

Using these methods, studies can be carried out that have a scientific significance and could be carried out by clubs of citizens who are interested in improving community health.

The Safety of Boron in Human Studies

This is just one substance that lends itself to this testing. In the EU there are attempts by the pharmaceutical industries to demonize boron by claiming it is mutagenic. However, the evidence is based on adding boron to tissue cultures and observing DNA damage. Such research was discredited in the late 1960s when it was used initially to scare people away from LSD by claiming it caused chromosome damage in 1968! The next year it was discovered that any substance causes DNA damage when added to tissue cultures. The 2015 Nobel Prize on the DNA repair mechanism of all organisms shows why no DNA errors are found in actual organisms. Boron is regarded as perfectly safe in North America, where it has been used as a laundry brightener for several hundred years without any noticeable negative health effects.

In addition to treating arthritis, there is research showing boron prevents cancer. That is another study that could be carried out on boron using a similar approach.

Radiation Hormesis in a Citizen Science Double Blind Study

I run the website at <http://radiation-hormesis.com> where researchers donate articles of interest. There is a research library, which offers many papers on the benefits of low dose nuclear radiation. A Canadian medical journal speaks of this alternative treatment for cancer through boosting the DNA repair rate by low dose exposure: <http://www.scirp.org/journal/PaperInformation.aspx?PaperID=58005>

Uranium glass beads (2%) can be purchased easily online from multiple sources. They have been popular since the mid-1800s since they glow under UV light. Hippies wore them in the 1960s. Because the levels of radioactivity from uranium glass are

so low, there are no regulations on uranium glass beads worldwide of any kind.

There are no ethical issues about wearing them since the radiation levels are so low (less than 10 microsieverts/hour). This is high enough to boost immunity to colds and flu. A double blind study would be very easy. Supply the subjects with beads that are in the form of a necklace near the thymus gland. Half of the necklaces would have ordinary beads and half would be supplied with uranium glass beads. A study lasting for a year would be done using “survey monkey” to compile the results using a similar method as is described above.

This is an interesting issue because I know a researcher from a Canadian university who was not allowed to do a similar study because the ethics committee believed in the danger of low dose radiation whereas we now know, due to the Nobel Prize of 2015 in chemistry, that the DNA repair mechanism makes this work completely safe. The ethics committee at the university was made up of old-timers who believed that the tiniest dose of radiation was carcinogenic. Yet the same study run by an amateur science group would have no ethics issues at all.

Please feel free to comment on these ideas at bodyworksvictoria@gmail.com



How do you get citizen scientists to dive with sharks?

Michael Bear

Given the current level of Galeophobia, or fear of sharks, that’s an excellent question. Most people will leave the water immediately if they think a shark is in the area. Oddly, the greatest number of those who fear sharks seem to come from those who rarely, if ever, go into the ocean—so, clearly, this is a primal fear, much like snakes or spiders.

Enter the average scuba diver. Our experience at Ocean Sanctuaries suggests that many (but not all)

divers have great respect for these apex predators and—ready for this?—Can't wait to dive with them. They engender such awe and fear, that merely being in the vicinity of a shark is an adrenaline rush for many divers, to say nothing of the 'fish tales', which will be told later.

But, what about collecting scientific data on sharks? Again, our experience has been that there is a sub-group of 'self-selecting,' highly motivated divers, who are eager to get close enough to a shark to photograph it. In fact, they don't need to be asked twice.

Now, what about the ethics and the inherent liability involved in asking people to dive with sharks? What happens when you ask citizen science divers to get close enough to sharks to photograph one?

First Encounter

My first encounter with a large shark came in the summer of 2009 while diving with a buddy off La Jolla. He and I were swimming about 6 feet apart, in a wide-open kelp forest, busily photographing things below us, when suddenly a large shadow appeared between us—we looked over in astonishment, to see a very large, 9–10 ft. Sevengill shark calmly and majestically swims between us—as if we were not even there. He was clearly unafraid of two humans down there in his domain—he was making it equally clear who the apex predator was—and it wasn't us. After we recovered from our shock at having this huge animal glide gracefully between us, we rushed back onto the boat, babbling incoherently to our friends in high squeaky voices about having survived an encounter with the oceans' most feared predator.

Encounters with these potentially dangerous predators evoke both fear and excitement in humans. They don't always end in tragedy, either. Most human and shark encounters end with both species going their separate ways peacefully. But, my encounter gave me a strong motivation to study this particular species further, since other divers had been reporting encounters with (*Notorynchus cepedianus*) off and on for the past year (2009) in the San Diego area. I was curious why this was so

since before that time, few encounters had been reported.

At that point in time, citizen science was not in the media as much as it is today and nowhere near as popular. For me, it began as a spreadsheet, which I made available to other divers online to fill in the details of their encounters. I simply wanted to know how many other divers were seeing them in the San Diego area. This was also just before the advent of Go Pro cameras, so there were no photographs in our database. It was not very reliable data, scientifically speaking!

Jump ahead to 2014, when citizen science was beginning to take off and Go Pro cameras were common among divers. Our database began to include both photographs and video to compare different sightings. We began to notice that certain Sevengill sharks were returning from year-to-year, identified by their markings (one, in particular, we called 'Spot,' due to a large white discolored area near the dorsal fin).

It was around this time that I made the acquaintance of Jason Holmberg, an information architect who had pioneered using an algorithm developed by NASA for star pattern recognition to identify whale sharks.

He had also developed a web-based application using two well-known pattern recognition algorithms to identify not only whale sharks, but any other animal with identifiable markings. The application, called Wildbook, was a perfect fit for our Sevengill Shark ID Program, which had now expanded to include both the San Diego and Cape Town areas.

Shark Citizen Science: Who Will Collect the Data?

Once we had Jason's Wildbook program installed and up and running, we needed data. We decided to tap into an already large, rather self-selected group to gather data for us: divers who love diving with sharks. At the beginning of this story, I outlined why it might be that some divers would jump at the chance to dive with these magnificent predators: it's the experience of a lifetime and many will

pay thousands of dollars to get on a charter boat to Guadalupe Island in Mexico to dive with Great White sharks.

So, tapping into such a self-selected group of divers avoids the problem of citizen science motivation here. We didn't need to motivate them—they were already self-motivated. The other key was: we made it clear that they were not diving 'for' Ocean Sanctuaries—which might create legal liabilities—but, diving for themselves and simply submitting the data to us from their dives, after the fact.

It seems to have been a successful strategy: we now have had over 80 underwater videos and 200+ photographs of Sevengill sharks encounters submitted to us from San Diego and Cape Town divers. The data will be processed and analyzed through Wildbook to determine which animals are returning from year to year to each location and we hope to publish the results soon.

So, in summary: it is possible to motivate people to dive with dangerous ocean predators as long as they are doing it for the thrill or enjoyment they derive from it and would have done it anyway on their own, regardless of whether they are contributing to a shark citizen science project.

Of course, the other key we always emphasize to everyone is personal safety. We caution anyone submitting data about sharks that they must never put their personal safety in danger to collect data for any project. Of course, the other advantage we have here is that most of the divers in this self-selected group of shark divers have prior experience diving around sharks and know when it's time to take a photograph and when it's time to get out of the water.



On Parenting From the Place Where Science, Medicine, and Love Collide

Hillary Savoie

When I decided to become a parent, I figured that I would become an expert in my child in the way of many mothers. I imagined that, in her infancy,

I would intuitively learn to read my daughter's expressions, predict her needs, and comfort her pains. I expected that this would bind us together, in the kind of ways I am bound to my own mother. At the time, I was in the last years of a doctorate in Communication and Rhetoric, and I imagined my daughter would grow up watching me advance my career, seeing me as an example she might follow for becoming independent and chasing her passions.

However, I did not think I'd find myself stepping away from my career and focusing entirely on my daughter's life, using what I learned in my doctoral research in an attempt to make the world a friendlier place for her. I did not imagine that seven years into her life, I'd still rely on my intuition in order to communicate with her. I never imagined I'd be raising a child who might never grow up and move out into the world independently. I did not expect how much I would have to turn my attention to the world of science in order to become an expert in my child.

However, this is what my daughter, Esmé, has required of me: combining my communication skills, mother's intuition, and acquired scientific understanding as a way of loving her.

Why Advocacy

Esmé's story is not one that can be told quickly or without the little details. It is in the twists and turns of her life, experiences, and diagnoses that important parts of who she is become clear—she is a child who is full of contradictions and mysteries. She is a child with a diagnosis and prognosis that remains uncertain and, seemingly, ever-changing in a way that has left me feeling like I am carrying out a long-term scientific experiment with my own child. Esmé was born full-term in January 2011. During my pregnancy, I was monitored closely due to a risk of growth restriction from a two-vessel umbilical cord. However, it was an otherwise unremarkable pregnancy. As far as I was concerned, I was expecting a healthy—if somewhat small—baby. Immediately after my daughter's birth, it was clear that she was struggling. At just over 6 pounds, she was bigger than I'd expected, but her body