Editorial

Controversy is not a subject we often deal with in *SHALE*; it is after all the journal of the museum, and museums are not noted for being outspoken on contentious matters. Controversies however abound in Gabriola's history, and they are, of course, endemic in all communities. It appears to me though, looking back over the past hundred and fifty years of Gabriola's history, that polarized controversy may be more common in smaller communities than it is in larger ones. We can speculate that in larger communities, "dilution" may occur because several controversies are usually going on at the same time, and it is rare that everyone is going to be impacted so personally by the outcome of whatever is in dispute.

Although controversies are an important part of our history, writing about them from a dispassionate, "big-picture" perspective is not easy—believe me. This is because some are either still on-going, or because they have their roots in conflicting values, priorities, and interests that haven't changed much with the passage of time.

All three articles in this issue deal in some sense with controversies, albeit by island standards rather mild ones.

Two of the articles, one on climate change, and one on electromagnetic radiation and health, draw attention—though that is not their main intent—to the controversy that often exists these days between what scientists say appears to be true based on their observations, and what the general populace thinks is true, or "ought" to be true, based only on anecdotal evidence and what, for want of a better word, I'll call "gut-feeling". I must avoid using the word "belief" here because that word's meaning in this context is ambiguous.

The third article, which discusses the causes of salt-weathering of sandstone, concerns controversy of a different nature. The cause of salt-weathering or honeycombing is not well understood, and there is consequently controversy among geologists with differing opinions. This kind of controversy is, I hope, dealt with here in the usual commendable dialectic fashion.

Going back however to the first two articles, what's interesting, even wryly amusing to me, is that from the perspective of some concerned non-scientists, the scientific consensus on climate change appears to be a "truth" to be taken very seriously; yet, from all I've read, the scientific consensus on the lack of danger in low levels of electromagnetic radiation appears to some of these same non-scientists to be "downright lies". Yet the scientific evidence on which the two scientific consensuses are based seem equally strong (or weak), and equally not that easy to interpret, certainly not when forced into a "sound bite" format, or used in the all-too-familiar eristical style of debate where the aim is not discovery, but victory.

I'll address the electromagnetic radiation controversy, but either would do for present purposes.

The "facts"

Most of the "raw material"—primary sources if you will—for a discussion on bioelectromagnetic effects is in the form of peer-reviewed articles published in scientific journals. The process of peer review, as Wikipedia has it, "…prevents the dissemination of irrelevant findings, unwarranted claims, unacceptable interpretations, and personal views; and it filters out obvious mistakes and incompetence, as well as plagiarism…. Publications that have not undergone peer review are likely to be regarded with suspicion by scholars and professionals."

Peer review runs the obvious danger of serving to preserve an "establishment" view, and as anyone who has ever tried to publish an academic paper will know, gaining credibility is, for a newcomer, never anything but an uphill task. However, while there may be good examples from the past of controversial ideas being delayed by the inherent inertia of an established elite, there are so many alternative ways to being published these days, it is well nigh impossible to stifle dissent,[1] so much so that it's also becoming increasingly difficult to quell the rapid spread of misinformation, absurdities,[2] and paranoia.

Conspiracy theory and suspicions about the motives of those with a stake[3] in the outcome of research into the debate over the health implications of exposure to electromagnetic radiation have a place, but not to the point where they unsavourily denigrate, without evidence, the motives of well-meaning professionals who actually do the scientific research with results that some people don't like. I know because I have worked in both the telecommunications and electrical supply industry and the people I know of who worked in these areas were as conscientiously concerned about people's health and well-being as anyone. It's not their fault that the research doesn't turn out the way some people think it should.

Most of us don't have access to the primary sources. If you're not a student or an academic or professional employee, you usually have to pay for access to scientific journals on the Internet, and few of us are going to be able to read, understand, and analyze a paper with a title such as, *Residential magnetic fields, light-at-night, and nocturnal urinary 6-sulfatoxymelatonin concentration in women*. Practically all of us have to rely on interpretations of such work by experts, and as such, on secondary opinions, and secondary opinions of secondary opinions, and so on.

Herein then lies the first bone of contention. These days, the biggest publisher of opinions and articles that have not been peer reviewed is probably the Internet, so anyone relying on the Internet for their sources is very likely to run into trouble with "experts". The boilerplate reply of Health Canada, for example, to anyone citing articles and information that has not been peer reviewed, and is therefore in their view "flakey" is:

> All studies, including recent ones, are reviewed by Health Canada scientific staff either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance.
>
> A weight-of-evidence approach is employed when assessing the possible health risks of electromagnetic fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or no

[1] There is some evidence that editors of leading scientific journals, with an eye to keeping their readership up, are slightly biased in their selections of papers to be published in favour of articles that include dramatic or important results. This has resulted in an equally slight, but measurable bias toward the publishing of research that later turns out to be false. The truth is sometimes dull. Prestigious scientific journals, particularly medical journals, are also very slow to retract articles that later evidence shows ought not to have been published because of fraudulent presentation of the data or severe conflicts of the authors' interests. One can only assume that this is because retractions show the peer-review process the journal is using is not perfect.

[2] For example, while one is quite free to imagine that human beings are surrounded by an electromagnetic "aura" that is linked to one's health, asserting that this is a "proven scientific fact" is a lie. There's no scientific evidence that auras exist.

[3] Power utilities and the telecommunications industry have an obvious vested interest, but so do businesses selling "health" products. The Breakspear Hospital, in the UK, which advertises itself as the world's leading facility for the treatment of electrosensitivity is an example.

effect), but also the quality of those studies. Poorly conducted studies, for example, with incomplete dosimetry or inadequate controls, receive relatively little weight, while properly conducted studies with all controls included, appropriate statistics used, and complete dosimetry data provided, will receive more weight.

There are numerous scientific flaws with the studies you referenced; therefore these studies carry little weight in the risk assessment process.

Disagreements over the merits of various sources of data are not confined to non-scientists. In its response to the BioIniative Report 2007 written by an international working group of scientists, researchers and public health policy professionals, the Danish National Board of Health said:

The BioInitiative report (a) does not provide any reason to change…and (b) does not include new data and has not taken the scientific quality of the cited reports into consideration in the way that is customary.

Other government institutions saying the same thing included those from Germany, the Netherlands, and Australia.

Another aspect of the scientific method that applies particularly to studies involving living animals, including humans, is that the results of a single study should only be accepted with caution. Unlike in most physics experiments, there are just too many uncontrollable variables in the biochemistry of living creatures to be sure that all have been accounted for. Repetition and verification by other researchers is the required standard scientific method of establishing the reliability of data.

But what then are you going to do if say, one study says an adverse effect on health exists and two other studies don't? Some will say that's enough to prove there definitely is a link; others that the preponderance of evidence shows that there likely is not. All you can really say, assuming all three studies are of equal merit, is that there are unknown factors involved. If the authors of the studies can't resolve differences, then, without more input, probably no one can.

More facts?

Numerous studies have shown that where intense public controversy exists and polarization has set in, additional information alone will seldom cause people to change their minds. Opinions may even take on the nature of quasi-religious beliefs. People are far more willing to read accounts that accord with their own beliefs than those that don't.

If you happen to "believe" that all electromagnetic radiation is very dangerous, try reading, if you haven't already, some of the WHO Information Sheets (left); and if instead, you happen to "believe" that it's "all a fuss about nothing", try reading the BioInitiatives 2007 Report (right).

"The main effect of radiofrequency electromagnetic fields is heating of body tissues. Despite extensive research, to date <u>there is no evidence to conclude that exposure to low level electromagnetic fields is harmful</u> to human health."	"In the last few decades, it has been established <u>beyond any reasonable doubt</u> that bioeffects and adverse health effects occur at low levels of RF and ELF exposure. <u>Some effects are shown to occur at several hundred thousand times below the existing public safety limits</u> where heating is an impossibility."

Whichever you read, if you read more of the source materials, my betting is that within a few minutes you will begin to feel quite uncomfortable.

I would contend this happens in science too. In my own experience, when I'm investigating some geological mystery, I first form a hypothesis in the time-honoured way, and then set out, by literature searches, observation, and experiment, to show that I am right. Notice I said, "to show that I am right". That's where the focus is because at this point in the process, it is what I "believe". Despite the ideals of the scientific method, the reality is that I don't set out to prove myself wrong. I don't want to read about observations that conflict with my ideas. For me, proving my ideas are wrong is essentially a process of failing to prove to my own satisfaction that they are right.

Science is, of course, generous; it allows you, even encourages you, to change your mind—abandon beliefs—and move on in the face of new evidence, but if you insist on interminably ignoring contrary evidence, as some pseudoscientists do,[4] there comes a point when continuing to try to have a rational discussion is futile.[5]

[4] The practioners of pseudoscience may be guilty of any number of failures (Wikipedia is good on this topic) including using scientific language and jargon in a meaningless way; selecting results that support their claims while ignoring those that don't; making false appeals to authority by an unbalanced selection of references; failing to keep up-to-date; failing to discard evidence shown to be false; personalizing issues; using alarmist and emotive language; providing misleading information; over-relying on anecdotal evidence; over-using holism as a reason for negative findings; using complicated explanations when simple ones will do; asserting scientific claims that are too vague to be tested; failing to provide additional evidence to support their claims as time passes; and using the results of experiments that investigations have shown were flawed.

[5] In the scientific world, the subject ceases to attract attention. I am reminded of the long debate among astronomers as to whether there was a "big-bang" or whether the Universe was in a "steady state". Fred Hoyle, with great ingenuity, kept up his arguments in favour of the "steady-state" hypothesis for years.

Polarization

This is not the place for a full discussion of the nature of a controversy that has evolved into a polarized political controversy; however, to say nothing here is to miss the point I'm delicately trying to make. Polarized controversy is an effect that has, at times, been sharply felt in the small community that is ours with its well-defined geographical boundary. It really is a pity that those in the midst of such controversies appear not to have had any great understanding or awareness of the polarization process. The author of the following quote was addressing the question of why nation states in the modern world go to war, but rather startlingly, I think, it could also apply to some of the events in a teacup (relatively speaking) that we are familiar with. Polarization is…

> …the process that causes neutral parties to take sides in a conflict. It also causes individuals on either side of the conflict to take increasingly extreme positions that are more and more opposed to each other. As parties move toward these opposite "poles", they define themselves in terms of their opposition to a common enemy. Trust and respect diminish, and distorted perceptions and simplified stereotypes emerge. Parties assume more rigid positions and may refuse to negotiate.
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> Polarization is caused by a number of related psychological, sociological, and political processes. It is closely tied up with escalation in a bi-directional relationship. Polarization causes escalation and escalation causes polarization.
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> As a polarized conflict escalates, the emergence of enemy images and stereotypes damages the relationship between adversaries. Important lines of communication and interaction that are normal to peaceful relationships are cut off, and trust diminishes. As parties begin to attribute their grievances to the other side, they often reduce the number of non-

> conflictual relations and interactions that they have with that party. Adversaries tend to become increasingly isolated from each other and because parties have fewer ties to individuals from the other group, they may feel freer to employ more severe actions against that group. As more people are drawn into the conflict, that conflict intensifies.
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> Conversely, escalation seems to increase polarization. Formerly neutral parties are pulled to one side or the other, and fewer community members can retain their moderate positions. In part, this is because those involved in the conflict demand that neutral non-participants decide whether they are "with us or against us". Those who would normally urge moderation and attempt to mediate the conflict are recruited by participants in the controversy, and forced to take sides. It is difficult for community members to remain neutral when people are fighting, damaging each other's property, and injuring each other. In such situations, there is a tendency to cast blame and to side with one party or the other.

The media

One of the accusations frequently levelled against the media is that they don't deal with controversy fairly. In interesting contrast to the unanimous opinion in the scientific literature that there is little or no evidence that low-level exposure to electromagnetic radiation is dangerous, one report I read, I think from the UK, says seventy-nine per cent of the reports in the media on this topic alleged adverse health effects from mobile phones and base stations, whereas only nine per cent concluded that there was too little rigorous scientific evidence to arrive at any definitive conclusion.

Curious about the question of balance on the Internet, I recently used a simple neutral Google request for information about health and electromagnetic radiation and looked at the responses, ignoring as best I could the many duplicates.

Over fifty-five per cent stated categorical that electromagnetic radiation at currently permitted levels was a proven health hazard. The sites often used alarmist and emotive language in making this point, and they made no mention at all of the current scientific understanding that this is not so. Only forty-five per cent, regardless of which side of the issue they favoured, mentioned that information is incomplete and that there was disagreement among experts.

Requiring the media to "strike a balance" is however not quite as easy as it sounds. Even people with a poor science education are allowed to express an opinion when their health is involved; and experts are sometimes overconfident in the exactness of their estimates, and put too much stock in small samples of data. And is the required balance to be struck by the number of people on each side, or by the intensity with which they promulgate and defend their views?

Doesn't it make sense for a newspaper that has to be commercially successful to give more weight to the opinions of the majority of its readers, given that people in a midst of a controversy prefer to read articles and letters that are sympathetic to their own position? The peer-reviewed scientific press largely avoids such dilemmas by requiring that individual articles, in their obligatory literature reviews, acknowledge controversy where controversy exists.

It seems to me that the very worst thing that can happen in the midst of a polarized controversy is for a publication or media outlet, on which people rely for information, itself to become polarized. *SHALE* plays a very minor role in this, but nevertheless will always try to avoid that. But when beliefs clash with observed facts, the prevailing perception of some people may be that we aren't trying hard enough. All we can do is state our case and agree that we disagree. ◊