its philosophy and rigour.

Conclusion

While an understanding of chemistry does not necessarily provide an antidote to pseudoscientific thinking, when coupled with the tools of rational thinking, it provides the skills to criti-

cally assess many areas where pseudoscientific beliefs persist including water fluoridation, environmental science, climate change, homeopathy and alternative medicines.

“Never let yourself be diverted by what you *wish* to believe, but

look only and solely at what are the facts.” –Bertrand Russell

Michael Edmonds has spent eleven years as a chemistry lecturer, researcher, and more recently as manager of science programmes at Christchurch Polytechnic Institute of Technology (CPIT).

earthquakes

Earthquake forecasts and earthquake predictions

Mark Quigley

Earth scientists can forecast the size and frequency of the aftershocks following Canterbury's September 2010 earthquake. But this is very different from earthquake prediction. This article is based on a presentation to the 2011 NZ Skeptics Conference.

SINCE the moment of the magnitude 7.1 earthquake in Christchurch on 4 September, GNS scientists have been using models based on aftershock statistics to ‘forecast’ the expected range of aftershocks of given magnitudes. Not to be confused with earthquake ‘predictions’, which require specific magnitudes, locations, depths, times, and methodological reproducibility estimates to be useful, this forecast model is based on a modified version of the long-established Omori's Law for aftershocks, which states that the rate of aftershocks is proportional

to the inverse of time since the mainshock. Thus, depending on the values of parameters specific to certain regions, whatever the odds of an aftershock are on the first day, the second day will have approximately half the odds of the first day and the tenth day will have approximately one tenth the odds of the first day. These odds can be summed over various time scales, and the longer the time scale, the higher the probability, even though the probability decreases with time.

At present, these forecasts commonly look something like this:

“The expected number of aftershocks of magnitude 5.0 and above for the next month is 0-2, with an expected average of <1”.

Of course, one could dress this up differently using the same model applied over a full year, taking into account a reducing number of expected aftershocks, and the statement would look something like this:

“The probability of a magnitude 5.0 and above aftershock over the next year is ~82 percent”.

We have had 31 magnitude ≥ 5.0 events since September, the frequency of which has declined systematically following our large earthquakes in September and February. So to say that there is a near certainty of an event occurring somewhere in this range in the next year is no surprising conclusion, because the unfortunate reality of aftershock sequences is that earthquakes decrease in frequency but not magnitude. Remember also that this takes into account the entire aftershock zone, spanning an area from the eastern foothills of the Southern Alps, to offshore east of Christchurch, to Rangiora and throughout the Banks Peninsula; it doesn't forecast the likelihood of one of these events occurring beneath your house. Large aftershocks have been recorded as far west as the Porter's Pass area.

The probability of larger earthquakes ($M > 6$) is a bit trickier, although the methodology behind the statement:

“There is a 10 per cent chance of a magnitude 6.0 to 6.4 quake in the next year”

is the same.

To generate an earthquake of $M \geq 6$, it is helpful to know whether there are faults that are long enough and ‘connected’ enough to be able to do this, and whether these faults have ruptured in big earthquakes in the past. One way to explore this is

Port Hills Fault that ruptured in the 22 February Christchurch earthquake.

Analysis of earthquake data and geophysical seismic reflection surveys indicates that the Gap is not a simple continuation of either the east-west striking



Mark Quigley presents some of the damage from the Canterbury earthquakes at the NZ Skeptics Conference.

to image faults in the subsurface using geophysical methods such as reflection seismic, gravity, and aeromagnetics. These can be combined with ‘relocations’ of aftershocks and by analysing the extent to which seismic waves are ‘guided’ by fault networks, which collectively help to refine the internal structure and strength of fault zones.

The Gap

The ‘Gap’ is a term used in reference to the region of intense and continuing aftershock activity between the eastern end of the Greendale Fault that ruptured in the 4 September Darfield earthquake and the western end of the

Greendale or ENE-WSW striking Port Hills Faults. Instead, it is a complicated zone of NE-SW to E-W oriented, steeply SE dipping faults with a total length of up to 10-12 km that is defined by an array of aftershock earthquakes that range in depth from 2 km to greater than 10 km.

Preliminary interpretations of seismic surveys indicate that a series of faults in the Gap have ruptured at various times over the past several hundred thousand years. Based on the length of the aftershock zone and the types of deformation we see in the seismic sections, we estimate that this region has probably experienced major earthquakes in

the range of Mw 6-6.3 in the geologic past. Such events appear to be very infrequent, ie, recurring only once every 10,000 years or more, because even sediments that are millions of years old are only subtly deformed. We do not see any evidence for a surface rupturing earthquake in the last 5000-10,000 years or so based on interpretations of air photos from this area.

The Gap has been seismically active throughout the Canterbury earthquake sequence, from immediately following the September mainshock to the present. There have been two earthquakes of $M > 5$ and 23 earthquakes of $M > 4$ in the gap since 4 September.

The total seismic energy release in this Gap (seismic moment) is less than the total energy released in the adjacent Port Hills and Greendale Faults. In the simplest interpretation, the total seismic energy release from the Gap would eventually fit a 'smoothed' profile between the Greendale and Port Hills Faults. This is not necessarily required, but it is something that would best fit our models for how fault slip accumulates across fault systems through time. 'Filling the Gap' could occur via a continuing series of smaller earthquakes, as has been the case so far, or via a larger event, possibly as large as a low magnitude 6 to high magnitude 5. From what we understand about the behaviour of earthquakes in this area to date, it seems most likely to us that this region will continue to release seismic energy in the form of smaller earthquakes rather than an isolated large one, although this possibility still remains.

The processes governing fault rupture are somewhat complicated, but our scientific understanding of these processes continues to improve. One could ask, "Why should the Gap behave one way during one earthquake sequence and a different way in another?" The answer is that the order and the direction in which

... the magnitude of the 6.3 could not have been exactly predicted, but something within this magnitude range was always possible and all scientists involved in this event recognised this.

adjacent faults rupture, the areas of these ruptures, and the processes that go on between large earthquakes, such as fault rock healing and fault closure, all influence the rupture behaviour of an individual fault segment. The overall pattern since September has been an eastward propagation of major earthquakes, starting with the Darfield earthquake in September, then the Port Hills fault rupture in the February earthquake, then the June earthquake even further east. If the sequence had started in the east and propagated west, it is entirely possible that some of these faults may have behaved differently.

Marine surveys by NIWA immediately offshore of Christchurch have revealed additional faults, some of which have had small earthquakes on them during this seismic sequence. The lengths of these faults suggest that some are capable of generating earthquakes as large as or

larger than the 22 February event, however, the increased distance from Christchurch would reduce the impact on the city for a similar-sized event. In the face of our seismic realities, the best way forward is to take this opportunity to make Christchurch one of the world's most earthquake-resilient cities.

Geologic analogies

This is my favourite geologic analogy for the Canterbury earthquake sequence. On April 23, 1992, the Mw 6.1 Joshua Tree earthquake rocked the Californian desert east of the San Andreas Fault. Two months later, on June 28, 1992, the Mw 7.3 Landers earthquake occurred in the same region, with an epicentre located approximately 40 km north of the Joshua Tree epicentre. Three hours after the Landers event, the Mw 6.2 'Big Bear' aftershock occurred some 40 km to the west. On 16 October 1999, seven years after the Landers event, the Mw 7.1 Hector Mine earthquake occurred, with an epicentre some 40 km north of the Landers epicentre.

This area is adjacent to a section of the San Andreas Fault (America's version of our Alpine Fault) that had not had a major earthquake since 1812 (one segment) and 1680 (another segment), just as our Alpine Fault does not appear to have ruptured in a major earthquake since 1717.

Palaeoseismologic estimates of the recurrence intervals of clusters of earthquakes in the Mojave Desert near the Landers rupture are in the range of 5000 to 15,000 years (Rockwell et al.,

2000), similar to the expected range of recurrence intervals of active faults in our Canterbury Plains. So a situation like this is possible, although we would obviously prefer that the region settled down without the occurrence of any more big events.

Where to from here? We'll do our best to provide the best scientific information possible. Wait for the information to come from scientists regarding the earthquake history, likely lengths, and 'connectivity' of faults in our region. Then take into account whether you want to occupy your time with fear of the next big one, which may or may not eventuate in the next few years or more, or get on with your life while learning lessons about being prepared for earthquakes.

Could the magnitude and location have been predicted?

Generally, when considering the maximum magnitude in an aftershock sequence, seismologists refer to Bath's Law, which states:

"The average difference in magnitude between a mainshock and its largest aftershock is 1.2, regardless of the mainshock magnitude".

This is a generalisation based on analysis of global earthquake datasets, recognising that each aftershock sequence is different and there are many exceptions to the rule. Let's look at how Bath's Law predicts the largest aftershock magnitude for some of New Zealand's largest earthquakes.

Table 1 shows mainshock-aftershock comparisons for

some large New Zealand earthquakes.

The *average* difference between the largest aftershock and mainshock for this small New Zealand dataset is 1.2, consistent with Bath's Law. Prior to 22

Earthquake	Date	Magnitude	Largest aftershock(s)
Hawke's Bay	1931	7.8	6.9, 5.9
Pahiatua	1934	7.5	5.7
Wairarapa	June 1942	7.0	5.3
Wairarapa	December 1942	6.0	4.7
Gisborne	1966	6.2	5.0
Inangahua	1968	7.1	6.0
Arthur's Pass	1994	6.7	6.1

Table 1. A comparison of the magnitudes of some NZ earthquakes and their largest aftershocks.

February 2011, the largest difference between the 2010 Darfield 7.1 mainshock and largest aftershock (5.6), that occurred only about 20 minutes after the mainshock, was 1.5. There was reason to be optimistic, as this difference had been seen from other events; however all scientists working on the Darfield earthquake acknowledged that a larger aftershock was still possible. Unfortunately, our fears were confirmed, with the 22 February magnitude 6.3 aftershock (0.8 point difference from mainshock, perhaps higher than predicted from a simplistic interpretation of Bath's Law) and the June 13 6.0 event.

This illustrates that, while we can use historical examples to help us predict possible aftershock magnitudes, each sequence can be different, depending on the length (or more accurately, the potential rupture area) of faults throughout the area, the strength of the faults,

how close they are to their breaking points, and how things like stress transfer and fluid pressures associated with the mainshock or other aftershocks influence these faults. This illustrates how important it is to

know the location and length of other faults in the vicinity of Christchurch and offshore before we even discuss putting billions of dollars into a rebuild. This can be done relatively inexpensively with existing technology. Shouldn't we know the location and magnitude potential of other faults throughout this region, and model how they may have been stressed or de-stressed following our big earthquakes before buildings are even designed?

To summarise, the magnitude of the 6.3 could not have been exactly predicted, but something within this magnitude range was always possible and all scientists involved in this event recognised this. We were hopeful it would not occur. A glance through some of the largest New Zealand earthquakes from the last century indicates considerable variability in the magnitude of the largest aftershock, but an aftershock of this large magnitude compared to the mainshock

Top scientist turns to alternative medicine

PROMINENT physicist and science commentator Sir Paul Callaghan is resorting to vitamin C megadoses and Chinese medicine to treat his terminal cancer (Dominion Post, 22 September).

Diagnosed in 2008 with aggressive bowel cancer, he has been advised by his oncologist to take a break from chemotherapy to establish the full extent of the cancer's spread. He is using the time to trial "unproven but interesting" therapies, including traditional Chinese medicine, intravenous vitamin C and "Uncle CC's famous vegetable juice".

"Let me be clear. I do not deviate one step from my trust in evidence-based medicine," Sir Paul said in his blog. However, if there was a potentially effective but unproven drug, "Why would I not try it?" he reasoned. "Am I mad? Probably."

Victoria University's Professor Shaun Holt said he could understand terminal cancer patients clutching at straws, but there was no evidence to support vitamin C treatment. It could be harmful, causing kidney problems and interfering with effective treatments such as radiation therapy.

He was concerned Sir Paul's use of the treatment would further increase the already high number of cancer and leukaemia patients asking for the injections.

GG swears by homeopathy

Another high-profile New Zealander expressing interest in alternative therapies recently was new Governor-General Sir Jerry Mateparae. The 56-year-old revealed in an interview (Dominion Post, 2 September) he and his wife Janine, Lady Mateparae shared an interest in homeopathy.

He said he had not taken a sick day since 1998. "We've practised a certain way of looking after ourselves which has been very good for me."

Perhaps he feels it's part of the job, given his position as the Queen's representative in New Zealand, and the royal family's well-known interest in the field.

Blogger John Pagani commented: "Placebos get you quite a long way, but only so far. After that you need actual medicine. If a soldier gets shot up on a battlefield in, say, Afghanistan, he doesn't want Sir Jerry rubbing arnica cream on the sore bit."

Divine solution to liquefaction

A Sefton water diviner believes he has the solution to Canterbury's liquefaction problems (Central South Island Farmer, 7 September).

Dave Penney says he can identify underground water flows by running a crystal over a Google

map, followed by on-site investigation. While the article quoted one happy customer, Waimakariri utilities manager Gary Boot was unconvinced by Penney's proposal that "confluences" of underground flows could be located and drilled, to reduce pressure and stabilise the land. Areas with the worst liquefaction had widespread and very consistent groundwater, Mr Boot said.

"Finding the groundwater is not the challenge. The challenge is how best to treat the land in an affordable manner."

iPhone trumps psychic

Chilean authorities have used a psychic to help find 17 missing bodies after the crash of a plane near Robinson Crusoe Island killed all 21 people on board (NZ Herald, 6 September).

"Not only are we using all of our technological capabilities, but also all the human and super-human abilities that may exist," said Defence Minister Andres Allamand.

He did, however, seek to lower expectations of recovering all the bodies.

The plane's fuselage was located a few days later, in part using information from a passenger's iPhone, which transmitted its location shortly before the crash (AVweb, 9 September). Now if only psychics were as smart as iPhones.

Spontaneous Human Combustion in Ireland?

An Irish coroner has ruled a pensioner found dead at home was a case of spontaneous human combustion (NZ Herald, 25 September).

Unsurprisingly, given the history of this phenomenon, 76-year-old Michael Faherty's charred remains were found on the floor near an open fireplace. Forensic experts concluded the fire was not the cause of the blaze, and that there were no accelerants at the scene. The only damage to the room was a scorched ceiling and floor adjacent to the body.

The case sounds like a classic of its type: an elderly diabetic with presumably limited mobility is found next to an open fire, with his body consumed but his head left unburned. In 1998 scientists on the British TV programme *QED* (available from the NZ Skeptics video library) showed how this happens, using a pig carcass wrapped in fabric to simulate the victim. An ember spat from the fire catches in clothing and starts to burn; the fire is then fed by fat from the victim (who has already died of a heart attack, or is about to due to the stress of finding himself alight) as it melts and 'wicks' into the clothing. The head, lacking a decent supply of fat, remains unscathed, and any sign of heart disease or other pathology is burned away. *QED*, indeed.

Medium caught cheating

Sally Morgan, who styles herself "Britain's best-loved psychic" has been caught receiving

outside information during one of her shows (The Guardian, 20 September).

Chris French, editor of UK magazine *The Skeptic*, relates how an audience member named Sue reported on an Irish radio station how she had been impressed by Morgan's accuracy during the first half of her performance.

"But then something odd happened. Sue was sitting in the back row on the fourth level of the theatre and there was a small room behind her ('like a projection room') with a window open. Sue and her companions became aware of a man's voice and 'everything that the man was saying, the psychic was saying it 10 seconds later.'"

Other callers to the radio show confirmed Sue's account.

Sue said she believed the man was feeding information to Morgan via a microphone. The voice would say something like "David, pain in the back, passed quickly", and a few seconds later Morgan would have the spirit of a David on stage with just those attributes. When a member of staff realised several people were aware of the voice the window was gently closed.

Sue speculated that information had been gathered in the foyer prior to the show by an accomplice engaging audience members in conversation, a technique French says 'psychics' use widely, as their marks naturally discuss among themselves who they are hoping to hear from.

The theatre's general manager claimed the voice came from two theatre staff members. Sally Morgan Enterprises also denied

that the medium was being fed information during the show.

French compared the incident to James Randi's use of a radio scanner to pick up messages sent to faith healer Peter Popoff's earpiece in 1986, the subject of an entertaining YouTube video clip. Although his exposure led to him declaring bankruptcy the following year, Popoff is back; his 'ministry' received US\$23 million in 2005. History suggests, says French, that most of Morgan's followers will continue to adore her and pay the high prices demanded to see her in action, despite this incident.

Ring again

Just one more small piece on Ken Ring then no more, I swear. Despite promises to get out of the earthquake prediction business, he was in Upper Hutt recently declaring Wellington could expect a magnitude 7 quake some time between 2013 and 2016 (Upper Hutt Leader, 5 October).

Of course, predicting earthquakes in Wellington is a bit like predicting drought in the Sahara, and a four-year timeframe is a bit vague, to say the least. He says Wellington gets magnitude 7 quakes every 11 to 13 years (really?) and this period is when the next one is due.

I guess any half-way decent shake in the next eight years or so will be put down as a hit, and if nothing comes along before the end of 2016, who's going to remember what he said in the Upper Hutt Library in October 2011? How can he lose?

From Page 9

is not unprecedented (eg the 1994 Arthur's Pass earthquake sequence).

Earthquakes and the moon: should we worry?

1. No one has predicted the recent earthquakes in Canterbury. Vague quotes about dates of 'increased' activity plus or minus several days, without magnitudes, locations, and exact times do not constitute prediction. Consider this: Ken Ring's probability of getting a prediction correct based on

several predictions and *nothing* unusual happened on those days. (ie 30 January, 14 February, 27 February, 29 March, 14 June, 12 July, 10 August, and so on for his liberal interpretation of the aftershock sequence). This does not constitute 'prediction'. It is opportunistic and meaningless self-promotion.

2. Consider your chances of getting a 'prediction' correct given this unscientific definition of prediction. On average, New Zealand gets around 330 earthquakes of M4-4.9 every year, 26 M5-5.9s per year, two

each earthquake occurs on a different day, which isn't the case, but you get the picture). This of course goes up immediately following a major earthquake like our 7.1 where the occurrence of large events is high. We had 203 earthquakes greater than 4 in the Canterbury region close to the 7.1 rupture in the six months since 4 September. So one's chances of 'prediction' are actually quite high.

3. If we had been specifically predicting large earthquakes ($M > 6$) on the faults near Christchurch that ruptured on 4 September and 22 February using the moon over the last several thousand years, we would have been wrong many thousands of times, with a success rate of 'zero', even invoking the broad criteria cast by invoking all of the possible moon scenarios listed above.

4. There is no clear correlation between the largest aftershocks in the Darfield earthquake aftershock sequence and diurnal tides. Some of our largest earthquakes have occurred near high tide and some near low.

5. Consider implementation of this 'predictive' strategy. Should we evacuate an area every time the moon is on its closest approach, is full or new, is moving rapidly, is at its maximum declination or is crossing the equator? Imagine the fear and frustration of such an approach, particularly given the unspecified times, locations, and magnitudes of the supposed 'imminent' events. Without a basic understanding of how faults generate earthquakes, where the faults are, at what stage they are at in the seismic cycle, and how they have been



Barry Campbell

perigee/apogee new moon/full moon for 2010 was 63 percent. That's 230 out of 365 days that fall on some day that he would argue influences earthquake activity. For days that combine several factors of new moon/perigee etc, he missed out on

M6-6.9s per year, and one M7-7.9 every three years (see stats on Geonet). If unspecific about magnitude and location, then your chance of 'predicting' an earthquake that is likely to be locally felt and recorded is greater than 90 percent (based on the simplified method of assuming

affected by prior activity, where should we evacuate and where should we go to? This would require several evacuations a month of ‘unspecified areas’ to other ‘unspecified areas’.

6. Since humans first looked into the sky and felt the effects of earthquakes, they have wondered if the moon and planets are in some way responsible for major earthquakes. As early as 1897, scientists began to pose hypotheses about moon-earth earthquake connections and test them in honest and rigorous way. After all, the moon still gets earthquakes in the absence of plate tectonics, so perhaps there is some validity to this claim.

While some astrologers may feel isolated from the scientific community, this shows a true lack of appreciation for all of those dedicating significant effort to this issue. Many of these findings from studies comparing earthquake catalogues to tides have been published in high-quality journals such as *Science* (eg, Cochran et al, 2004) and some scientists have argued based on statistical data from global earthquakes for an influence of tides on earthquake activity under certain circumstances, such as beneath the oceans and within active volcanoes. Some scientists have even argued for a small correlation (perhaps an increased earthquake likelihood of 0.5 to 1 percent) between smaller, shallower continental earthquakes and ‘solid earth tides’ (changes in the shape of our planet due to the gravitational pull of the moon).

This is peer-reviewed but controversial research; it does not

make it so, but it has undergone scrutiny and will continue to do so. This is the scientific process. To this end, I have a postgraduate student conducting high-level geologic and statistical research on the Canterbury aftershock sequence, including spatial, temporal, and mechanistic relationships with lunar parameters. You can bet that any results,

regardless of the outcome, will be published for all to see and openly scrutinise.

Dr Mark Quigley is a Senior Lecturer in Active Tectonics in the Department of Geological Sciences at the University of Canterbury. His peer-reviewed publications pertaining to the Canterbury earthquakes can be obtained from www.drquigs.com

bent spoon

Everyone take a bow

Vicki Hyde

The NZ Skeptics cast the net wide for the 2011 Bent Spoon.

THE NZ Skeptics have awarded their annual prize for journalistic gullibility to all those media outlets and personalities who took Ken Ring’s earthquake prediction claims at face value, thereby misinforming the public and contributing to 50,000 people leaving Christchurch with all the inconvenience, cost and emotional harm that caused.

We believe that it is the business of the professional media to ask pertinent questions on behalf of the public when presenting material as factual. We even have broadcasting standards which call for accurate reporting. Many, many media outlets and journalists failed the basic standards of their profession in failing to ask “where is the evidence?” in the face of Ken Ring’s claims to predict earthquakes. They did us all a disservice.

The group Bent Spoon award is an unusual one for the NZ

Skeptics, but we felt that so little was asked by so many that it had to be a broader award this year. That said, we did single out some reporters and commentators whom we felt had made particularly poor journalistic efforts in this area. They include:

- Marcus Lush (RadioLIVE), for giving great and unquestioning publicity for Ring’s claims that Christchurch would have a major earthquake – “one for the history books” – on 20 March, and continuing to support Ring’s promotion as an earthquake predictor and weather forecaster.
- *Closeup*’s Mark Sainsbury for giving Ring another platform to air his ideas with very little in-depth critique (12 July).

The best thing about Ken’s failure on March 20 was his long silence afterwards. Yet there he was back on what is supposed to be a credible current

affairs show with more vague pronouncements and self-justifications. Surely *Closeup* had another Kate-and-William clip they could have played instead to maintain their level of journalistic quality.

- The *Herald on Sunday*'s Chloe Johnson, who provided uncritical publicity for Ring which continued long after his failures had been well and truly demonstrated (26 June).

It's been sad to see the *Herald* name devalued by the tabloid approach of the *Herald on Sunday*, especially when the spin-off can sometimes do good stuff such as its hard-hitting editorial headlined "Charlatan Ring merits contempt" (20 March).

- Brian Edwards, described by one commentator as providing "banal and rigourless equivocations", including such gems as "the evidence that the moon has some contributory influence on earthquakes seems slight ... however, it is not impossible that it does".

We've seen Edwards co-gently skewer sloppy thinking in the past, so it was surprising to see just how wishy-washy he was in this particular case.

And what of the notorious John Campbell interview where the television interviewer lost his cool and boosted sympathy for Ring by shouting him down? This has given us the unusual situation of seeing nominations come in to give Campbell both the Bent Spoon and the society's Bravo Award for critical thinking.

We appreciate what John was trying to do – introduce a little evidence and call into question some very dubious claims – but we knew he'd blown it as soon as he started to talk over the top of Ken.

Bravo Awards

The NZ Skeptics also applaud critical thinking with a number of Bravo Awards each year. This year's recipients are:

- Janna Sherman of the *Grey-mouth Star* for her item "Sceptics revel in Hokitika 'earthquake' non-event" (14 March).



Blue Duck: one of several indigenous species protected by 1080. Photo: DoC.

Ken Ring predicted an Alpine Fault rupture and/or an extreme weather event which would require Civil Defense to prepare for gales and heavy rain at the Hokitika Wildfoods Festival in March. As Sherman's report noted:

"The 22nd annual Wildfoods Festival on Saturday was held under sunny skies, with temperatures climbing over 20 deg C."

In science, a lack of evidence or a failed prediction can tell us a lot; in the media, we rarely see

any stories about a non-event. That's why it was great to see Sherman and the *Star* cover Ken's failure – pseudo-scientists and psychics alike will only trumpet their successes as part of their self-promotion. To get the real picture, you need to hear about their failures too.

- Philip Matthews, writing in the *Marlborough Express*, for a great article on 1080 that actually says there is really only one side to the story rather than introducing an alleged controversy with token 'balance' (22 June).

We don't ask the Flat Earth Society to provide balance for a story on the International Space Station orbiting a spherical Earth. Why should we give a false impression of evidence-based 'debate' in other areas such as 1080 or immunisation? In discussing the entrenched views regarding the use of 1080, Matthews wrote:

"One of those 'entrenched views' is the weight of science; the other, emotive opinion. The debate is done a disservice by suggesting the views are somehow equivalent."

The NZ Skeptics also commend Dr Jan Wright, the Parliamentary Commissioner for the Environment, who, while not in the media itself, did a great job of evaluating the evidence on 1080 and presenting a report clearly outlining the evidence.

As always, the Bent Spoon was awarded telepathically by those gathered for the annual NZ Skeptics Conference.

Vicki Hyde is the NZ Skeptics Media Contact.

Pseudoscience for profit

Siouxsie Wiles

Proponents of alternative therapies often throw around charges of vested interest when challenged. But often their own interests don't bear scrutiny.



AS THIS is the first of what I hope will be a regular column in the *NZ Skeptic*, I thought I would take the opportunity to tell you all a little bit about who I am and what has motivated me to write this column (besides David twisting my arm...). I am a research scientist with two obsessions: bioluminescence (the production of light by living organisms – think glow worms and fireflies), and nasty microbes. I feel immensely privileged to have made a career out of combining these two passions: in a nutshell, I make bacteria glow in the dark for a living.

After many years working in the UK, I was awarded a fellowship from the Health Research

Council of New Zealand and relocated to the University of Auckland. Shortly after arriving in Auckland I joined *Skeptics in the Pub* and a fellow skeptic lent me a copy of *Trick or Treatment*. This fantastic book, written by Dr Simon Singh and Prof Edzard Ernst, reviews the evidence for the effectiveness of complementary and alternative medicine. I'm sure I don't need to tell this audience that despite very little evidence for their success, these treatments are widely used.

In the final chapter, Singh and Ernst list some reasons why this might be. Surprisingly, scientists are on their list. Singh and Ernst argue that alternative health practitioners are highly vocal and many of their claims go unchallenged. They believe scientists have a responsibility to make their voices heard too. I found Singh and Ernst's call to arms inspirational and took up blogging and writing letters to the editor as a result.

A very rich source of ire comes from a free monthly 150-page glossy A4 advertising magazine called the *Ponsonby News*, distributed to over 16,000 homes and businesses in Auckland.

The *Ponsonby News* has a couple of 'health correspondents': John Appleton, who has a website selling vitamin and other supplements, and 'Dr' Ajit, an Ayurvedic practitioner with a couple of spas in Auckland. For those unfamiliar with Ayurvedic 'medicine', it is a system of traditional medicine that originated in India. Mr Ajit's column is usually pretty funny, like urging people with hay fever not to eat stodgy food in winter for fear it will clog them up.

But John Appleton's column usually worries me. A couple of months ago, he was inspired by an article he read in the *Listener* assessing the risks and benefits of hormone replacement therapy, which advised readers to avoid the internet and talk to their doctors instead. Unsurprisingly, Mr Appleton was somewhat horrified by this suggestion having "found the internet to be a fabulous resource" for researching topics like hormone replacement therapy.

Indeed, what he went on to write about was 'bio-identical' hormones which he implied are a safe and effective alternative to hormone replacement therapy. I wrote a letter to the editor to

point out that the benefits of ‘bio-identical’ hormones were at best overhyped and at worst pseudoscientific nonsense¹, which prompted a reply both through his column and in person. In it, I was accused of being part of the medical establishment, locked away in my ivory tower, only interested in “science for profit”, unlike those in the complementary and alternative medicine field, who he believes are doing “science for people”. He has since sent me an envelope full of reading material to show me just how bad evidence-based medicine is.

It was really interesting to read the propaganda material which has shaped Mr Appleton’s views on evidence-based medicine and the medical establishment. Needless to say, they are all non-peer reviewed articles posted on natural health websites.

I found one article in particular quite fascinating, as it trumpeted Andrew Wakefield, the disgraced gastroenterologist who insists there is a link between autism and the measles-mumps-rubella (MMR) vaccination. As a microbiologist, I am very

familiar with Wakefield’s work, which is just plain old bad science (see *NZ Skeptic* 100). But Wakefield continues to be held up as a shining example of how a good doctor trying to do the



Measles, once regarded as a childhood rite of passage and still played down by the antivaccination lobby, is a serious disease that can have dangerous complications.

best for his patients has been vilified by the medical establishment. If this kind of material is what Mr Appleton is using as his evidence base then I’m definitely alarmed!

I am left contemplating Mr Appleton’s concept of “science for profit” versus “science for people”. I have never thought of myself as doing science for profit. True, I make a decent living being a scientist but it is nothing like the money I imagine some of those involved in alternative medicine make. It is worrying that the alternative health field has successfully propagated the belief that it is purely motivated by improving people’s health and wellbeing, completely glossing over the fact that it is an extremely lucrative industry.

Indeed, one of the pieces of evidence that Mr Appleton used to back up the claims he made about ‘bio-identical’ hormones was a review paper written by a medical doctor called Kent Holtorf and published in an obscure peer-reviewed journal. Interestingly, Dr Holtorf declared no conflicts of interest despite the fact that he is founder of the Holtorf Medical Group which has offered ‘bio-identical’ hormone therapy for over 10 years. Science for people? More like ‘pseudoscience for profit’, if you ask me.

¹‘Bio-identical’ was a phrase coined to describe plant-derived molecules believed to be identical to human hormones. No evidence has ever been presented to verify this. Many of the conventional treatments include similar plant-derived molecules. The difference is that the conventional therapies have been studied over many years so doctors know what the side effects and risks associated with them are. There is no evidence that ‘bio-identical’ hormones are safer or more effective; it is likely they have the same side effects and risks. As for it being pseudoscience, ‘bio-identical’ hormone treatment often involves blood or saliva testing to determine which hormones are deficient and hence tailoring treatment to the individual. While this sounds like a good idea, there is no scientific basis or indeed evidence that such a strategy is useful or relevant. In fact, hormone levels in the blood and saliva vary from day to day and are unlikely to reflect the actual biological activity in specific tissues.

Bad science and vaccines

AS someone currently enduring a bout of shingles I have a few comments to make on the excellent article on the bad science behind the vaccine scare (*NZ Skeptic 100*). Further to benefits of vaccination mentioned in the article I think the point should be made that viruses can actually be eradicated from humanity which is ironic since they cannot, unlike bacteria, be killed as they are not living entities. Bacteriological diseases on the other hand are treatable and curable but the infectious agents cannot be eradicated.

Of course we are beginning to reach a point where some bacteria are resistant to most, if not all, current antibiotics thanks to misapplication, abuse and ill-informed prescription by doctors who should know better.

The damage done by the originator of the vaccination scare is incalculable. I don't think being struck off the medical register is enough – I have long held the opinion that anyone earning a degree on the back of research which is later invalidated should be stripped of their degree and in the case of this man I think an apt reward would be the loss of his doctorate and professorship. He has demonstrated an inability to do good research and should not be overseeing students doing theirs.

I further think that vaccination should be done by law and the decision taken out of the hands of well-meaning but deluded parents who don't realize that they don't know what they are doing. Vaccination is a public

health issue and there is no reason it shouldn't be mandated in order to prevent children from contracting diseases they need not suffer and as a useful step to eradicating infectious agents. The payback in terms of saving tax expenditure and avoiding misery for children is huge.

I was lucky that my parents saw we were vaccinated against everything for which vaccines had been developed at the time and I am delighted that the common 'wisdom' of 'once you've had it you are immune for life' has been effectively thrown out forever. I well remember my best friend's mother being crippled as a result of having contracted poliomyelitis in her childhood. It was a tragedy which need never be repeated in this day and age.

And anyone who thinks that talk of eradication is mere cant should think again – look what has happened to smallpox with a bit of directed will and determination. And in case anyone reading this doesn't know it, the condition I am currently suffering from is caused by the chickenpox virus I contracted over 50 years ago. It has been lying dormant in my nervous system where the body's immune system cannot get at it. I have so far suffered relatively lightly but a bout of severe nerve pain could ensue. I am not looking forward to the possibility and am hoping for the best but am prepared for the worst.

Malcolm Watts

Placebo effect quantified

It's not often that we obtain numerical information about the strength of a placebo effect. Thus we should applaud the manufacturers of Voltaren for their webpage www.voltarengel.com/hcp/efficacy.aspx ("Direct route to relief").

Under a caption "Patients experienced a 51% improvement in [osteoarthritis] knee pain ..." is a bar graph that shows both a 51 percent improvement with Voltaren gel and a 39 percent improvement with placebo gel. (Treatment period was 12 weeks.)

Similarly, "a 46% improvement in ... hand pain ..." turns out to be 47 percent improvement after six weeks of using Voltaren gel versus 40 percent improvement with placebo.

To simple-minded people like me, this sounds like a Voltaren effect of 12 percent for knee pain and 7 percent improvement for hand pain. I'm not knocking Voltaren, which I use myself, but clearly external use of the gel is not necessarily superior to taking this medication by mouth.

To the practitioners of alternative medicine, these results are wonderful.

Regardless of treatment, after four to six weeks hand pain will be significantly reduced. Similarly a few months of quack therapy will reduce knee pain by almost half.

Jay D Mann

Christchurch

Inspiring Aussies and dodgy waiters

After almost 15 years of intermittently tagging along with her parents, Iris Riddell reports on her first official attendance at a NZ Skeptics Conference.

I ATTENDED my first ever Skeptics conference this year. Well, that's not entirely true. Technically, I've been coming along since I was six years old, but critical analysis and conferences in general aren't so interesting at that age. Rather, I attended my first ever Skeptics conference that I fully *appreciated*. I came away from the Christchurch get-together in August with my head in a spin, inspired by the lectures I'd witnessed and the people I'd spoken to.

One of those people and one of the biggest highlights for me was Kylie Sturgess, educator, writer, blogger and podcaster extraordinaire. She winged her way over from Australia with Dr Martin Bridgstock especially for the conference, and shared with us the results of a study they recently conducted, regarding what the average Queenslander believes in.

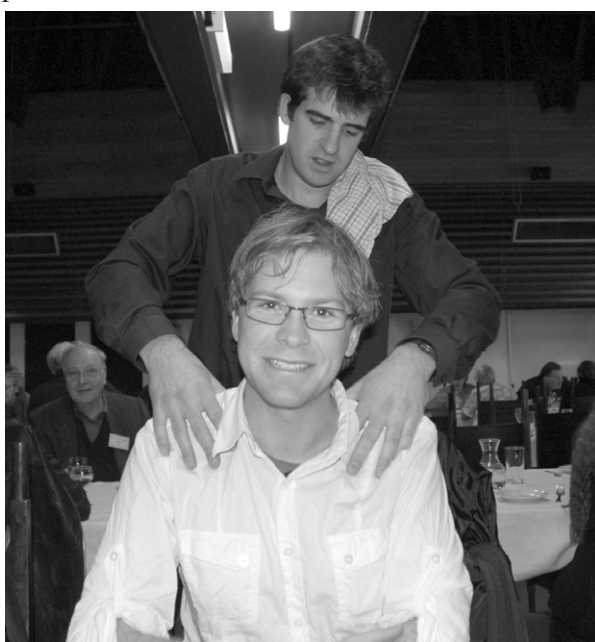
The session that really got me buzzing was one of theirs, about activism, the future of skepticism

and the two cultures it is starting to sprout. Martin Bridgstock said skepticism is divided into two camps: he called the first group "the old grumpies" and cheerfully lumped himself in that category. The grumpies tend to be older people who

toward organising a Skeptics in the Pub event for Hamilton, but that's another story.

I was surprised at the diverse age range at the Christchurch conference. There appeared to be a lot of people my own age (I've just turned 21) or not much older. Sure, there were still plenty of the "old grumpies" that Martin Bridgstock so proudly associates himself with, but there were definitely a lot of younger people, too. As someone often frustrated by the lack of critical thinking in the majority of my peer group, it gave me hope to see so many young skeptics.

The Friday night entertainment was a quiz on all things skeptical, with a bonus challenge to write a limerick as a group. These were gathered up and read out over the course of the next three days, and there were some very funny and clever ones to come out of the mix. I've never heard so many poems about alternative medicine, horoscopes and Ken Ring in one place.



Daniel Mills gets a back rub from a rather suspect waiter. All photos Annette Taylor.

belong to structured organisations, whereas the second group is far younger, and connect via podcasts, blogs and forums as well as casual social gatherings. I was so set off by this discussion that I've started making motions

I have to say, unfortunately, that the waiting staff at the venue for the Saturday night dinner were very unprofessional and had little respect for personal boundaries. I first noticed something amiss when I glanced up the table to see Gold, the chair-entity, receiving a rather sensuous head massage. "That's odd," I thought, and returned to my conversation. Moments later, one of them was looming over me. "Excuse me, ma'am. We've had a complaint about the state of the cutlery. Fancy a spit shine?" By the end of the meal they were zigzagging precariously up and down the unoccupied dining tables, a bottle of wine in each hand, singing loudly. I don't think anyone was surprised when, once the food had been dispatched, they announced that they were members of a local theatre group, and the evening wound up with a short improv performance. For the record – the actual kitchen staff was polite, efficient, and served up some wonderful meals.

Some of the other notable lectures were earthquake expert Mark Quigley on forecasting quakes (see p 8 – there were at least three detectable aftershocks



Special guests: Martin Bridgstock and Kylie Sturgess brought an international flavour to the conference.

over the weekend, including one during a conference session), a wonderful photographic presentation by Simon Pollard on how different cultures commemorate the dead, and a talk by Puzzling World founder Stuart Landsborough on his psychic challenge and experiences with mediums. All around it was a thoroughly thought-provoking and inspiring conference, and a great experience for a first-timer like me ... an almost first-timer, at least.

Iris Riddell is a Waikato journalist.



Is it a bird? Peter Hyde sorts out a minor technical issue with the projector.

Some limericks – and a clerihew – from the Friday quiz night

Jenny McCarthy knew that she oughta
Do what was best for her daughter
But how to appease
Her daughter's disease?
Give a 10C solution of water.

There once was a preacher named Ray
Who would eat a banana a day
He claimed they were godly
But skeptics looked oddly
At him and his fruity DNA.

To give me a homeopathic gin
Is an absolute mortal sin
I had a hangover so chronic
I needed a 14C tonic.

Sir Isaac Newton
Never slept on a futon
His 3 Laws of Motion
Were one hell of a notion.

Dishwashers of doom

Alison Campbell investigates alarming reports on what is living in our dishwashers.



I DON'T know what worried me more about an article I read in *The Registrar* recently (www.theregister.co.uk/2011/06/21/dishwasher_peril/) – the implication that my dishwasher and its fungal denizens might be out to get me (which I suppose could necessitate returning to Plan B: the Significant Other; after all, I do the cooking, so he can wash up!), or the rather piss-taking tone of the story. I mean, how else to take the headline: “The Killer Mutant Fungus in Your Dishwasher: don’t approach without a biohaz suit and a flame-thrower”?

On the other hand, it did spur me into going to look for the original article (P Zalar, M Novak, GS de Hoog, N Gunde-Cimerman 2011: *Journal of Fungal Biology*: 10.1016/j.funbio.2011.04.007). And

now I know that the ‘interesting’ black stuff that sometimes springs up around the seals is probably a living organism and not necessarily due to the family’s regrettable inability to rinse dishes before loading. (The authors of the article don’t actually say whether their investigation was initiated after observing similar black mouldy bits, but I can’t help wondering...)

Now, purveyors of various household cleaning agents would have us believe that the kitchen is home to a range of nasty microbes, which can be held at bay only by spraying or wiping with various anti-microbial or anti-septic products. (I wonder how my family remains so healthy, in the absence of many of these wondrous chemicals.) But you’d think something like a dishwasher would be hygienically clean – after all, anything that goes through the wash cycle has been exposed to high temperatures and a fairly alkaline (high pH) environment (although that may be changing, as we move to less harsh detergents and cooler temperatures in attempts to use less energy and release fewer wastes).

Not according to Zalar and colleagues. Noting that our knowledge of organisms that live

in extreme environments (extremophiles) is expanding, they decided to look away from the hot pools and volcanic vents and into a more mundane environment – the domestic dishwasher. Anything that can colonise and survive in that machine’s hot, alkaline conditions could also rightly be described as an extremophile – one with a ready source of nutrients from all those messy food smears. So the team took samples from the inside surfaces of dishwashers: specifically, the rubber seals, as their surface would be easier to colonise than slick metal.

They ended up sampling 189 machines from private homes: 102 from Slovenia, 42 from elsewhere in Europe, and the rest from North and South America, Africa, Australia, Israel, and Far-East Asia. Because they were interested in the possibility of dishwashers harbouring human pathogens, they incubated their samples at 37°C, before going on to test the ability of some of them to grow at temperatures closer to what you might find in an operating dishwasher.

The results: a range of fungi, including *Aspergillus* (which can cause quite significant disease), *Candida* (aka ‘thrush’) and

Penicillium, with the most commonly-found species – in around a third of dishwashers – being the ‘black yeasts’ (*Exophalia* spp.) They also found quite a bit of variation in terms of how ‘infected’ the machines were, with those from North America having the most fungal species while those from Spain were all devoid of fungal life. However, I think the numbers are a bit low to draw much from that, with only 13 from North America and five from Spain.

Exophalia is “known to cause systemic disease in humans” and is a common pathogen in the lungs of cystic fibrosis patients. Some of the *Exophalia* strains survived in temperatures up to 47°C, although I do wonder how they could hang on given that dishwasher temperatures can exceed 60° and get up to 80°C on occasion. The authors don’t propose any survival mechanisms, and I’d like to hear more about that.

However (before you rush out and get rid of the dishwasher) they found no evidence of fungal illnesses that could be attributed to the ‘dishwasher’ fungi in the homes where they obtained their samples. So while the possibility is there for the home dishwasher to be a hotbed of infection, in practice no link has yet been observed. And this rather gives the lie to the somewhat hysterical tone of the *Register* report. We’re not yet at the point of needing haz-mat suits to wear while doing the dishes. Still, I suppose that approach wouldn’t sell so many papers...

But it’s also rather cool to think that extremophile organisms may be living much closer

to home – no need to head off to the slopes of Erebus or the edge of a boiling soda spring to spot them.

I must go and get the rubber gloves and baking soda...

Alison Campbell is a lecturer in the Biological Sciences Department at Waikato University. She writes *Bioblog* as a way of encouraging critical thinking, looking at scientific papers that are relevant to the Level 3 curriculum and Scholarship, and fielding questions from readers.

film review

A hoax the size of a mountain?

The Bosnian Pyramids: The Biggest Hoax in History?
Directed by Jurgen Deleje. VOF de Grenswetenschap.
Watch online (www.thebiggesthoaxinhistory.com): €5.95.
DVD: €19.95 (excl. shipping). Reviewed by David Riddell.

WHILE there are people in New Zealand who variously claim this country was settled in prehistoric times by a motley assemblage of Celts, Phoenicians and Chinese, among others, the alternative archaeology scene here is nothing like it is in Bosnia.

Now seeking to shake off the traumas of its recent past, the country has apparently embraced the theories of one Semir ‘Sam’ Osmanagich. Resplendent in his Indiana Jones-style hat, Osmanagich is delivering his compatriots a glorious ancient prehistory in the form of giant pyramids, dwarfing those of Egypt. The largest, which Osmanagich calls the Pyramid of the Sun, towers 220 metres above the town of Visoko. He claims underground tunnels link it to other, almost equally massive pyramids nearby. Single-handedly he has created a substantial tourist industry, much to the delight of the Bosnian government, which has given him support.

The Dutch team making this documentary follow Osmanagich around his sites, and generally

give him enough rope to hang himself, bringing in other experts as necessary to add further comment. Those familiar with the Kaimanawa Wall (*NZ Skeptic* 41) and the Overland Alignment Complex in Northland (*NZ Skeptic* 72) will recognise how natural features can be re-interpreted in a more dramatic fashion, though the situation in Bosnia has a couple of added layers of complexity. First, there are genuine archaeological sites on and around the ‘pyramids’ and second, Osmanagich has actively reworked the landscape, even following and enlarging fissures in the earth to create his ‘tunnels’.

Bosnia is a country with a remarkable and lengthy human history and, as is very apparent in this film, great natural beauty. It shouldn’t need the dubious enhancement Osmanagich provides to entice tourists from abroad. On the other hand, it’s such a magnificent folly if I ever found myself in Bosnia I’d probably stop by Visoko to see it all for myself.

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