Science and Truth

Quote of the day:

"All great truths begin as blasphemies."

--playright and social critic George Bernard Shaw

Readings for next time

Recap of last class; questions

Applications of our last class to Covid-19

1. Beware of media assertions of a scientific consensus (e.g., lab leak theory). Look instead for systematic reviews of the peer-reviewed literature, statements of scientific associations, or (for matters with a large body of research) Wikipedia.

2. For many scientific questions, there isn't a consensus. Research continues, and sometimes a consensus emerges over time. The same applies to Covid-19.

3. The Centers for Disease Control and Prevention (CDC) is a governmental body, not a scientific association (though it draws on scientific research). Similarly for the World Health Organization (WHO).

4. Assertions about the benefits of masking (from Anthony Fauci, the CDC, etc.) changed virtually overnight in spring 2020. The underlying scientific research did not.

5. Beware of assertions that we can just "follow the science." Thinking we can do so violates the is-ought fallacy.

scientific questions	public policy questions
"is"	"ought"

Examples of the distinction between "is" and "ought" questions:

scientific questions ("is")	policy questions ("ought")
Rates of spread of SARS-CoV-2 in a certain place at a certain time, and the threats to human health	Whether a jurisdiction should implement lockdowns
The effectiveness of different types of masks, under different conditions, in slowing the spread of SARS-CoV2	Whether we should require masks (and if so, which kinds) indoors, or outdoors

scientific questions ("is")	policy questions ("ought")
The consequences for schoolchildren of requiring masks (including, but reaching beyond, SARS-CoV-2 infections)	Whether we should require masks in schools
The safety and effectiveness of various vaccines, including boosters, at a given moment and over time	Whether we should require vaccines for various populations in various settings

Moving next to the limitations of scientific knowledge (drawing in places from Stuart Ritchie, *Science Fictions*.) Strong advocates of science have a responsibility to acknowledge these limitations.

How science can get corrupted: five pathways

First pathway. The actual conduct of science is fine. The problem lies instead in the communication of science by politicians, activists, or interest groups, especially industry (e.g., smoking, flame retardants, acid rain, pharmaceuticals, nutrition, and climate change).

Book/documentary, *Merchants of Doubt*

Second pathway. Industry groups, through their funding, shape the actual practice of science. The published, peer-reviewed literature then becomes tilted toward the findings they want. Pharmaceuticals and nutrition as examples.

Third pathway. Even without industry funding, the pressures for publish-or-perish lead to flawed studies getting published.

Beyond outright fraud, we have publication bias ("file drawer problem"). Studies with positive findings (those that find a relationship) are more likely to get published than those with negative or null findings (no relationship). The peer-reviewed literature will therefore be biased toward positive findings.

My own example

Solutions:

- **Techniques for determining whether a research area is affected by publication bias**

- **Journals need to publish well-designed studies with null findings. Note the qualifier, "well-designed." Sometimes a study fails to find a relationship because it was poorly designed.**

Fourth pathway (related to the third): p-hacking, the name for research practices that commit the Texas sharpshooter fallacy. Happens when scientists rummage through their data to find something interesting, then claim they hypothesized it all along.

The downfall of Brian Wansink:

https://web.archive.org/web/20170312041524/http://www.brianwansink.com/phd-advice/the-grad-student-who-never-said-no

Basic information on Brian Wansink:

https://en.wikipedia.org/wiki/Brian_Wansink

Ed Yong, A Waste of 1000 Research Papers. A combination of the 3rd and 4th pathways:
https://www.theatlantic.com/science/archive/2019/05/waste-1000-studies/589684/

Solutions:

- **Post-publication scrutiny. Scientists have to read each other's work and publicize critiques.**

- **Sharing data, which has become the norm. Necessary for post-publication scrutiny.**

- **Replication. Others follow identical procedures to see if they get the same results. A failure to replicate could indicate that the original finding is wrong, or that it emerges only under certain conditions.**

- **Pre-registration. Researchers commit themselves in advance to a plan for data collection and analysis. Cuts down on possibilities for p-hacking.**

Fifth pathway. Groupthink and hidden biases in the research community. Certain findings will be accepted, others won't. Shapes what gets studied, how it is studied, and what gets published.

Solution: need diversity of all kinds in the research community, including race, gender, and other identities and viewpoint diversity.