- *How scientists can stop fooling themselves over statistics*
- **Dorothy Bishop**
- **Nature, Aug. 2020**
- **Link to paper**

Overview:
This was a short "Worldview" nature article in which Dorothy Bishop discusses the need for scientists to develop "lifelong habits" so as to not be fooled by our own confirmation bias.

She focuses on this psychological phenomenon (confirmation bias) – the tendency to look for and recall information that fits with what we already think – in order to highlight the fact that scientists need to be better trained to understand and interpret statistics.

Major Take Aways:
- Make sure you understand statistics and how to interpret your findings
- We need to be aware of our confirmation bias and work to develop habits which ensure we do not fool ourselves into making statistical mistakes
- Training students with simulated data can be extremely helpful in allowing them to see how data translates (or does not translate) into legitimate statistical findings.

Additional details:
She provides an example of where our typical perception of statistics and probability can trick us into incorrect conclusions…

"As a topical example, suppose 5% of the population is infected with a virus. We have 100 hospitals that each test 25 people, 100 hospitals that test 50 people and 100 that test 100 people. What percentage of hospitals will find no cases, and wrongly conclude the virus has disappeared? The answer is 28% of the hospitals testing 25 people, 8% of those testing 50 people and 1% of those testing 100. The average number of cases detected by the hospitals will be the same regardless of the number tested, but the range is much greater with a small sample. This non-linear scaling is hard to grasp intuitively. It leads people to underestimate just how noisy small samples can be, and hence to conduct studies that lack the statistical power needed to detect an effect."

She also highlights the importance of conducting proper statistical tests, depending on how many variables you are measuring…

"The more variables you explore, the more likely it is that you'll find a spuriously 'significant' value. For instance, if you test 14 metabolites for association with a disorder, then your probability of finding at least one P value below 0.05 — a commonly used threshold of statistical significance — by chance is not 1 in 20, but closer to 1 in 2."

She suggests that generating simulated data for students to work with can be extremely beneficial…

"I use this to teach two crucial concepts. First, if presented with null data sets (such as random numbers), students rapidly discover how easy it is to find false results that seem statistically 'significant'. Researchers have to learn that the interpretation of a P value is very different when their question is "Is A associated with B?" from when it is "For variables A, B, C, D and E, are there any correlations where P < 0.05?" Asking whether a particular metabolite is associated with a disease is not the same as searching a set of metabolites to see whether any are associated with it. The latter requires much more stringent testing … A 30-minute session of data simulation can leave researchers stunned when they understand the implications."

Finally, she finishes with a Charles Darwin quote which I rather liked…

"In 1876, Charles Darwin said that he made it a habit 'whenever a published fact, a new observation or thought came across me, which was opposed to my general results, to make a memorandum of it without fail and at once: for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favourable ones'."