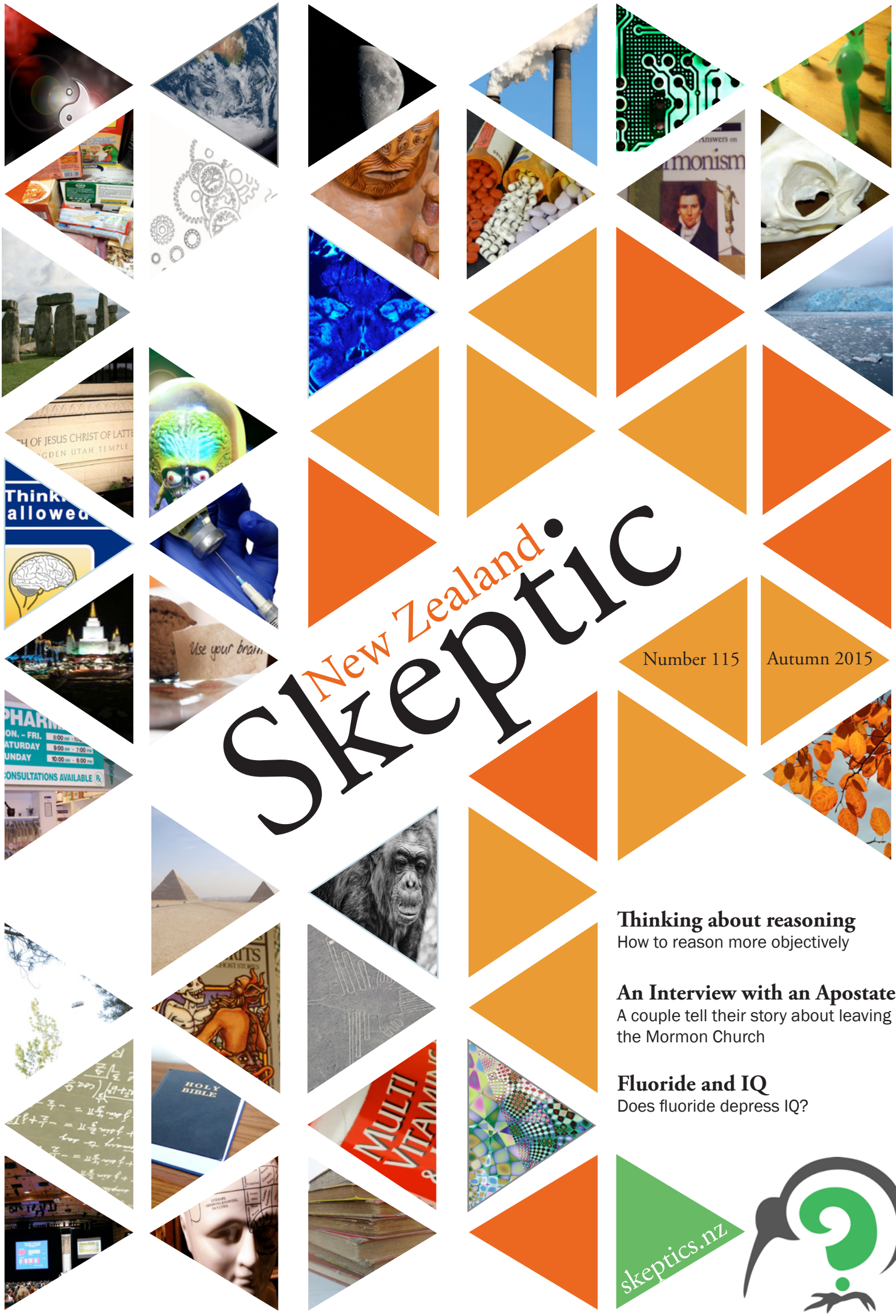

New Zealand Skeptic

Number 115 Autumn 2015

Thinking about reasoning
How to reason more objectively

An Interview with an Apostate
A couple tell their story about leaving the Mormon Church

Fluoride and IQ
Does fluoride depress IQ?

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The New Zealand Skeptics form a network of New Zealanders including scientists, health professionals, teachers, magicians and many others from all walks of life. Members have a variety of religious faiths, economic beliefs and political leanings, but are all interested in examining what objective scientific support there is for claims of such things as psychic abilities, alternative health practices, creationism and other areas where science, pseudo-science and shonky science interact.

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Deadline for next issue: 10 July 2015

Letters for the Forum may be edited as space requires – up to 250 words is preferred.

Please indicate the publication and date of all clippings for *Newsfront*.

Material supplied by email or web document is appreciated.

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All references and citations for this issue can be found at *skeptics.nz/journal/115*

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A-tishoo! A-tishoo! We all fall down!

As a teacher, it's unsurprising that I often come face to face with issues to do with children. I don't pretend to be an expert on children, and neither am I a parent, pediatrician or psychologist. However, while the government is making their laws, and social media is debating the ins and outs, and parents are wailing about their parenting rights, I have been there with the kid who has nothing for breakfast, the kid who thinks hitting is a way to solve problems, and the kid who thinks a certain way because that's what his mum and dad think.

Parents can be great. And parents can be so wrong. Sometimes I think that when people have kids, they automatically think they know best. "I'm not an expert, but as a mother..." is a sentence-starter that I'm sure most of us have heard bandied about. The loudest being the anti-vaxxers.

As an early childhood teacher, I had numerous conversations with parents about immunisations. The usual points from parents who are leaning towards vaccine refusal are often mentioned: that vaccines cause autism, that there is a Big Pharma conspiracy, and that doctors just plain don't know what they're talking about.

Should childcare centres be able to refuse admission to children whose parents are vaccine refusers? The Australian government recently announced, to be effective in 2016, that parents who fail to immunise their children based on conscientious objections will no longer be paid childcare benefits or rebates, and that the only reasons for exemption will be medical. Short of barring anti-vaxxers from childcare centres, they have at least made it more diffcult for them to access childcare.

Hitting parents in the pocket is a crude, but probably effective way to get anti-vaxxers immunising their children. Although it would be great if educating the public was enough, we all know the pitfalls of how people think. Give them a sensational headline or a celebrity on their side, and rational, well-documented arguments go flying out the window.

A doctor friend of mine sent me an article called *What if measles were lice* written by Dr. Amy Tuteur for *The Skeptical OB*. In the article she parallels the anti-vaxxers' reasons for not immunising their children as a case for not treating head lice.

While most parents I know would never dream of letting their child walk around with an ongoing infestation of lice, and while most preschools don't allow children who are infested to come back until they have been treated, Dr. Teteur makes the interesting point that the same cannot be said of measles. But why is that? Lice aren't deadly; measles can be. Lice need close contact to be contagious; measles is transmitted through the air. Lice can't lead to complications; measles can. Treatments for lice involve chemicals, while the measles vaccine works with the body's immune system.

What if a mother walked up to me and told me that she refused to treat her poor kid Sally's head lice because: a) it's completely natural; b) the treatments cause autism; c) she had head lice when she was younger and it was fine; d) she has the right to raise Sally however she wants to and freedom means Sally can pass head lice on to as many children as possible, God willing?

I would say: here's some head lice shampoo and a comb. Get to it.

The skeptical movement plays an important role in ongoing efforts to inform the public about the importance of vaccinations. There is no doubt that every child deserves the right to be healthy and safe from disease, no matter what their parents think. ❐

Read something of interest? Share it with us.
Email *editor@skeptics.nz* (Please indicate the publication and date of all clippings)

THE IMPLICATIONS OF GOOGLE RANKING SITES BASED ON ACCURACY | NZ Herald, 12 Mar 2015 | For some time, those of us studying the problem of misinformation in US politics – and especially scientific misinformation – have wondered whether Google could come along and solve the problem in one fell swoop. After all, if Web content were rated such that it came up in searches based on its actual accuracy – rather than based on its link-based popularity – then quite a lot of misleading stuff might get buried. And maybe, just maybe, fewer parents would stumble on dangerous anti-vaccine misinformation (to list one highly pertinent example).

It always sounded like a pipe dream, but in the past week, there's been considerable buzz that Google might indeed be considering such a thing. The reason is that a team of Google researchers recently published a mathematics-heavy paper documenting their attempts to evaluate vast numbers of Web sites based upon their accuracy.

As they put it:

> The quality of web sources has been traditionally evaluated using exogenous signals such as the hyperlink structure of the graph. We propose a new approach that relies on endogenous signals, namely, the correctness of factual information provided by the source. A source that has few false facts is considered to be trustworthy.

As our friends at The Intersect note, this does not mean Google is actually going to do this or implement such a ranking system for searches. It means it's studying it. For what purpose, we don't know.

But it's not the company's first inquiry into the realm of automating the discovery of fact. The new paper draws on a prior Google project called the Knowledge Vault, which has compiled more than a billion facts so far by grabbing them from the Web and then comparing them with existing sources. For 271 million of these facts, the probability of actual correctness is over 90 per cent, according to Google.

The new study, though, goes farther. It draws on the Knowledge Vault approach to actually evaluate pages across the Web and determine their accuracy. Through this method, the paper reports, an amazing 119 million Web pages were rated. One noteworthy result, the researchers note, is that Gossip sites and Web forums in particular don't do very well – they end up being ranked quite low, despite their popularity.

Google's new research didn't explicitly mention how this approach might rank science contrarian websites. But media have been reporting this week that climate-change sceptics seem unnerved by the direction that Google appears to be heading.

If this ever moves closer to a reality, then they should be. If you read the Google papers themselves, for instance, you'll note that the researchers explicitly use, as a running example, a fact that has become "political." Namely, the fact that Barack Obama was born in the United States. And thus, before our eyes, algorithms begin to erode politicised disinformation.

Substitute "Barack Obama was born in the United States" with "Global warming is mostly caused by human activities" or "Childhood vaccines do not cause autism," and you can quickly see how potentially disruptive these algorithms could be. Which is precisely why, if Google really starts to look like it's heading in this direction, the complaints will get louder and louder.

NEW ZEALAND RANKS HIGHLY IN SOCIAL PROGRESSIVE INDEX | Stuff, 9 April 2015 | New Zealand has pipped Australia as one of the most "socially progressive" countries in the world, outperforming many of its wealthier counterparts.

In a report released run by US-based not-for-profit organisation The Social Progress Imperative, New Zealand was ranked the world's fifth-most socially progressive country in the Social Progress Index. The country was ranked first in the inaugural index last year, however the organisation said the two results should not be compared because the measures had been changed.

The index measured everything from access to technology, education, and human rights, to environmental management.

Overall, 133 countries were ranked on their social and environmental performance, using 52 indicators, all pegged against a country's gross domestic product.

New Zealand did particularly well in the "person rights" category, ranking first for freedom of expression and political rights. It also ranked third on "access to basic knowledge" and performed well on access to communications, tolerance and inclusion, and freedom of religion.

However the country did less well on access to nutrition and basic medical care, partly because of our high child-mortality. Environmental sustainability was also something to work on, with poor water management a particular concern.

New Zealand's fifth beat Australia, which was ranked 10th, as well as Canada, Britain and the United States. Norway was listed as the most socially progressive country, followed by Sweden, Switzerland and Iceland.

Michael Green, executive director of the Social Progress Imperative, said New Zealand's placing was a "fantastic result" – particularly impressive given it was economically weaker than many countries it outranked, such as the US and Australia.

"It's particularly on the measure of opportunity that New Zealand performs strongly," he said.

Areas in which New Zealand did particularly well, such as rights, tolerance and opportunity, were areas that globally were the weakest. If the world was measured as a whole it would be about as socially progressive as Cuba or Kazakhstan.

> New Zealand ranked 5th overall. Australia ranked 10th
> Ranked 1st on "personal rights"
> Ranked 7th on "personal freedom and choice"
> Ranked 5th on "tolerance and inclusion"
> Ranked 8th on "access to information and communications"

Ranked 28th on "nutrition and basic medical care"
Ranked 34th on child mortality
Ranked 34th on "ecosystem sustainability"
Ranked 61st on 'water withdrawals".

VACCINATION WARNING AHEAD OF POTENTIAL WHOOPING COUGH EPIDEMIC | NZ Heralad, 19 Apr 2015 | Parents are being warned to vaccinate themselves and their children ahead of a potential whooping cough epidemic. The highly contagious disease, also known as pertussis, is said to work in cycles, with a large-scale outbreak every two to five years.

"Every few years we see a huge spike of pertussis cases in New Zealand, and with the last one starting in 2011 and only just waning now, we can expect another in the near future," registered nurse and former Waikato DHB immunisation coordinator Kim Hunter said. "We've done a good job of getting lots of adults immunised, particularly parents and grandparents, but in 70 per cent of whooping cough cases in babies, they catch it from a parent or close family member, so we need to keep working to prevent that from happening."

Infants are worst affected by the disease as their airways are smaller, and they are quickly exhausted by the wracking cough that is a hallmark of the condition, she said. If they are placed in the intensive care unit, they have a one in six chance of suffering severe lung damage, brain damage, or of dying from the disease, she said.

Babies should be vaccinated against whooping cough at six weeks, three months and five months, Dr Helen Petousis-Harris, senior lecturer at the department of general practice and primary health care at the University of Auckland said.

"If you put off vaccinating your baby, all you're doing is leaving them unprotected for a longer period of time," she said.

The warning comes ahead of Immunisation Week, which runs from Monday April 20 to Friday April 24. It aims to raise awareness among parents of young children and babies of the importance of immunisation to protect their child against serious illnesses.

SCIENTOLOGISTS USE CHURCH'S PHILOSOPHIES TO TRAIN TEENS TO DRIVE | Stuff, 18 April 2015 | A private education trust is having a roaring success teaching government-funded driver licence courses using education techniques inspired by the teaching methodology of the controversial Church of Scientology.

But the Secular Education Network is decrying the classes, saying any influence of the church on the education material meant a "biased education" was being delivered.

Registered charity Rule Education Trust, run by David Rule, is delivering driver licence courses to Aucklanders in need. Rule set up the not-for-profit in 2002 and has since launched courses in more than 15 locations across Auckland, including marae, decile 1 schools, community centres and prisons.

Rule has been a member of the Church of Scientology for 30 years and uses some of the teaching techniques he learned while teaching the church's study skills programme.

Rule taught Scientology's Applied Scholastics programmes alongside Auckland social worker Betty Wark. Applied Scholastics International teaches study skills developed by the church's founder L Ron Hubbard. The techniques include making sure students understand the meanings of words, encouraging them to physically interact with what they are learning about and not teaching too much too soon.

Rule said he believed in the education technology and while he did not teach these study skills or any religious material during the driver licence courses, he did draw on what he had learned in his time teaching Applied Scholastics.

Last year more than 1000 people enrolled in the driver licence courses and about 200 people across the region were currently attending classes. About half the people enrolled in the courses were referred by organisations like police and Work and Income (WINZ), and the success rate was sitting at about 75 per cent for the community and prison classes and more than 95 per cent in high schools.

The courses are funded partly by Auckland Transport and Adult and Community Education Funding. In the past, money had been received from the Ministry of Social Development and the trust hoped to gain funding from Auckland Council.

Rule said people attending the courses often found it hard to come up with money to pay for test fees and for the means to get to courses. The people Rule taught in prison were often there for repeat driving offenses, sometimes for driving without a licence.

Year 13 Tangaroa College student Filiamata Tapumanaia attended a course last week and passed her learner licence on Friday, along with 21 other students. Tapumanaia said she knew having her licence would improve her chance of getting a job.

Tangaroa College careers advisor Susanna Sabbage said gaining a driver licence was a "huge confidence booster". A significant amount of students from the decile 1, south Auckland school would go on to work in a trade, where a driver licence was essential.

Rule was in the process of piloting restricted and full-driver licence classes and tests at James Cook High School. He was also training more tutors and expanding the reach of the courses to take in west Auckland. He said his ultimate goal was to open a private school using the Applied Scholastics technology where parents could also join classes.

Meanwhile, the church hopes its education courses would be revived and one day a school would be founded. Church of Scientology New Zealand secretary Mike Ferriss said there was currently a lack of resources but he hoped the opening of Scientology's Athena School in Sydney would have a flow-on effect. Some church members home school their children, including Rule and himself, he said.

Ferriss said the church's teaching programmes were "common sense" and they did not teach religion or anything with a spiritual base. "People will try and

conflate them together because that's what they want to think."

While Ferriss was "passionate about education", the church's current focus was on moving into its $10.2 million heritage building in central Auckland.

Ferriss said the church had secured the additional funding to carrying out the renovations, something that would cost more than the building itself, and it would open in about 12 months.

The work on the new building came at a time when the church was once again under fire following the release of the scathing 2015 documentary *Going Clear: Scientology and the Prison of Belief* based on the book by Lawrence Wright.

Ferriss said members of the church's New Zealand branch "cringe" each time a documentary or damning piece of media is released.

"That creates a very negative picture. We're kind of used to it."

NEW BEAUTY TREND SNAILS THE LOOK | NZ Herald, 26 Apr 2015 | Kiwi women are turning to a humble garden pest in the search for eternal beauty. Snail slime is being sought as a miracle face-fixer to make skin appear softer and younger.

Snail Soap, imported from Europe, has customers in a lather at La Cigale French market in the Auckland suburb of Parnell. And a new craze of snail facials – which involves shelled slugs being placed on the face – is expected to arrive at New Zealand beauty parlours soon.

The trendy Snail Soap costs $25 a bar. Made in Portugal, it contains snail slime, virgin olive oil, honey and extracts from medicinal plants.

"Some people have a chuckle when they see it has snail slime in it, others go, 'Oh, God' and need a bit of convincing," Dianne Perillo, La Cigale Shop manager, said. "But it is proving popular with women who can afford it."

It is claimed snail mucus helps reduce pigmentation and scarring, as well as beating wrinkles.

"Young to middle-aged women who are well-versed in organic products and looking for something different have been buying the Snail Soap," Perillo said.

"No one has come back and said it is rubbish or doesn't work."

The healing and repairing powers of the slime was discovered when snail farmers in Chile, harvesting for the French food market, noticed their hands were extremely soft and smooth, and minor cuts healed quickly.

Laboratory analysis showed a substance called Helix Aspersia Muller produced by the snail to quickly regenerate its shell and skin contains beneficial glycolic acid, collagen, elastin, allantoin, vitamins and minerals.

Actor Katie Holmes, former wife of Hollywood actor Tom Cruise, is said to have taken to the product.

Snail facials are popular in Thailand, Japan and the US. Beauty salons in New Zealand are now eyeing the craze.

Stacey Power, cosmetic nurse and co-director of Ever Young in Auckland, said the idea would take getting used to.

"Some Kiwis will probably think it is all a bit weird and might consider using their own snails from the garden," she said. "But snail facials are believed to be very good, particularly for treating scarring,"

Dani Revell, founder of the *We Are Anthology* blogging site representing a number of beauty bloggers, tested a snail facial for the Herald on Sunday.

It was "a bit weird" but said she'd be willing to try again.

"I didn't mind the snails being on my face but it was a bit creepy when they came into my vision because their heads and shells appeared huge," she said. "But my skin felt clean and tight afterwards."

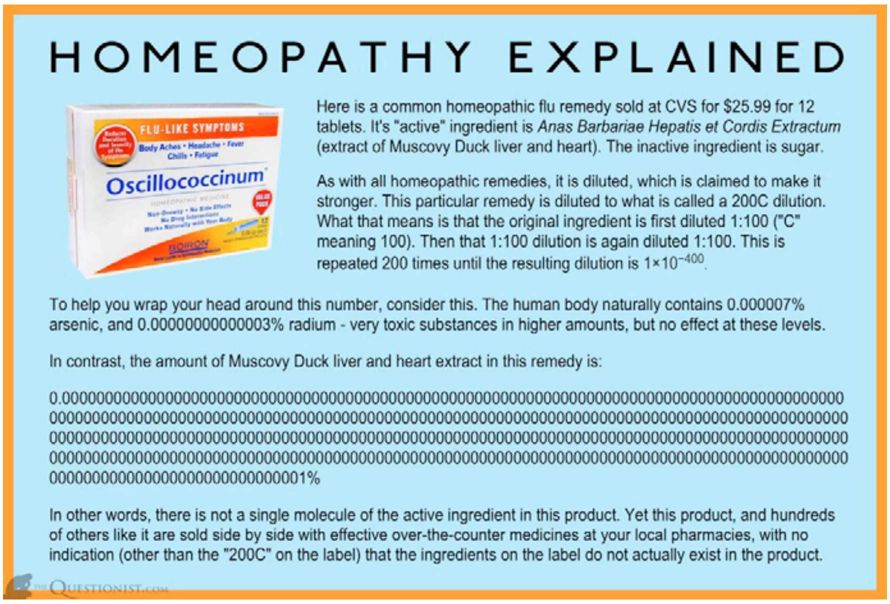
But Christchurch-based dermatologist David Nicholls said he hadn't seen any scientific proof to back up the claims for snail slime.

"There is no evidence using snail slime on your skin, either raw or in products, provides any benefit, and I believe it would be a waste of money," he said. ❐

Letters

From my daughter in San Francisco, always a skeptic.

Janelle Wallace



Got something to say? Email us!
editor@skeptics.nz

Thinking about reasoning:

How to reason more objectively

Why do individuals who read the same information react differently? To some extent, beliefs affect individuals' reactions. While this is normal, it can be problematic if beliefs interfere with objective reasoning.

By Matthew T. McCrudden

In a famous experiment at Stanford in 1979, researchers identified individuals who strongly supported or opposed capital punishment and asked them to read two fictional research studies: the first study reported evidence that capital punishment was a deterrent to homicide and the second study reported evidence that capital punishment was not a deterrent. After participants read each study, they evaluated the convincingness of the study and judged how well or poorly the study had been conducted. Participants rated the study that was in line with their prior beliefs as more convincing and better-conducted.

What makes this finding interesting is the fact that the researchers controlled for the possibility that differences in ratings could be due to the way in which the data in the fictional studies were obtained. For half of the participants, the fictional pro-deterrence study compared the murder rates in several states before and after the adoption of capital punishment, whereas the anti-deterrence study compared murder rates in adjacent states that did and did not have capital punishment. The other half of the participants read the opposite: the pro-deterrence study used an adjacent-states design, whereas the anti-deterrence study used a before-after design. Thus, participants evaluated information that supported their beliefs more favorably than information that challenged their beliefs even though the fictional data were essentially the same!

This example illustrates a type of bias known as *myside bias*. Myside bias occurs when individuals fail to reason independently from their beliefs, such that they evaluate evidence in a way that favors their beliefs and attitudes.

When people encounter information that confirms their beliefs, they often generate thoughts that support the information. However, when people encounter information that challenges their beliefs, they tend to generate thoughts that refute the information. This is normal, and in many cases justified. For example, if someone told you that he had invented a time machine, you would have good reason to question and doubt his claim.

Nonetheless, results from the study described above (and other similar studies) indicate that the participants' evaluations were not sufficiently justified. Why? When given equivalent pieces of evidence that were open to the same criticisms, they applied different standards of evaluation based on whether it was consistent with their beliefs, not on the quality of the evidence. Thus, a clear indicator of biased reasoning is that a person uses different standards to evaluate belief-consistent and belief-inconsistent evidence.

Reasoning more objectively

How can you reason more objectively? Obviously, there is no simple answer to this question. However, there are at least two ways you can increase your ability to reason more objectively:

(1) be aware of how you reason

(2) develop your understanding of the nature of knowledge.

Admittedly, these sound a bit abstract and vague, so I'll elaborate with some concrete examples.

Become aware of how you reason

The first way you can increase your ability to reason more objectively is to become aware of how you reason. Let's use an example to illustrate.

John sees a debate between Sherry and Liz about whether global climate change is occurring. Further, let's assume that John believes that climate change is happening. To resolve the debate, Sherry and Liz both gather information about air temperature. Sherry looks up the average temperature in Tokyo in 2012 and 2013. Then she compares the average yearly temperatures in 2012 and 2013 to determine if temperatures have changed. The results indicate that the average yearly temperature increased significantly from 2012 to 2013. She concludes that climate change is occurring in Tokyo.

Liz looks up the average yearly temperature in Copenhagen over the past two years. Then she compares the average yearly temperature between the two years to determine if temperatures have changed. The results indicate that the average yearly temperature did not increase significantly over the past two years. Thus, she concludes that climate change is not occurring in Copenhagen.

For the sake of simplicity, let's say that there are two basic types of reasoning that John can use to evaluate Sherry and Liz's arguments: *less-objective* and *more-objective*. And keep in mind that Sherry's argument (climate change is happening) is consistent with John's beliefs, whereas Liz's argument (climate change is not happening) is inconsistent with his beliefs.

Let's begin with less-objective reasoning. For the belief-consistent argument, John sees from Sherry's argument that the temperature in Tokyo increased over the two-year time span. Because this is consistent with his views that global warming is a reality, he accepts this information and views it favorably.

For the belief-inconsistent argument, John finds reasons to discredit Liz's evidence: he argues that two years is an insufficient amount of time in which to measure a change in climate, that to measure a change in global climate it is necessary to obtain data from multiple locations, and that Copenhagen may show less variability in temperature because it is near a harbor. He wonders if Liz's source is credible.

What makes this less-objective reasoning? Sherry and Liz's arguments are structurally equivalent and open to the same criticisms. But John notes more problems with Liz's argument, which is inconsistent with his beliefs. This clearly shows a bias in his reasoning because he is applying a different standard of evaluation to Liz's argument despite the fact that both arguments are practically identical. The first argument confirms his views and he accepts it at face-value, whereas the second argument challenges his views and he scrutinizes it to a much greater extent. Thus, he evaluated the belief-consistent argument more favorably than the belief-inconsistent argument, but he bases his judgment on his beliefs rather than the quality of the evidence.

Now let's look at more-objective reasoning. John reads both arguments and says that they are both weak. Although he believes that climate change is happening and acknowledges that the first argument is compatible with his views, he still points out that evidence of global climate change needs to be obtained from numerous locations around the globe and over a much longer time span than two years. He provides the same rationale for the second argument, which is inconsistent with his views.

What makes this more-objective reasoning? As indicated above, Sherry and Liz's arguments are structurally equivalent and open to the same criticisms. In the case of more-objective reasoning, John decouples his beliefs from reasoning. That is, although he holds a view on the topic, he does not let his view influence his ability to focus on the quality of the evidence or arguments. He applies the same standard of evaluation to both arguments independent of his beliefs.

A defining feature of more-objective reasoning is the ability to reason independently from one's belief.

As you read this example, you may have wondered whether I presented you a caricature for illustrative purposes and that no one would really reason in this manner. Quite the contrary; in some of my research we've had participants evaluate arguments like the ones you read above and they have shown this same type of reasoning. In one study, we had participants rate the strength of arguments that were consistent and inconsistent with their beliefs and had them justify their ratings. The arguments were structurally equivalent and open to the same criticisms. Collectively, participants rated belief-consistent arguments more favorably than belief-inconsistent arguments.

We decided to have closer look at individual participants' ratings and found that some participants gave identical ratings to both kinds of arguments, whereas other participants rated belief-consistent arguments much more favorably. Then we interviewed them. We gave them the arguments, their ratings, and their hand-written justifications for their ratings. We asked them to explain their ratings and then asked them why they rated the arguments differently (or similarly depending on their specific ratings). Sure enough, their responses mirrored the justifications provided above to illustrate more- and less-objective reasoning.

There are two important ideas to note about the example. First, a defining feature of more-objective reasoning is the ability to reason independently from one's beliefs. This example illustrates the concept of more-objective reasoning and juxtaposes it with the concept of less-objective reasoning. Second, holding a belief or view does not necessarily lead to biased reasoning. Rather, biased reasoning occurs when individuals do not decouple their beliefs from the evaluation of evidence and arguments.

Develop your understanding of the nature of knowledge

The second way you can increase your ability to reason more objectively is to develop your understanding of the

nature of knowledge. One definition of knowledge is true justified belief. Let's unpack this.

How can we know for sure if something is true? Well, the reality is we can't know anything with absolute certainty. But does that mean that knowledge is always a matter of opinion? Of course not. It means that some beliefs are more certain than others and that we have sufficient reason to believe and act upon them, keeping in mind that they may need to be modified in the future. For example, while driving to work, suppose you are at an intersection waiting for the traffic light to turn green, which it eventually does. After a brief delay, you can assume with a high degree of certainty that you can drive forwards without fear of colliding with cross traffic. What would it be like to drive in a city if you were unable to make this assumption? Clearly, we can't know with absolute certainty that cross traffic will stop at a red traffic light; in fact we have evidence that tells us that cars do collide at intersections. Nonetheless, the probability of driving through an intersection unimpeded by cross traffic is dramatically higher than the probability of colliding with cross traffic.

Now assume that there is a power outage and that the traffic lights stop working. You may become less certain about the likelihood of driving through an intersection unimpeded and approach the intersection more slowly. The situation changed and you had to modify your beliefs and assumptions given the new information.

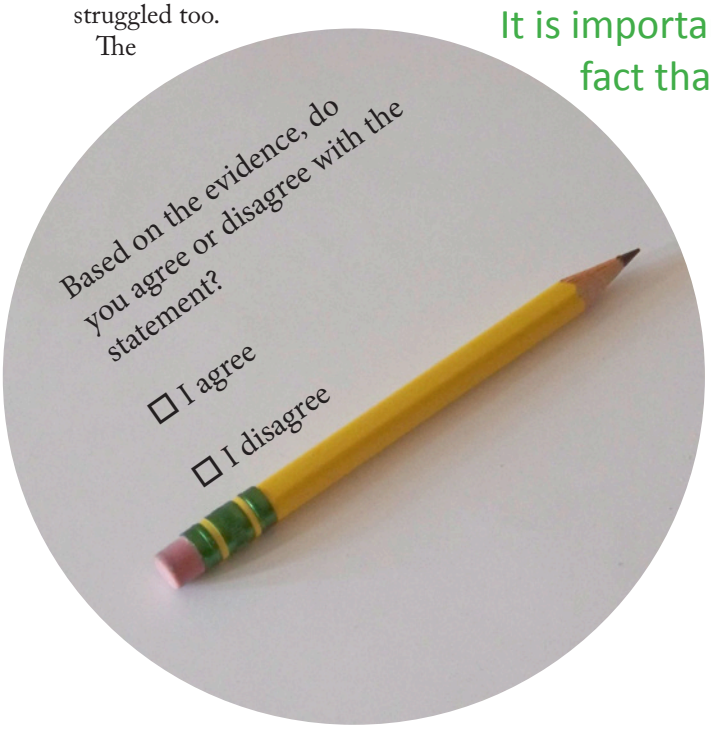
To develop your understanding of the nature of knowledge, it is important to know what makes some knowledge claims more defensible than others. To do this, you need to understand that, despite the fact that we cannot know something with absolute certainty, some claims are more justifiable than others. For instance, suppose two researchers observe a child solve a complicated mathematics problem. The first researcher claims that the child struggled to solve the problem. To support this claim, the researcher says she struggled to solve the problem, so the child must have struggled too.

The second researcher also claims that the child struggled to solve the problem. To support this claim, the researcher indicates that the child asked several questions while working on the problem, indicated in a conversation that he was frustrated, he looked confused at times, and was unable to solve similar problems on a class quiz. Which researcher provides more convincing evidence? They both make the same claim, but the second researcher provides a greater amount of evidence and the evidence is more objective. This example illustrates that evidence is one source of knowledge and that the quality of evidence affects the certainty of a knowledge claim. That is, higher quality evidence increases the certainty of a knowledge claim.

However, evidence is not the only source of knowledge. To illustrate, suppose I give you two tasks. For the first task, I show you a red marble and a blue marble. Next, you close your eyes and I place the marbles into separate opaque cans. Then, you look into one of the cans and I ask you to identify the color of the marble in the other can that you did not look into. I also ask you how certain you are that you have correctly identified the color. If the marble in the can that you look into is red, then you can be quite certain that the color of the marble in the other can is blue.

The second task is similar to the first task, but has one major difference: this time you don't look into either of the cans. Rather, I just point to one of the cans, ask you to tell me the color of the marble in the can, and how certain you are that you have correctly identified its color. In this task, you have to guess the color in the can and will be much less certain about accurately identifying the color of the marble.

For neither task can you be absolutely certain that you have correctly identified the color. Nonetheless, you will be more certain that that you correctly identified the marble's color in the first task. The example illustrates that inference can be a source of knowledge in the absence of direct perceptual experience. That is, for the first task, you had to infer the color of the marble by process of elimination. To begin there was a red marble and a blue marble. You saw that the marble in one can was red, and without actually seeing inside other can, you could infer that it was blue. In the second task, you simply had to guess.

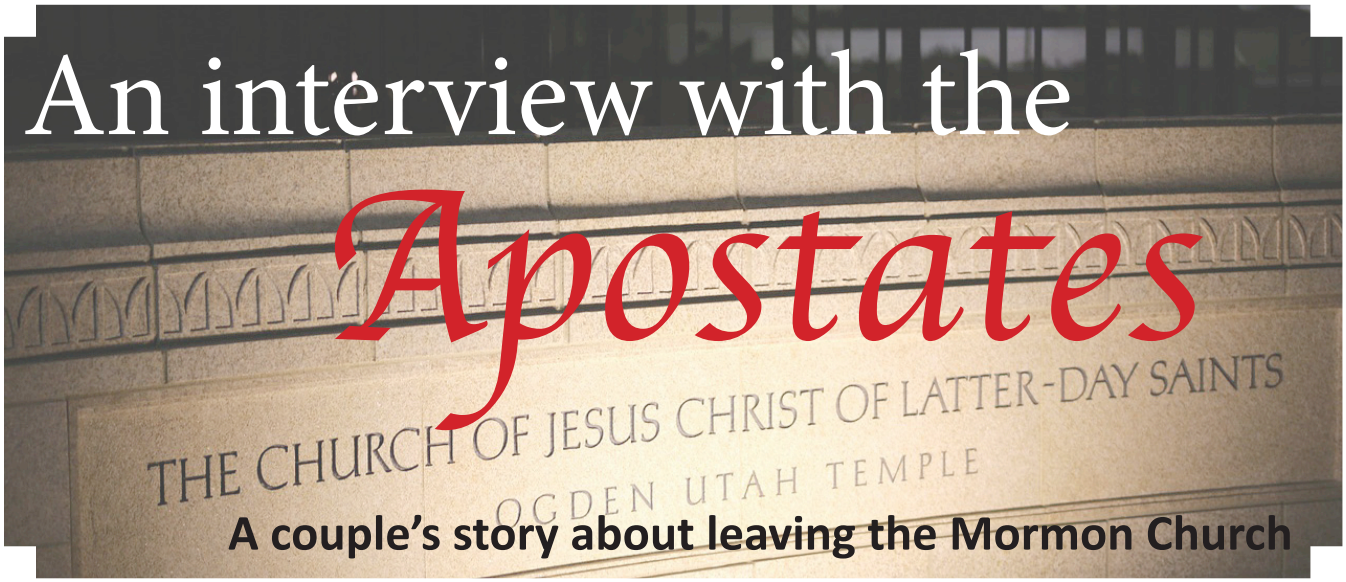


It is important to be aware of your beliefs and the fact that they can affect your reasoning ability.

A hallmark of rational thought is the ability to reason independently from one's beliefs. Thus, it is important to be aware of your beliefs and the fact that they can affect your reasoning ability. On a related note, it is important to understand that although we cannot know anything with absolute certainty, some ideas are more certain than others. So the next time you are at a busy intersection, ask yourself how certain you are that you'll pass through the intersection safely, and enjoy the ride! ❐

Matthew Willey works in schools as an adviser for children with disabilities. He lives in Palmerston North with his family, who tolerate his enthusiasm for skepticism with a kindly forbearance. He is English, but losing the accent.

An interview with the Apostates



A couple's story about leaving the Mormon Church

Midsummer New Zealand. Driving to Jen and Camilo's house I pass two missionaries. On a hot and humid February afternoon in Palmerston North, the two handsome young Mormons dressed in immaculate white shirts breeze along on bikes. Their flawless presentation and purposeful demeanour is a contrast to the dusty, lethargic city around them. Pondering them as I drive by, I formulate another question for the people I am going to meet.

They are Apostates. Jen and Camilo have willingly abandoned the One True Church, and in so doing have surrendered their chance of an eternal life with their family in the celestial kingdom. For the bulk of their lives they have trodden the path of righteousness, but no more. They have made their choice.

In the eyes of the Church of Jesus Christ of Latter-day Saints, apostasy is a crime more serious than child abuse. It is a lurch from virtue to damnation, from security to the void. For the decades Jen and Camilo spent as Mormons it was, in a literal and very deliberate sense, unthinkable.

But it did happen. It happened on a precise date, February 9th, 2014, in middle of the northern winter. In our interview Jen and Camilo described a sequence of tectonic events that led to a delusion falling away, and a world changing forever.

They told me their story at their home a year after they had crossed from one life to another. I interviewed them over the course of two fleeting hours. We traced their journey into the church, through it, and out again to where they now stand unrepentant.

CHILDHOOD, GREAT GOOD FORTUNE AND HAPPINESS

In fairness to them, apostasy was no choice at all; nothing could have been more inevitable. But I'll begin at the beginning.

Camilo and Jen both have memories before their families joined the Mormon Church. Jen was an American Catholic, whilst Camilo grew up in Colombia and Venezuela.

Camilo described the way that happiness and stability came to his family. They were recruited by American Mormon missionaries, and he remembers a Chapel in Venezuela with huge banners saying "Be Happy, Be Mormon". This was no idle claim, it turned out.

The Mormon missionaries who came to town were clean cut American 19 year-olds who would show remarkable generosity and attentiveness. They would feed families and play with their children, and won over even South Americans, who distrusted the USA. They lured families into the church with a very specific promise: you will be with your children forever. The promise of happiness, for a child like Camilo, was fulfilled. Everywhere they went they met a ready-made family that welcomed them, that thought as they did, that provided for them. He saw his drinking, promiscuous father become family-oriented, and his mother become happy. "We thought that growing up in the church made us very lucky."

At the same time, the church warned them of the dangers of being outside of the church. "We were told that we needed to be in the world, but not of the world." The only safe place was in the Mormon family, and Camilo's family did indeed feel safe.

Jen also has memories of Catholicism before the Mormons, but at the age of six the family were baptised into the church. Jen confirms that the rhetoric in the

church is that those baptised are enormously fortunate to have found the truth. "You are so lucky you found the truth! You made it, you're here, you'll get to be with your family forever!"

Jen was eight years old when she was given this message. As Jen says, for an eight year old, what greater fear is there than losing your family? "You just feel like you've won the lottery." The sense of gratitude to the church, for both their childhood selves, was overwhelming. Questioning was out of the question. The stakes for the children in the church could not be higher; they were the chosen ones, saved for the latter-days, united forever with their mum and dad.

They lived glorious childhoods surrounded by love. Everybody loved them, they had become part of one big, sharing, attentive family. They remember the feeling of being new members of the church. "We were treated like rock stars," says Jen. "These are our new members, aren't they fantastic? They found the true church, they want to be with their families forever." This is called 'fellowshipping' in the jargon of the church; everyone in the congregation would raise their arms in support of this new family. For Jen, it all worked like a dream; why would you question anything when people are being so kind?

One of the ways the church exacts its hold on its members is through constant repetition of doctrine. 'Bearing your testimony' is a principle technique, where the onus is on the individual to publicly (and convincingly) rationalise their faith. To do so in front of the congregation is a major status symbol.

Jen describes it as a bit like an open mic night. Members of the congregation stood and shared their response to scripture. The testimonies followed a pattern: they generally start with "I'd like to bear my Testimony, I know this church is true, I know Joseph Smith was a True Prophet." From this foundation individuals weave their own monologue that demonstrates to their fellow believers how, for example, *The Book of Mormon* is a true record of ancient Americans.

A MORMON FAMILY FEEL THE LOVE

The members of the church are encouraged to intellectualise this position, to rationalise it in front of the congregation. As Jen and Camilo say, it is an enormous status symbol to have a strong testimony, and as teens they stepped up. In their own words, to a packed house and an appreciative audience, they spoke of their acceptance of what they now understand to be a fraudulent doctrine.

In these meetings Camilo and Jen not only delivered their own testimony, but listened to untold others. Smart, articulate people would stand and use the same formulaic utterance, but in this way it would be given subtlely and diversity and have behind it a weight of numbers that was undeniable to Jen and Camilo.

Children as young as two or three years old gave their testimony; they stood on stage, held a heavy mic in front of the congregation and parroted the formula whilst their proud, deluded parents whispered in their ears.

As Jen now says, "I believed absolutely every word of it, hook, line and sinker. I didn't have any need to question it. You are told, over and over again, this is the plan of happiness, and that the world is dangerous. You are taught to fear the world."

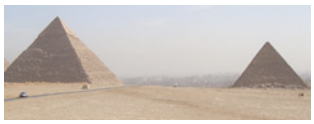
The love they were surrounded by, the complete surety of their cause, and the adulation earned by having a strong testimony fuelled their teenage years. These were years which were filled with activities and social events that widened their social circle without ever taking them outside the shelter of their faith. It was a wonderful time for them both.

THE REAL WORLD SEEPS IN, AND THE CHURCH REVEALS ITS TRUE COLOURS

Camilo and Jen are burdened with inquiring and agile intellects. To control these powerful tools, these minds had to be systematically managed by the Mormon church using techniques that Jen and Camilo can now identify.

"The last thing we thought was that we were being brainwashed," Camilo says. The indoctrination was, and is, robust and adaptable. The process is one of self-indoctrination, and it a process able to assimilate

Camilo (second from right) with his family in Colombia in the 1970s. In the background is the message, "Ser Mormón, ser feliz": Be Mormon, be happy.



> I remember people saying *The Book of Mormon* is true because it must have taken people from other worlds to do this, look at the research of Erich von Däniken... Over twenty or thirty years, you listen to people who have no evidence, but they say things that you latch onto, and you form this scaffold of lies that perfectly explains why the church is true. -Camilo

cultural and intellectual challenges.
In the late seventies the now discredited Erich von Däniken's star was in the ascendant. It was no problem for Camilo's father to incorporate ancient aliens into a testimony that held *The Book of Mormon* to be a true record of ancient America. Why would there be any difficulty in melding two fantasies?

Everyone around them, the people they trusted and whom they counted as good friends, shared intellectual and emotional testimony that reinforced the message of the church. Friends would cry on stage, and the emotional reaction of the congregation confirmed for Jen and Camilo that the spirit had visited them that day.

And yet, despite the daily, systemic, emotional and intellectual reinforcement of the religion that they shared, Jen and Camilo were diverging gradually from the world that had nurtured and contained them. Unconsciously, they were questioning in ways that were both prohibited by the church and that they denied to themselves.

Jen was a true believing Mormon until she was nineteen and a half. She was due to marry a "returned missionary who was righteous and valiant", and to enter the temple in a ceremony she had no idea about. Throughout her teenage years, Jen had been anticipating this mystique-shrouded occasion. She was so excited, "...everything was lining up perfectly for my Mormon story."

The temple ceremony turned out to be a complete departure from the familial, supportive community that she had lived with all of the years of her childhood. It is a pastiche of the Freemason's ceremony, and was starkly at odds with the loving, familial face of the church that Jen had become used to. It is so sacred, so secret, that neither Jen nor any other child in the church had ever been told what happens; the experience was utterly alienating for her. The weird formality, the costumes, the arcane gestures and language, all of these left her baffled. She was surrounded by people congratulating her for attaining this exalted state, but Jen was like a deer in headlights. Three days before her wedding to her courageous missionary, the church shot itself in the foot.

WHEREIN WE ENCOUNTER 'THE SHELF'

This was the moment in Jen's life when she was encouraged by her elders not to concern herself with doubts. Doubts can be parked, and can wait for the appropriate revelation.

She used a mental technique that she now refers to, along with other ex-mormons, as 'the shelf'; it is the place where doubts can be placed. It is the means, as Camilo says, of compartmentalising the mind. The shelf is a place where questions are placed, secure in the knowledge that at some point enlightenment will resolve those difficult questions. This is how intelligent, questioning individuals still adhere to the doctrine of Mormonism. They consciously park their doubts on a shelf that is managed in their heads. At some point, the answers will come, whether in this life or in the next. God will answer the question, all they need to do is park it and have faith.

Camilo was better at this than Jen. His status in the patriarchal structure of the church was higher than Jen's; he was a returned missionary with a strong testimony. He is a medical doctor, and he managed to compartmentalise faith and science in a way that may have continued to this day, if it were not for Jen. Women's primary role in the church is to populate it, certainly not to form opinions of their own: "I was a Mother of Zion," she says later. "My role was to raise up seed to the Lord, and you can see with six kids I was on board with that doctrine!"

Jen was struggling to keep all of her doubts on the shelf. She says she "literally split into two". She was aware of this, but kept it buried for many long years. Yet still it never occurred to Jen that the problem might not be with herself. She thought that she was broken.

For nearly two decades she managed to keep the two sides of her life apart. She became a channel for the souls that she was to bring into the world, and she dutifully raised Mormon children whilst managing a shelf that became ever more precarious. "I now have words for it," Jen says. "The cognitive dissonance was getting unbearable."

In January 2014, experiencing panic attacks and taking medication to get through church, she assumed that "there was something very wrong and broken with me". Part of the control that the church exercises over its adherents is to manage information, and the only place that provides accurate information for the devout is *www.lds.org*, the carefully managed information portal for the faithful. Anywhere else is labelled "anti-Mormon". Yet Jen did what was expressly forbidden and Googled Joseph Smith's plagiarised opus, *The Book of Abraham*.

In a single free-roaming, Friday night internet session,

following links and watching YouTube videos, the weight of doubts on Jen's shelf reached a critical mass and the entire flimsy edifice gave way. Jen now had evidence of the lies of Joseph Smith; she was presented with incontrovertible, objective evidence that the founder of her faith was "full of it".

Standing amidst the wreckage of her shelf, surrounded by doubts that she had put away for twenty years, her mind took the most economical route to explain what had happened: it was all lies. "You could see how it had all been done! All of my issues just dissipated in an instant!"

It was a moment of intense relief, yet Jen immediately began to count the cost of what had just happened to her. It was a bittersweet moment; she was free of contradiction, but she was acutely aware of her friends and family who remained deeply entrenched in the church's monoculture.

Jen turned to the only person she could trust, to Camilo, despite a taboo on injuring the faith of others. If you are in the church you do not share doubts, only certainties.

Camilo has a stronger shelf, and there is no indication that he would have lost his ability to compartmentalise faith and science. He does describe a scratch, a crack or two on his windshield. But Jen had no idea that he held the same doubts. Why should she? She certainly couldn't talk about them.

Cam's doubts were scientific in nature. The Mormon church holds that the first Americans were Hebrew, but Camilo is a doctor, he's steeped in science, he knows genetics, knows the elegant logic of mitochondrial DNA. He knew that the first Americans were Asians, crossing the Bering Land Bridge. He knew, and couldn't account for the fact, that the sacred temple rituals handed to Joseph Smith are actually Masonic in nature, and predate by a long way Smith's revelation. But the mental discipline instilled by the church allowed Camilo to function, more or less, with these contradictions sitting on his shelf, these scratches on his windshield.

Jen, meanwhile, had discovered that it was possible to leave the church. She discovered a website where hundreds of ex-Mormons told their stories. Apostates, the very worst kind of people, people worse than paedophiles, told stories that closely matched her own. She followed those stories, one after the other.

Then, with perfect synchronicity, their daughter came to them in tears. Three days after Jen's collapse of faith, her daughter cried over the church's treatment of gays and lesbians. Having friends directly affected by this prejudice became an issue that affected their daughter personally. Camilo agreeed with his daughter, and now saw that not only his wife, but his daughter was losing her testimony. For a patriarchal religion like Mormonism, this is a reflection on the father. He is a priesthood holder, which is a really big deal, he's a spiritual leader. Camilo had failed as a member of the church in keeping his family's faith strong. He was on the ropes.

The conversation that Jen and Camilo had that night was shattering. Their daughter had gone to bed laden with platitudes, but Jen and Camilo faced a glaring, undeniable question about the direction of their lives. Camilo tried to hold onto past certainties and testimony, but it was far too late for that. Jen told him, shockingly, "Do not quote *The Book of Abraham* at me." She was ahead of Camilo, she knew it was fake.

Camilo was deeply challenged, and rose at two in the morning to commit the same mistake that Jen had committed only days before: he Googled *The Book of Abraham*. Camilo braved himself and researched the archaeological evidence that the church had long claimed substantiated the claims to revelation made by Joseph Smith. With horror Camilo could see where the truth had been hidden, twisted, dodged and buried by his own church. "This sinking feeling came over me and I think, if they are lying to me about this, what else are they lying about?"

It is hard to imagine that night of internet exploration. Camilo knew by that point that if he kept looking, his faith would fail; but if he denied it, if he stopped and went back, what would he tell Jen in the morning? Jen had been right to doubt all along, and he knew this now.

The next morning Camilo didn't want to face Jen. He thought, "How am I going to tell her? Because what comes out of my mouth is going to change our lives.

"So I got up, turned round and said, 'You're right. The church isn't true',and I just walked into the bathroom." And that was it; standing amidst the wreckage of inadequate wall-mounted doubt-storage solutions, Jen and Camilo were on the same page again.

A NAUTICAL METAPHOR

Jen and Camilo's experience in the church, the people they knew personally, was benign in nature. The love, the community, the mutual support that they saw around them maintained a spell over them. Above them, they now realise, exists a level of exploitative and manipulative people who are very clear about what they are doing, and what the human cost is. These people can be tracked through their money, and Camilo says this is a trail that can be followed.

In losing their faith and the prescribed and constricted way of thinking that kept them blind to the ways of the church, they soon began addressing the question of the church's nature as an organisation, and how it operated.

Key to the church's survival is the tithe, and Jen had been paying to the church 10% of every dollar she had made since she was six years old. With the family leaving, the church now faced the loss of 10% of Camilo's doctor's salary. The church would also lose the income from their children as they grew into wage-earners. Small wonder that Apostasy is such a crime.

With such considerations, Jen and Camilo now see the church that nurtured them so convincingly as a corporation, beset by massive croneyism and relentlessly protective of its interests. Camilo came to the realisation that "I have been conned all of my life! These people know they are lying, and they are persecuting the people who are bringing it into the open, and they are doing it for profit."

Camilo lost a friend who died whilst on a mission for the church. It was a horrible accident that happened while they were progressing the church's interests. It seemed like sacrifice whilst Camilo held faith. But now Camilo thought, "How would I feel as a father to know that my son had died for a bunch of lies for a corporation?"

Like many large corporations, its purpose has become simply to perpetuating itself. But it is a church and has, at its core, an irrationality that cannot adapt to changing circumstances. Camilo and Jen outlined a huge effort it made to rationalise *The Book of Mormon* by beginning to teach history at the organisation's flagship, the Brigham Young University. The church filled the course there with indentured, bright, talented Mormon scholars, convinced that the combination of faith and well-funded brilliance would place their sacred text in its proper historical context.

It was a miserable failure. The more people knew about the book, the less historical validity it had. In September 1993 they purged the academics they had sponsored. They excommunicated them en masse for the blasphemy of pointing out that there were no horses or elephants in prehistoric America like *The Book of Mormon* says, nor steel, nor chariots.

The Mormon Temple in Oakland, California; not exactly short of funds.

Camilo suspects that the elders see this mistake and realise that they can't, in the information age, keep repeating lies. He sees their strategy shift away from recruitment to exacting tithes upon the faithful, whom it is hemorrhaging. "The church turned its strategy from baptising people in Africa to really running it like a business, and they started buying farms in Australia and real estate in Florida... So those poor missionaries [that you saw], they just bought the last ticket to the Titanic. They just don't know it yet."

Jen disagrees with how flexible the church can be. She sees it continuing to believe in its central calling as it tries to control its flock, tries to stem the tide. Continuing the doomed Mid-Atlantic theme, she sees the wheel hard over but the iceberg still looming. "It's too late to turn the ship around. It's going to become more cult-like than ever... They'll probably say you can't use Google in any form... I want to have hope that they are not maliciously steering us wrong. I want to have hope that their intentions are good."

Camilo is pragmatic: "This has been going on since the first person made fire and said "It's god!", and got attention and money for it. It's a business, they sell hope."

Cam and Jen argue it out. It speaks volumes that the only hypotheses that these intelligent and informed people can come up with are equally unpalatable. It seems that they spent decades in the thrall of either a cynically manipulative theocracy or a deluded and desperate dictatorship. The jury is still out.

COSTS AND BENEFITS

In the month of the interview the church magazine published an article which, to Jen and Camilo, shows how much they are hurting. The article tells its readers "If you are doubting, if you have questions, you need to repent. Satan has a hold of you." From the outside this is a church trying to control the ability of its flock to think. But Jen knows that her family is still on the inside, and she knows they read this propaganda.

She reads articles like this and knows that this will influence whether or not her family will even talk to her. The people she cares about most in the world see her as an agent of Satan because she has left Mormonism. The church has no qualms about driving a wedge between family members. Where once familial ties were the bait for baptism, those same ties are now the price of apostasy.

It seems like an awful cost. I ask straight out: "So, you are swapping eternal happiness with your family for what? What have you gained?"

Jen answers without hesitation. "Oh my gosh. I gained my mind. I get to think, and that was never a privilege I was ever granted until I was 38 years old. Now I have questions – and I love having questions!... It's not me that's broken any more, it's them!... I can't express the elation, how that felt in those first few days, when I realised that it's not true."

Camilo agrees: "It's sad to know that you are not going to be with your family forever, but then something kicks in... A few days after I leave the church I feel that I am at last at the top of my pyramid. I feel like I am finally at the top of Maslow's hierarchy of needs. I am fulfilling my innate need to self-actualise. I have the right to wonder, I have the right to figure things out."

Jen cries out delightedly: "I Google ten, twenty times

Right: Camilo as a young Missionary in Chile. He now regrets what he did in this part of his life. His mission was to connect with happy families and to convince them that they weren't, in fact, happy. From there he would lead them to baptism into the church. Doing this to people, even as a believer himself, now leads Cam to feelings of anguish, long after the event.
Below: Jen and Camilo at their home in Palmerston North.

a day! Anything I damn well please! We have become fully-fledged skeptics in every sense of the word. I hear something; I Google it. I want to hear both sides of the story!"

Camilo jumps in: "Someone made a statement to me the the other day and I said, 'Show me the evidence!"

One of their first considerations was the health of their children. What would they think? How would they adapt to the change? Jen armed herself for what she thought might be a long battle. She went out and bought *The Magic of Reality* by Richard Dawkins and read it cover to cover. Filling the gaps in their knowledge, and explaining the new world to their children was part of the long and ongoing process of recovery.

Jen had been brought up believing the absolute truth of Joseph Smith's idiosyncratic version of Adam and Eve, which, for example, placed Eden in Jackson County, Missouri.

Jen researched evolution avidly, and once sure of her ground passed this new wisdom on to her children. They too were read *The Magic of Reality* every night.

As it happened, the transition was a lot easier for their children than they had anticipated. Their eldest son had already 'come out' as a rationalist, though he had continued to attend church with them. In her appetite for all things rational, Jen also read *Raising Freethinkers*, and realised that she had, in fact, already done much of the groundwork for the change that had occurred in their lives. She had raised her children to ask questions, to go to Google for answers, and this had happened every day except for Sunday. On Sunday, that enquiring approach was turned off, but in effect Jen found out that it never had been. Her children had a shelf in their heads, for sure. But instead of parking rational doubts there, it seems they patiently parked Mormonism as a side issue. They seemed to have quietly gotten on with being rational beings themselves. She had already raised freethinkers, and they took the change in their lives in their stride.

At Palmerston North Skeptics in the Pub, Jen and Camilo bless the sessions with their presence, where they still bear a strong testimony. But that testimony is now a warning against the dangers of unremitting faith, of the harm caused by the control of inquiring minds, of the hope that reality brings, of the light shone by science.

Jen is active in ex-Mormon groups and in skepticism. Their visas run out soon and they are leaving New Zealand soon to go back to America. They have already contacted skeptics groups in the States, and look forward to their new life. Jen's new testimony, stronger than any she proclaimed for the church, can be found on a blog that includes poetry and thoughts on her journey. Well worth a read at *http://koruvoice.blogspot.co.nz*

Their story should remind us of how much we take for granted, how valuable is our intellectual freedom, and methods by which it can be taken away if we are not watchful.

I drive off into the hot evening, back to my home where my kids, like Jen and Camilo's kids, live happily godless lives. They are so vulnerable, these inquisitive little treasures of ours. ❐

Fluoride and IQ

Anti-fluoride activists often claim community water fluoridation (CWF) depresses IQ. So does fluoride depress IQ? Or is it just another myth?

By Ken Perrott

Anti-fluoride claims are usually presented on social media, submissions to local bodies and magazine articles in forms like:

-The Nazis used fluoridated drinking water in the concentration camps to keep the Jews passive;

-Research shows fluoride decreases the IQ of children; or

-The general claim that fluoride is a neurotoxin.

So let's look at what the science actually says about fluoride and human IQ.

First we need to be clear that there are no scientific studies supporting the claim that CWF is related to decline in IQ. Quite the opposite.

Broadbent et al., (2014) is the only detailed study investigating the relationship between CWF and IQ. They found no statistically significant relationship of IQ to fluoridation so their findings do "not support the assertion that fluoride in the context of CWF programs is neurotoxic."

I recently checked this out for the US using online data for the average IQ level in each US state and the corresponding data for the percentage of CWF in each state (see my blog article *IQ not influenced by water fluoridation*). The graph in Figure 1 shows there is no statistically significant relationship between the two.

IQ was significantly related to other factors like poverty and premature births. These two factors together explained almost 70% of the variation in IQ while CWF explained none of the variation.

Incidentally this is the same method used by Malin and Till (2015) who claimed a relationship between Attention Deficit Hyperactive Disorder (ADHD) and CWF. Anti-fluoride propagandists are currently promoting this paper, although it has basic problems because it ignored the role of confounding factors. When these factors are included in the analysis, there is no statistically significant relationship of ADHD to CWF. See the blog article *ADHD linked to elevation not fluoridation* for details.

There are studies relating IQ deficits to high natural fluoride concentrations in drinking water. Choi et al., (2012) reviewed most of these and their paper is probably the most frequent citation used by anti-fluoride activists. Reliance on this paper has been criticised because the reviewed articles are usually brief and often of poor quality, confounding factors were rarely considered, and the studies were generally made in areas of endemic fluorosis in China. There are also a few reports of IQ deficits in other areas of endemic fluorosis in India and Iran. Natural fluoride concentrations in the water of these areas are usually much higher than used in CWF.

IQ and dental fluorosis

Skeletal and dental fluorosis are common in areas where

fluoride concentration in drinking water is high. I think dental fluorosis could be a factor in the observed deficits of IQ of children living in those areas (Perrott 2015). Severe dental fluorosis, like severe dental decay, has a negative influence on quality of life, and this could result in learning difficulties leading to measured IQ deficits. In a sense dental fluorosis prevalence could be an important confounding factor ignored by researchers concentrating on a simply chemical toxicity hypothesis.

Unfortunately most studies of IQ deficits in areas of endemic fluorosis have concentrated on a chemical toxicity hypothesis. They have therefore measured drinking water fluoride concentrations but few studies have determined dental fluorosis prevalence. However, Choi et al., (2015) did find a relationship of cognitive deficits to severe dental fluorosis, although there was no statistically significant relationship with drinking water fluoride. Sudhir et al (2009) also reported that IQ grades of 13-15 year old children were lower in children with moderate or severe dental fluorosis (Figure 2).

It is worth considering dental fluorosis in more detail, especially the different forms found in areas where CWF is used and in areas of endemic fluorosis.

Figure 1

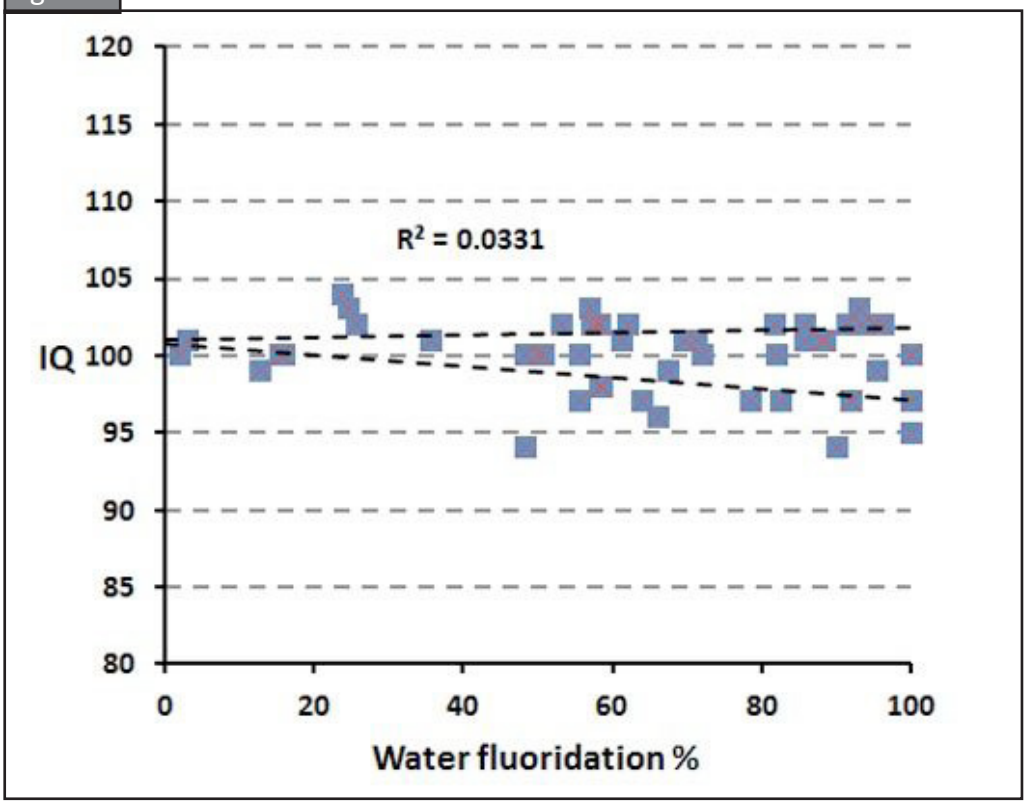
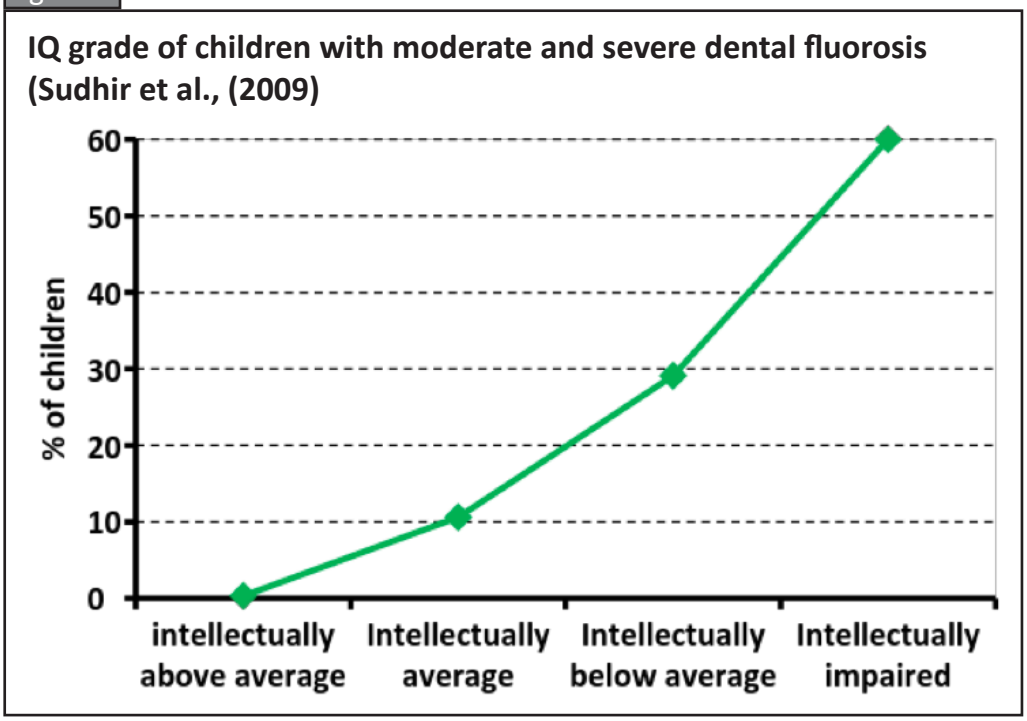


Figure 2



Dental fluorosis

Dental fluorosis is an imperfection in teeth resulting from excessive dietary intake of fluoride. It occurs in different degrees of severity, and mild or very mild fluorosis is the only confirmed negative effect of community water fluoridation.

Dental fluorosis occurrence has been used to define the upper limit of fluoride concentration for CWF. Severe dental fluorosis only occurs where drinking water concentration is higher than 2ppmF (National Research Council, 2006). In New Zealand F concentrations are adjusted to ensure F concentrations are in the range 0.7-1ppmF.

The *NZ 2009 Oral Health Survey* (Ministry of Health, 2010) provides dental fluorosis data for New Zealand. The graph shows the frequency of the different forms of dental fluorosis reported. The distribution is very similar to that for the US (Figure 3).

Although the Ministry of Health data does

not show any difference between fluoridated areas and unfluoridated areas, more detailed studies usually show a small increase in the mild forms of dental fluorosis where water is fluoridated. Importantly, water fluoridation has no effect on the medium and severe forms of fluorosis. The prevalence of medium and severe forms of dental fluorosis is very low in countries where CWF is used and is probably due to industrial contamination, local high levels of natural fluoride or excess consumption of fluoridated toothpaste.

Perception of the different forms of dental fluorosis is also important. People usually judge mild and very mild forms of dental fluorosis positively so they have a positive effect on their quality of life. In contrast people judge moderate and severe forms of dental fluorosis negatively so these have a negative effect on the person's quality of life. As I mentioned above, moderate and severe forms of dental fluorosis could possibly contribute to IQ deficits in children.

Figure 4 compares the prevalence of the different forms of dental fluorosis in New Zealand and the USA (where CWF is common) with that in an area of endemic fluorosis in China where IQ deficits have been found. I have combined the milder forms together to contrast them with the moderate and severe forms (also combined) because of their different perception and influence on quality of life. There is a big difference and this underlines why we should not naively extrapolate from studies in areas of endemic fluorosis to areas like New Zealand and the United States.

Figure 3

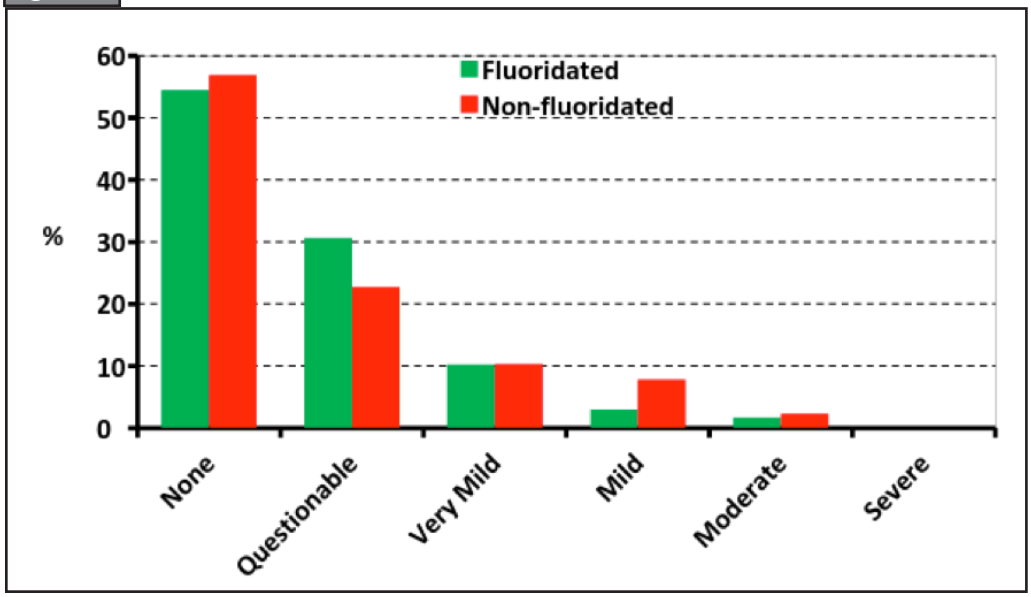
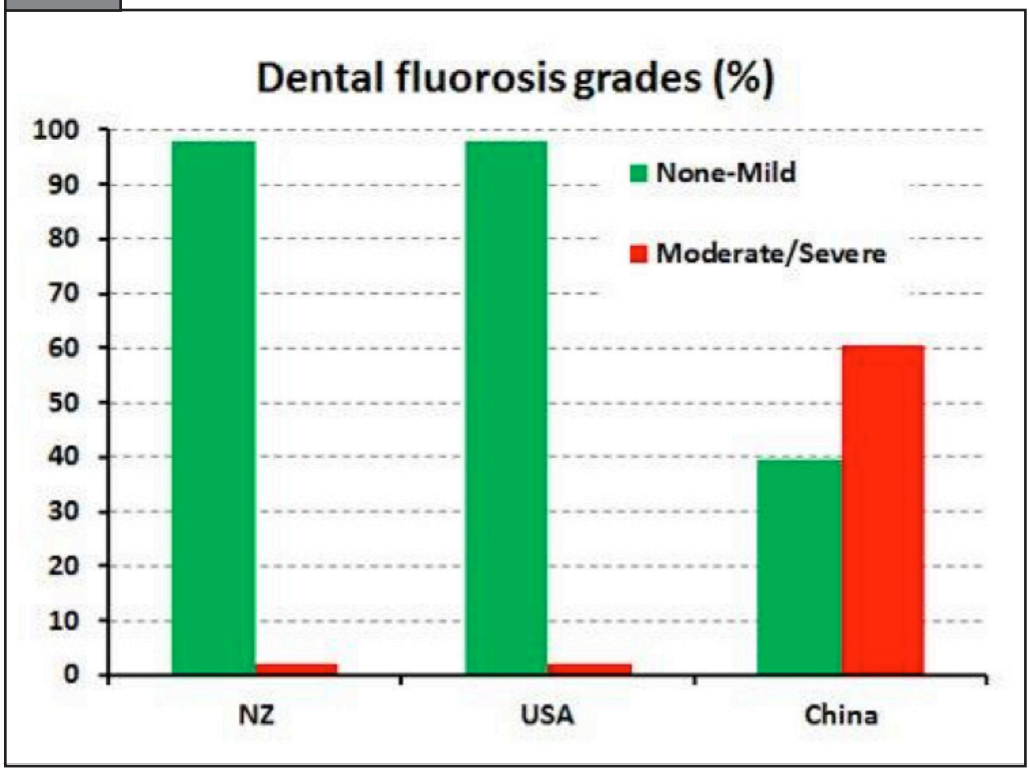


Figure 4



Conclusions

Anti-fluoride activists most frequently cite Choi et al., (2012) as "proof" that fluoride causes IQ deficits in children. They will often give it special endorsement by presenting this as a claim that Harvard University has proven that CWF lowers IQ. Of course, institutions prove nothing, and this endorsement is false considering that the deans of the Harvard Medical School, Harvard School of Dental Medicine and Harvard School of Public Health have declared their support for CWF "as an effective and safe public health measure for people of all ages" (Flier et al., 2013).

But the Choi et al., (2012) study is not directly relevant to CWF because it refers to studies in areas of endemic fluorosis where drinking water fluoride concentrations are high. These studies only considered a chemical toxicity hypothesis and did not take confounding factors into account.

Grandjean & Landrigen (2014) are also often

quoted by activists as "proof" that fluoride is a neurotoxin (or more correctly a neurotoxicant). Again to give it special endorsement it is often presented in the form of the claim that the "world's most prestigious medical journal" (*The Lancet*) has officially declared that fluoride is a neurotoxin. Again, a scientific journal cannot officially make such a declaration.

But the only evidence quoted by Grandjean & Landrigen (2014) is the paper of Choi et al., (2012). When we realise that Grandjean himself was one of the co-authors of the Choi et al., paper these citations start to look a bit incestuous.

These studies only considered a chemical toxicity mechanism and did not look at other possible mechanisms like the physical effects of severe dental fluorosis on the individual and their development. So far the only study which has looked at community water fluoridation as a possible factor in IQ is that of Broadbent et al., (2014). They found no statistically significant effect of CWF on IQ. My analysis of the percentage of CWF and average IQ in the 50 US states plus DC supports that conclusion. ❐

From the Vault

New Zealand Skeptic Winter Issue 2001

How many times in the last month were you conned or approached by a con? Maybe this con took the form of a weight loss product described in an ad in the newspaper. Perhaps it was a too-good-to-be-true TV infomercial that claimed to be backed by science. Or maybe it was a testimonial from a friend.

Even if you didn't take the bait, it seems that the more often you hear or see something that isn't true, the more likely you are to believe it eventually. This is especially so when claims are partial truths couched in scientific jargon.

The Internet is loaded with this type of misinformation. In just a matter of days, contemporary urban legends and outright hoaxes are broadcast all over the world.

These legends are part of a type of folklore that claims to be true. They may be harmless, containing stories that describe humorous scenarios, but many report terrifying happenings.

Many of these hoaxes are broadcast over email among friends and acquaintances. They frequently have a sinister or threatening side to them. You want to pass on this information to those you care about. Of course, these things always happened to someone other than the concerned friend passing it along.

Food is the topic of many hoaxes. Here are a few we've come across the last month:

"Costa Rica bananas have been infected with a flesh-eating bacteria. The FDA has been reluctant to issue a country-wide warning because of fear of a nationwide panic."

This is completely untrue as is indicated on the Center for Disease Control Website: *cdc.gov/ncidod/banana.htm*.

"Aspartame is the cause of lupus, multiple sclerosis, memory loss, Desert Storm health problems, and obesity."

These claims, said to have been presented at a Conference of the American College of Physicians, are untrue. There are hundreds of websites on this topic, making it nearly impossible to discern fact from fiction. The most reliable source we could find was Arnold Dias, a respected investigative reporter who actually contacted all of the claimed sources.

"The Mayo Clinic has a weight reducing diet that has been formulated to alter your metabolism so that you literally burn fat. You can lose 20 pounds of fat in two weeks."

Untrue. The fact that there is no Mayo Clinic Diet is indicated on the Mayo Clinic Website (mayohealth.org/mayo/9806/htm/mayodiet.htm).

This legend has been around for decades. The most common version is a very low calorie diet which contains lots of grapefruit, eggs, meat, fish, chicken, spinach, tomatoes, celery and carrots. You will lose weight quickly but most of it is water and muscle, not fat.

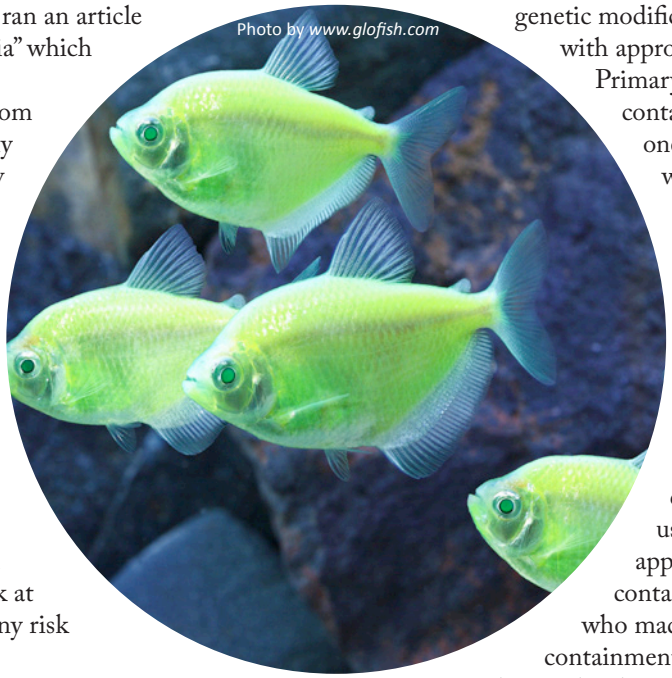
Today, we encounter tremendous amounts of information. Because of the difficulty in discerning fact from fiction among the info overload, there is a strong human tendency to just believe what sounds good.

The next time that you think you're not being given the straight scoop or maybe just want some entertainment, check out *urbanlegends.about.com*, a website dedicated to clearing up hoaxes. ❐

Dr. Siouxsie Wiles describes herself as a microbiologist and bioluminescence enthusiast but to others she is "the owner of the pinkest head of hair you'll ever see". Siouxsie heads the Bioluminescent Superbugs Group at the University of Auckland where she combines her twin passions to understand and combat infectious diseases.
Read her blog *Infectious Thoughts* at *sciblogs.co.nz/infectious-thoughts/*

'Illegal' School Science Kits

The Dominion Post recently ran an article about "Glowing GE bacteria" which were "produced illegally in New Zealand using mail-order kits from America". Perhaps unsurprisingly given that the phrase 'genetically engineered' was mentioned, Green MP Stefan Browning and GE Free New Zealand spokesperson Jon Carapiet chimed in to share their dismay that people/kids were fiddling with complex natural systems and things that posed a threat to our GE-free status (which we aren't). I'm paraphrasing here, but I think that was the sum of it. The usual GE = evil sort of stuff. Let's look at what happened and if it posed any risk to anyone.



Who made what and why was it illegal?

A global biotech company originally founded in the USA, and which makes lots of laboratory reagents scientists like me commonly use, make a kit for school kids to teach them about genes. The kit includes a piece of DNA called a plasmid*, and a harmless strain of the bacterium E. coli. Heat the bacteria up a little and they will take up the plasmid DNA, technically creating a genetically engineered strain of E. coli.

In this case, the plasmid carries the gene for an amazing jellyfish protein called Green Fluorescent Protein (GFP). When you shine light of a particular wavelength at GFP, it emits a beautiful green light. So once the E. coli have the plasmid and the GFP gene is turned on, the bacteria glow green.

So it turns out that two educational facilities in NZ imported the kits from the USA (which is allowed) and then presumably used them to teach people (presumably kids or undergraduates?) how bacteria can be manipulated to express different genes, and how genes can be turned on and off. The problem is that in NZ, thanks to the Hazardous Substances and New Organisms Act**, such genetic modification can only be done with approval from the Ministry for Primary Industries and in suitable containment facilities, like the one I work in. Because this is what my team and I do for a living. We use genes from other glowing creatures like fireflies, only we put them into nasty bacteria, not harmless strains of E. coli. And we have all the relevant paperwork. Reams and reams of it.

My guess is that in this case, the kit was perhaps used without the proper approvals, or outside of a proper containment lab, or someone who made the modified bacteria in a containment lab thought it was so cool they took it home. Any of those scenarios would be illegal. But let's be clear. The bacteria 'created' is harmless and highly unlikely to pose any threat to NZ's environment. In the USA (with the exception of California, I'm told, who are as hysterical about genetic engineering as NZ), you can buy pet fish which express GFP and other fluorescent proteins. They are beautiful.

NZ needs to have a rational discussion about genetic engineering

All around the world, the evidence shows that genetic engineering as a technique is safe. The hysteria and fear-mongering of people like Browning and Carapiet isn't helpful. NZ needs to have a rational discussion about the technology. If we decide to be GE free, it won't be because the science is dangerous. It isn't. It'll be so that we can appeal to markets that want GE free products. That's economics.

New Zealand's ludicrous New Organism designation

As a final comment, the Act's definition of a New Organism is problematic, especially for microbiologists. Here's the definition:

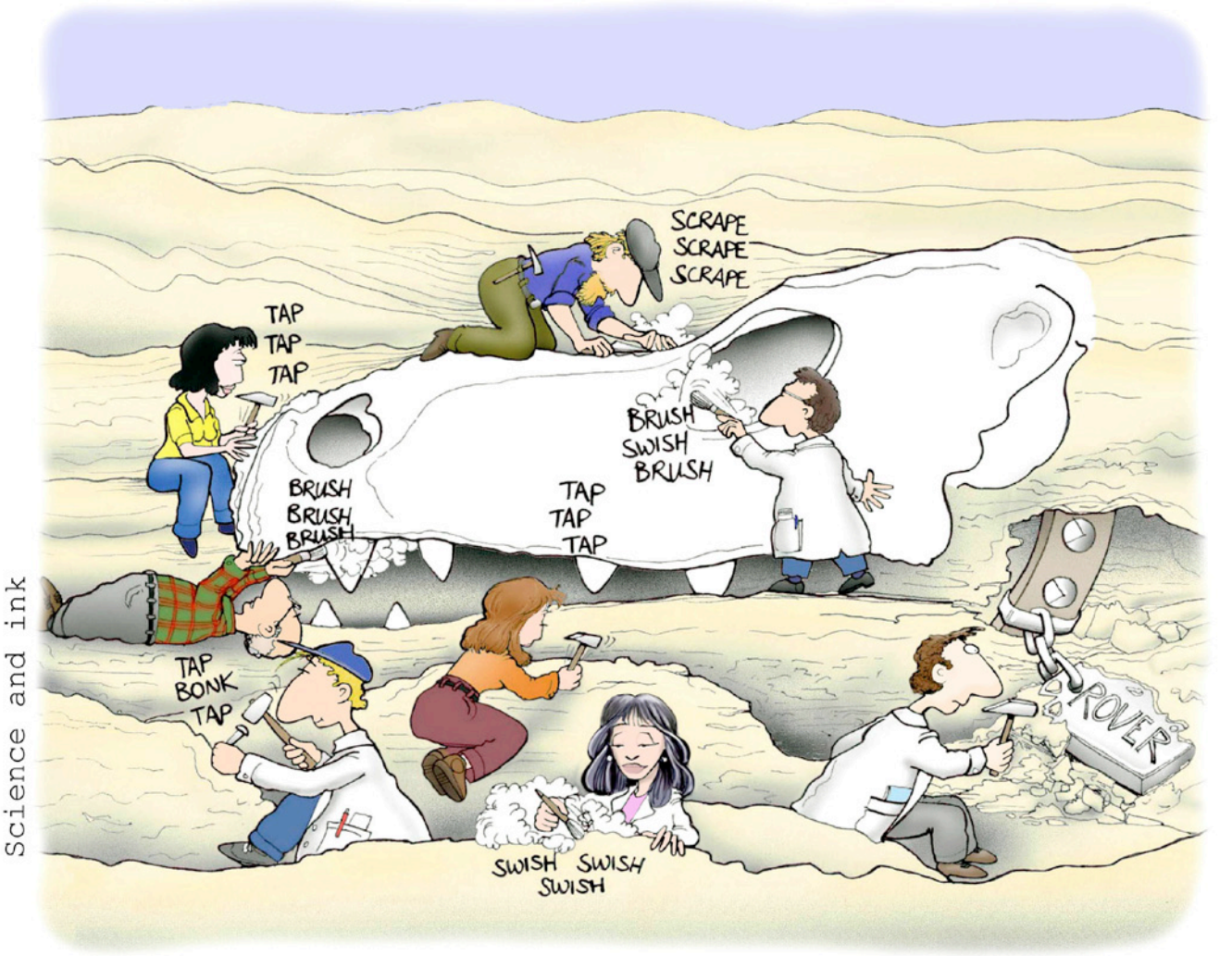
A new organism is—
- a) an organism belonging to a species that was not present in New Zealand immediately before 29 July 1998:
- b) an organism belonging to a species, subspecies, infrasubspecies, variety, strain, or cultivar prescribed as a risk species, where that organism was not present in New Zealand at the time of promulgation of the relevant regulation:
- c) an organism for which a containment approval has been given under this Act:
  - a) an organism for which a conditional release approval has been given:
  - b) a qualifying organism approved for release with controls:
- d) a genetically modified organism:
- e) an organism that belongs to a species, subspecies, infrasubspecies, variety, strain, or cultivar that has been eradicated from New Zealand.

Read part (a) again. If an organism is not on any database or listed in a paper as showing it was present in NZ before 29 July 1998, it's considered a new organism. I'm told the first time NZ researchers sequenced the gut microbiome of a person in NZ, they came across a whole heap of microbes that according to the law didn't exist in NZ. Seriously. The flip side to this, of course, is that each time anyone comes here from overseas, be it a holiday-maker or NZ resident returning from a trip, they are likely bringing in a whole heap of new (micro)organisms in or on their person. And there's not much the government can do about that! ❐

**A plasmid is a piece of DNA that exists outside of an organisms chromosome and can replicate itself independently. The wikipedia page for plasmids uses a nice analogy – think of the chromosome of the organism as its hard drive; a plasmid is like a USB drive that contains extra information.*

***According to the Hazardous Substances and New Organisms Act, its purpose is "to protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms".*

Cartoon by Nick Kim



Alison Campbell has expertise in the disparate fields of animal behaviour and science education, with a particular interest in students' understanding of the language of science; gaps in student knowledge (and how to bridge them); and attitudes to the theory of evolution.
Read her *BioBlog* at sci.waikato.ac.nz/bioblog/

Slugs and snails and ... facials?

Sunday 26 April's Life/Style section in the *NZ Herald* (see *Newsfront* p6) brings us the latest 'beauty trend' to hit our shores: the snail facial.

Yes, you read that correctly. Apparently one can (if one has a sufficiency of funds) already purchase Snail Soap, which contains "snail slime, virgin olive oil, honey and extracts from medicinal plants". The slime component supposedly helps 'beat' wrinkles (what's wrong with a bit of character?) & reduces scarring. We're told that "No one has come back and said it is rubbish or doesn't work," but then, it might be a tad embarassing to have to 'fess up to spending $25/bar on soap that didn't meet one's expectations.

Apparently the next contribution gastropods have to make to our outer beauty is the snail facial: snails crawl about over your face, leaving their silvery mucus trails behind them. This probably does leave your face feeling a bit tighter, when the trails dry. But saying that "snail facials are believed to be very good" may well be an example of wishful thinking, especially in the absence of supporting data.

Snail slime does contain lectins, which are a class of glycoprotein; the amount and type of this substance vary with the species of snail. (Many years ago now, my Significant Other used to go out collecting them on dewy mornings, so that the lectin could be extracted and analysed.)

It also contains other proteins such as collagen & elastin, which probably comes in helpful for the slug species that indulge in balletic aerial sex at the end of a mucous bungee cord.

But as far as I can see the claims that smearing one's face with this slimy mix will encourage skin cells to make more of these proteins lack support. And indeed, quite why putting protein molecules (which are highly unlikely to be absorbed through your skin) on the dead outer surface of your skin would encourage the cells beneath to spring into activity, is not immediately clear.

Lectins are 'sticky' molecules produced by plants (and algae), animals, fungi and prokaryotes, and are involved in communication between cells, defence against pathogens, fertilisation, metastasis of tumours, and appear to generate an inflammatory response (something that's picked up on by various 'alt.health' sites such as *mercola.com*). Those from snail slime may have anti-microbial activity, but in absence of actual infection that would not be a burning reason to use it on one's face. And indeed, I think there's need for caution in their use, as it seems that bacteria such as E.coli can survive for quite some time in snail faeces. I'd certainly want to be sure that the snails had been kept long enough to evacuate their bowels prior to crawling over my skin! ❐

Podcast Review:

Hosted by Fraser Cain of *AstronomyCast,* this hour long magazine-style show takes listeners through the previous week's space news. Each episode has an assortment of guests who take it in turns to present, each with their own topic, and with Fraser asking the questions and expanding the stories. Each week a cast of regular voices tend to appear, and there's a wider community of more infrequent guests.

Weekly Space Hangout is available to download as either an audio or a video recording. The recordings are from a Google Hangout session. It is possible to get involved with these hangouts: you can watch them live and ask questions or suggest topics. This review is of the audio podcast.

Because the podcast is a recording of a live video session, rather than an edited podcast, the show has a rambling, somewhat unpolished quality. This annoyed me at first, but now I find it charming and refreshing; you don't have to listen to a prerecorded introduction or any ads. It gives the impression of listening-in on the private chat of a few space nerds. Particularly amusing is waiting for Fraser Cain's voice to kick in at the start of the show, "alll-riighhht…".

The show does an amazing job of bringing to the foreground stories that don't make the headlines. If you're interested in the harder science stories or the more incremental developments in space technology, this is a good place to get a weekly rundown. The show also discusses stories that do make the headlines, and the guests discuss how well the mainstream media dealt with the stories.

Fraser has an affable, enthusiastic, skeptical, distinctly Canadian, voice and presence. Entertainingly, he isn't afraid to speculate about all sorts of ventures for the future of space, astronomy and human exploration. But, like the best speculation, it is done with a healthy dollop of skepticism.

Weekly Space Hangout is a fun, informative show. If you're a space nerd or would like to be, you owe it yourself to give it a go. **Highly recommended. 5 out of 5.**

Subscribe to the show in iTunes or through any other podcatching software. Watch the show live on Google+.

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It's natural to think that living things must be the handiwork of a designer. But it was also natural to think that the sun went around the earth. Overcoming naive impressions to figure out how things really work is one of humanity's highest callings.

-Steven Pinker,
Can You Believe in God and Evolution?
Time Magazine, August 7 2005

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