

Science in the age of Covid-19 (Part 1)

by Wilbur McFadden 2020-5-20

I grew up in a time of very active science in my field of medicine.. The logic of science and math in understanding and describing the world we live in has always made sense to me. There were no professional scientists or doctors in my family tree. On the other hand, most were sensible, practical and logical thinkers. At an early age, I knew I wanted to be a doctor. I had good teachers that helped me nurture that goal. Looking back, I had REALLY good teachers! As a group they laid a firm foundation in science.

Scientists are by nature skeptical. That's true in medicine. Our history is littered with many thousands of ideas and treatments that didn't work or weren't factual. In the 1890s', eugenics, a theory that taught that the human race could be improved by selective breeding, was promoted enthusiastically. That "science" led to 30,000 sterilizations in the US, on mentally "defectives". Eugenics was one of the foundational blocks of the Holocaust, and led to many crimes against humanity in Nazi Germany.

My favorite quack story (among many) started in 1920, when a Dr. John Brinkley (with a bogus degree) started promoting and implanting pieces of goat testicles in many desperate men. I imagine the imagery he created in a very gullible population! He built the 4th most powerful radio station in the US in Milford, Kansas and broadcast his message, mixed with testimonials, religious music, and other programming 24 hrs/day He branched out into patent medicines.. He became very rich and very famous! He ran for Governor of Kansas twice, and both times he lost by small margins. Eventually, a combination of lawsuits and facts put him out of business, and he died a pauper.

In Physics, it's easier to design experiments that explain how our world functions. Because we understand energy, electricity, computers, etc., we put several men on the moon 75 years ago. And we knew who the experts were! They weren't the politicians, or the taxpayers, or the university academics. They were among the best in their field. Thousands of highly trained scientists had worked together to design and test every part, including more than a million micro-chips. Everyone understood their role, and that it had to be accurate and factual. The proof of the science came when it worked!

When Einstein developed his Theory of Relativity in 1915, it was based on his imagination of how energy and matter behave in space. No one could go there to do experiments. It wasn't until 1919 that Sir Arthur Eddington and teams went to an island off West Africa, and also to Brazil to photograph stars during a complete solar eclipse of the sun, and proved that light bent in space, confirming the theory. The theory (now fact!) has withstood many attacks, but theoretically, it is possible to prove it wrong. All someone has to do is show that light travels faster than 299,792,458 meters/sec.

In Medicine, experiments are complex. Human populations are more diverse, they move and change behaviors, and study subjects die. A well-designed study sometimes is found to



have "fatal" flaws. In Spain, a few years ago, a large study about diets was discounted when they found out that some families were eating the same kinds of food (surprise?) rather than what was randomly assigned to individuals.

Now we have politicians, media and TV personalities, promoting theories, ideas, and plans, often mixed with real facts (goat testicles do work really well---for the goats!) and promises to "follow the data". So for me, it comes down to who is interpreting and making decisions about the data. In science (and medicine), analyzing and making sense of exploding data points requires expertise. Establishing evidence-based information is driven by the logic of math and science. I trust science. It's the form of study that as developed over hundreds of years that has helped us understand the natural world we live in. There really is only one set of facts. I trust the process by which the experts that understand that set of facts emerge. The process now takes collaboration, by a group of highly trained individuals, using a common set of rules. When the science is accurate, you can make predictions that are true. (Apollo 11 actually landed where and when predicted.)

A vaccine for Covid-19 is probable. But we don't know enough yet to make accurate predictions. Maybe we'll get lucky. Let's hope. But neither luck or hope are part of a fact-



based plan. Anecdotes are isolated, single stories of events. I spent my professional life hearing anecdotes. Every time I had a patient encounter I was collecting an anecdote. At one time, perhaps 100 years ago, understanding anecdotes moved science forward. But no longer. Anecdotes and bias introduce an unacceptable level of error in scientific experiments. The "double-blind" studies are designed for this purpose. But I

understood the difference and worked really hard to base my care of patients on evidence-based treatments, and not on my personal experience.

For example, I'm confident such a study is being done now on hydroxychloroquine. After establishing the goals and plans (number of subjects, selection criteria, dosages, length of time, measurements of outcome, and many other criteria that could confound outcomes) then the people administering the tests (giving the meds and collecting the data) would not know who got the meds or the placebo. Neither, of course, would the study subjects. And those that evaluated the results would not have any prior role. So the study would be blinded on all sides in an attempt to eliminate, or at least minimize the influence of bias. In a less rigorous way, that's how juries are selected. In spite of good intentions, many studies have had design or flaws that ruined studies that have cost thousands of dollars. With really accurate studies we will have evidence-based information.