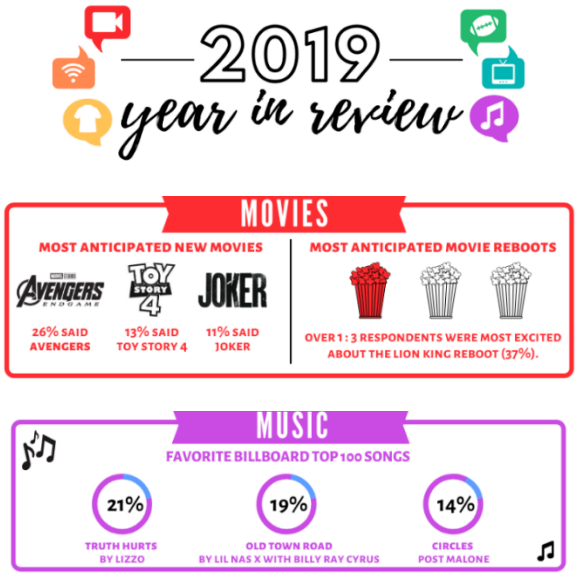
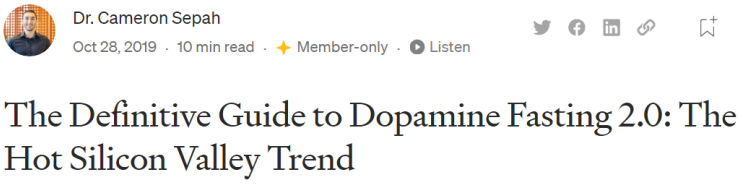
GETTING THE SCIENCE WRONG

Celeste Headlee



Remember October of 2019? Donald Trump was the president, but a presidential election was on the way. Simone Biles won her 21st medal, setting a record for World Championship wins in women's gymnastics. There was a mass shooting in Brooklyn, a mass shooting in Kansas City, a mass shooting in Texas followed by another shooting at the vigil for the victims of the Texas violence, and a law allowing teachers to carry guns in Florida schools took effect.

But you may have missed a trend that was gaining steam in that month: the rise of the "dopamine fast." It started with a 2019 post from Dr. Cameron Sepah in which he recommends establishing an organized schedule to control external stimuli and thereby cut down on impulsive behavior.



It’s not groundbreaking advice. Essentially, he’s using a lot of pretentious jargon to tell people to set aside significant blocks of time when they resist the temptation to refresh their feed or peek at their inbox.

[https://abc7news.com/dopamine-fasting-addictive-behavior-happiness-does-work/5685298/]

Sepah claims in his post that the idea went “viral”, but since one of his job titles is “Executive Psychologist to CEOs and VCs,” he has a financial interest in both hyping the popularity of his technique and citing that popularity as a reason why executives, particularly in the tech sector, should hire him to teach them how to do it.

The tech industry has long been fertile ground for silly life hacks and unhealthy but cool-sounding habits that supposedly help techies become and remain super-efficient. Medical professionals and scientists have wasted a lot of breath warning people not to fall prey to some of these trendy lifestyles.

Twitter co-founder Jack Dorsey often humble-bragged about going days without eating anything or only drinking water. Phil Lipin, who used to lead Evernote, says he will often go without eating for up to eight days. He’s lost 90 pounds, he says, and finds the practice “transformative” and mildly euphoric. It’s not an eating disorder the tech bros insist, it’s “biohacking.”

To be fair to the bros, dozens of research studies conducted over many decades show that controlled, intermittent fasting can have beneficial effects on weight and even strengthen the immune system in certain patients. Dr. Mark Mattson, a neuroscientist at Johns Hopkins who’s studied fasting for a quarter century, says restricting your eating to a six- or eight-hour window each day can boost your memory and prevent obesity.

But Dorsey and Lipin aren’t engaging in intermittent fasting—they are practicing prolonged fasting, which can be life-threatening. I read through at least a dozen different research reports that examined the effects of prolonged fasting, and the overall message is that many factors can make this practice dangerous. As noted in the Mayo Clinic blog: “Little long-term research has been done on intermittent fasting to examine how it affects people over time.” Which means, we simply don’t know enough about this practice. It’s risky, especially for those who have other health concerns.

Most of these studies follow a small group of patients as they undergo a fasting protocol for a few weeks. By that measure, the TV show “The Biggest Loser” was a massive success because most of the participants lost about 130 pounds. Years later, though, scientists at the National Institutes of Health checked back in with the contestants and discovered that all but one had regained all the weight they’d lost. Further, their resting metabolic rate had slowed, meaning they were burning fewer calories, thus making it even harder to shed pounds in the future.

6 Years after *The Biggest Loser*; Metabolism Is Slower and Weight Is Back Up

The work provides new insights into why it is difficult to keep off the pounds

May 11, 2016

[https://www.scientificamerican.com/article/6-years-after-the-biggest-loser-metabolism-is-slower-and-weight-is-back-up/]

The research we have on fasting is simply not comprehensive or useful when trying to decide whether it’s healthy to spend years skipping meals. One 2022 study, for example, that I saw cited in several recent blogs, claimed that adults can “well tolerate a 10-day [complete fast]” and that prolonged fasting was “associated with deceleration or prevention of most chronic metabolic illnesses and inflammatory diseases.”

If you are not practiced in reading and evaluating journal articles, this might sound conclusive. But let me point out just a couple of problems with this study. First, it was published in an open-access journal called Nutrients. If you research that publication, you’ll find that the editorial board and nine members of the editorial board resigned in 2018, claiming that the publisher “pressured them to accept manuscripts of mediocre quality and importance.”

[https://www.science.org/content/article/open-access-editors-resign-after-alleged-pressure-publish-mediocre-papers]

Also, the study included only 13 men. They started with 60 participants, but, if you read the Methods section, you'll see that "44 participants dropped out due to age, weight, BMI, underlying health conditions or religious beliefs...Three dropped out for personal reasons." So, they studied fewer than two dozen males, all in great shape, who fasted for 10 days and then were examined to see if they suffered any ill effects.

I'm sure you can see how flawed this approach is. The study clearly does not prove that complete fasting prevents chronic illness. But you would only know that the headlines were inaccurate if you know how to read a scientific study, and that's not easy. Even trained scientists miss things or misinterpret results, and it often takes years of reading these odd documents to develop a critical understanding of their claims.

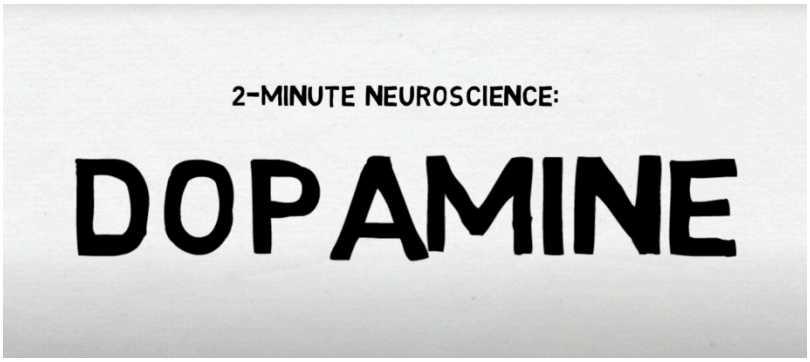
Let's go back to the beginning and the concept of "dopamine fasting." I find Dr. Sepah's original post about the technique to be a little silly, but his science is basically sound. It's weird that the name he chose for this behavior strongly implies that following his advice will lead to a reduction in the amount of dopamine in a person's system. That, of course, is ridiculous.

Dopamine is both a type of hormone and a neurotransmitter, meaning it carries information from one neuron to another as a kind of messenger. It's true that it's sometimes called the addiction hormone because it's heavily involved in our brain's reward and motivation system. When you pull the arm on a slot machine and the lights start flashing and the music plays, you will get a shot of dopamine that makes you feel good and drives you to pull the arm again, feel the pleasure again, and thereby reinforce that behavior.

However, dopamine also plays a role in motor function, learning, blood flow, kidney function, sleep, and many other bodily functions. People with Parkinson's often have low levels of dopamine, leading their movements to become stiff and jerky. It's produced in the base of the brain using an amino acid called tyrosine. Solid research suggests that eating foods with significant amounts of tyrosine, like avocados, soy, bananas, and chicken, can improve your brain function and memory.

So, you would never want to go without dopamine, even if you could, and you don't have control over the levels in your system anyway because avoiding certain activities doesn't lower the amount of the chemical in your body. Dopamine is not a drug or food that you can cut back on. As Harvard Medical School instructor Peter Grinspoon explains, "People are viewing dopamine as if it was heroin or cocaine and are fasting in the sense of giving themselves a 'tolerance break' so that the pleasures of whatever they are depriving themselves of—food, sex, human contact—will be more intense or vivid when consumed again, believing that depleted dopamine stores will have replenished themselves. Sadly, it doesn't work that way at all."

If you're interested in the way dopamine functions in your system, there is a lot of material out there from reputable sources. Neuroscientists say that clearing your mind by abstaining from pleasurable things can lead you to more enjoyment when you finally indulge, but "it just won't be a result of the regulation of dopamine." Again, if you are thirsty for a deeper understanding, I highly recommend digging into the research, or at least watch this video called, "2-Minute Neuroscience: Dopamine."



You may wonder: how have people so completely misread the science? After all, many of the people who are most excited about trying a “dopamine fast” are college-educated and even work in a technical, science-adjacent field like tech. The problem is a lack of literacy when it comes to reading scientific papers and understanding their limitations.

It’s never enough to read one paper on a particular subject because science is about testing and re-testing and testing again under different conditions and variables. We can’t learn much from forcing 13 healthy men to fast for a week-and-a-half, but we might learn a lot if we replicated that experiment many times, using a large and diverse pool of patients, and then monitored changes in their biochemistry over time.

Reading the summary of a scientific study in a newspaper article tells you very little about what was discovered or the methods used. The study that Dr. Sepah cites to back up his not-at-all-innovative approach was published in 2013 by a psychologist at St. Bonaventure University. She examined 128 people who were seeking treatment for Internet addiction and measured the impact of using Cognitive Behavioral Therapy (CBT) to treat their problem.

CBT is a type of talk therapy that helps you identify negative thinking patterns, adopt more objective and healthy approaches, and devise new strategies and behaviors that are more adaptive. The patients in the study attended therapy sessions for 12 weeks and were then evaluated at one, three, and six months after the last appointment. At no time did they completely avoid computer use because, as the report very sensibly explains, “abstinence recovery models are not practical”: computers are an important part of everyday life, and “clinicians have generally agreed that moderated and controlled use of the Internet is most appropriate.”

The participants’ dopamine levels were not measured and were not a part of the research in any way. The report also explains that most of the participants were white men with college degrees who were addicted to online role-playing games and porn.

To extrapolate from that study (which was carried out in a responsible and ethical way, underwent peer review, and was published in the Journal of Behavioral Addictions) to a suggestion that one can and should abstain from using social media, watching movies, talking to friends, and basically anything stimulating and pleasurable seems like an incredible act of intellectual gymnastics.

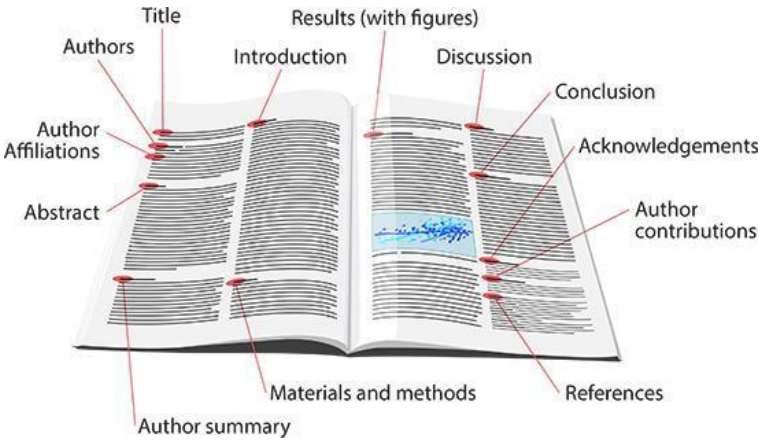
I think Dr. Sepah's underlying goal—to help people set reasonable limits on the use of smartphones, social media, etc.—is sensible, but it's hardly new. For years, medical practitioners have advised people to find ways to go without screens or set aside time when they don't pick up their phones. If that's what a "dopamine fast" really is, then I'm all for it.

It doesn't need to be branded with an unscientific and inaccurate name that involves the word "fast" to piggyback on a current trend that's neither entirely safe nor grounded in solid evidence. And it doesn't need to be sold to tech bros as expensive consulting, so they can post about it on Twitter and convince thousands of other people to avoid socializing with their friends.

To quote the good Dr. Grinspoon of Harvard and Massachusetts General Hospital again: "Dopamine fasters are depriving themselves of healthy things, for no reason, based on faulty science and a misinterpretation of a catchy title." Amen, Doctor. Amen.

READING SCIENTIFIC STUDIES: A PRIMER

Celeste Headlee



Be skeptical, but when you get proof, accept proof. --Michael Specter

You may be asking yourself, why do I need to know how to read a scientific paper? I'm not a scientist, nor do I want to be, and much like calculus, this knowledge is not useful in the life of an average person. I would argue, though, that all of us need this information because there is a lot of scientific bullshit in the world and, if the COVID-19 pandemic has taught us nothing else, we now know exactly how dangerous it is to get bad scientific information.

There are at least two layers of crappy science info: First, the media coverage of research and discoveries is generally abysmal. I won't give a long list of examples, as John Oliver already did this better than I can.

[https://www.youtube.com/watch?v=0Rnq1NpHdmw]

Suffice it to say that when a headline reads, "Study: Abstaining from Alcohol Significantly Shortens Life" or "New study says staring at breasts is good for men's hearts," you can bet that either the reporter didn't really understand the results of the study, or the study was flawed and unreliable.

When I first started working as a journalist, I had no training in the field. I was a classically trained vocalist with two advanced degrees in music. So, I worked feverishly to cram four years of learning about journalism into my spare time after work and during my lunch break.

One of the first subjects I tackled was how to read scientific reports because reporters are tasked with writing about new discoveries all the time. My news editor would hand me a press release from a local university declaring that a professor had identified some revolutionary new treatment for hemorrhoids and I would have to figure out what the headline really was (hopefully, without using the word “butt”).

At the time, I didn’t realize that many reporters do *not* read the original research. They often don’t even talk to the author of the report. Instead, journalists will sometimes pull quotes from the summary supplied by the university press office, and they’ll rewrite the press release. This is how we end up with headlines that read: “New Study Shows Taking LSD Explains the Meaning of Life.”

I wasn’t going to do that because I didn’t want to make mistakes in my reporting, which can tank a reporter’s career quickly if they work for a reputable outlet like NPR. Also, I was mission-driven. As corny as it sounds, I have always been fully aware that I have a duty to provide the public with useful information and help clarify complicated issues. Misrepresenting scientific studies is counterproductive for journalists who want to actually... you know... do journalism.

So, I forced myself to learn the odd and sometimes archaic language of scientific journals and to bring a skeptical eye to any new research that crossed my desk. You can learn how to do this, just as I did. If a soprano can do it, so can you.

Before you begin, it’s important to understand the different components of a scientific paper and their purposes. A scientific report contains five principal sections: Abstract, Introduction, Methods, Results, and Discussion or Conclusion (or both). You’ll see variations in which the sections are in a different order, or the author has added sections like an Author Summary or Figures, because many journals require a specific format, but those are the five big ones.

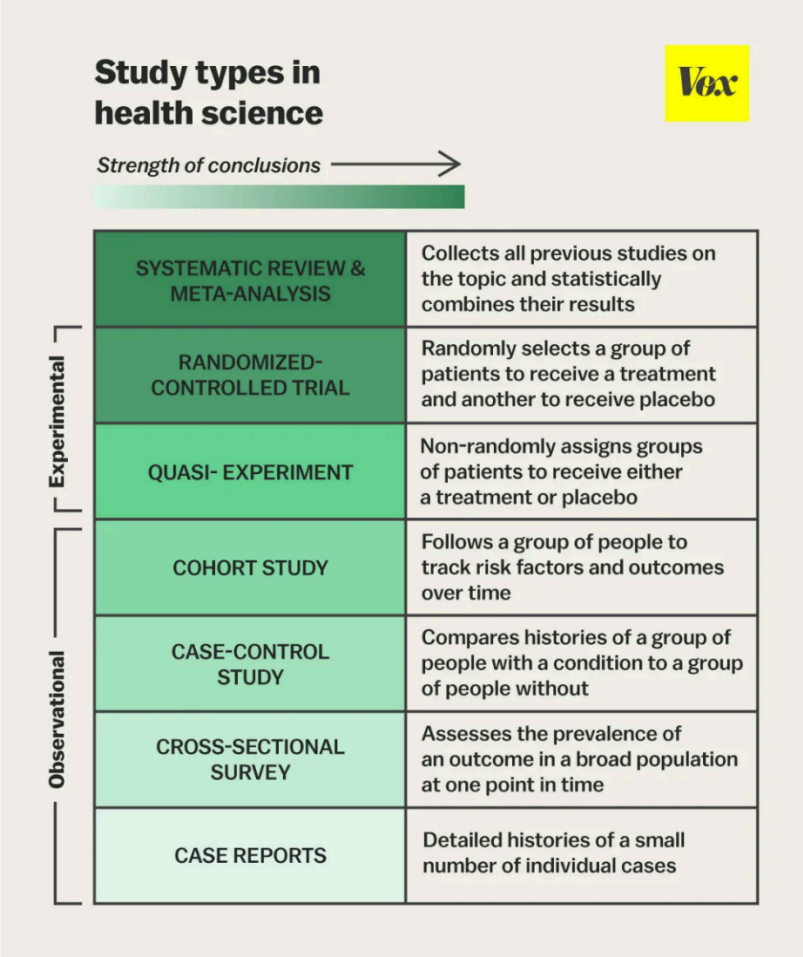
If you're a scientist who is scanning through journal articles trying to decide which studies are relevant to your own work, you can begin with the Abstract. It's the Cliff Notes version of the study that tells you what the original question was, why the research was needed, some of the context, and the author's conclusions.

If you're not a scientist or researcher, do not start with the Abstract. Instead,

STEP ONE: Start by making sure this study is worth reading. And that means you must ask a few questions.

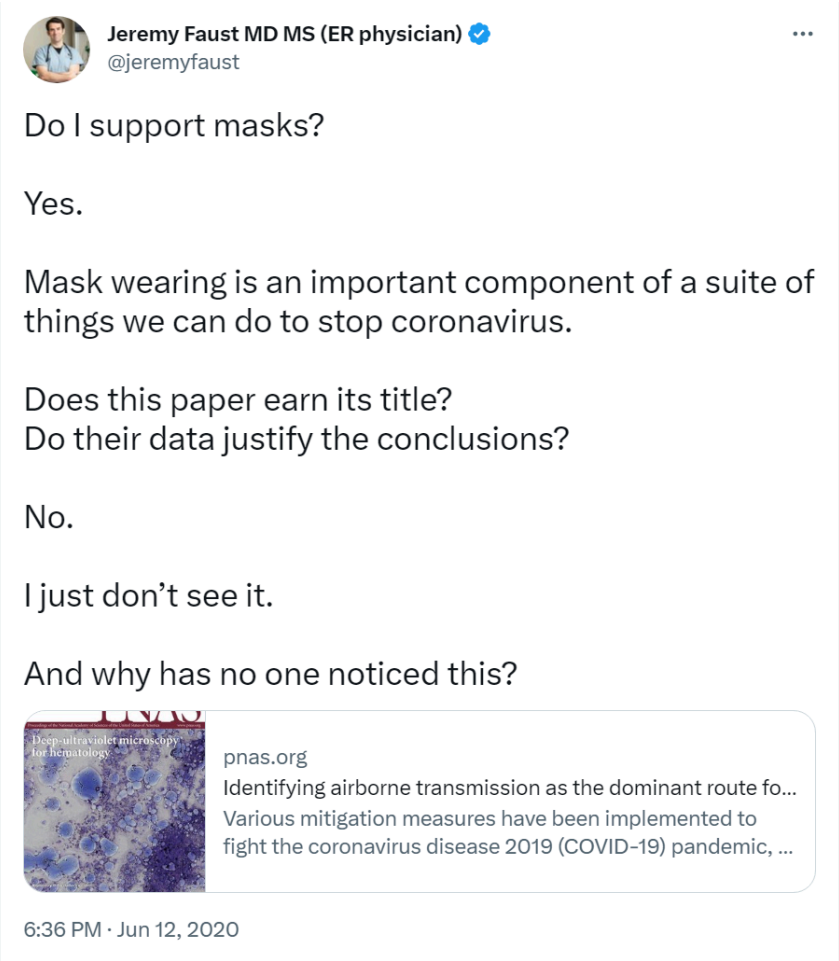
1) **Who wrote this and with what institution are they affiliated?** A study that was conducted jointly by academics at Oxford, UCLA, and Princeton is probably more credible than the one written by a prof at the Grigore T. Popa University of Medicine and Pharmacy in Romania, which is consistently ranked as one of the worst of 25,000 or so global institutions.

2) **What kind of study was this?** The gold standard is generally the meta-analysis, which gathers a significant number of studies on a particular topic, sifts through them to choose the best, and then combines the results to arrive at a fairly reliable conclusion. Be wary of papers in which a scientist simply critiques the research of others, as they generally summarize methods and findings, present areas of debate or consensus, and tell you what's missing. These are often quite opinionated and it's easy for the author to shape the narrative to fit the story they're trying to tell.



[https://www.vox.com/2015/1/5/7482871/types-of-study-design]

3. **Which journal published it?** It used to be that a paper published in the Proceedings of the National Academy of Sciences could be trusted simply because it appeared in those august pages. PNAS, after all, is a very prestigious journal. But even PNAS got in hot water in 2020 for releasing a paper that claimed masks were the best way to prevent the spread of COVID and social distancing and other measures were "insufficient." One biostatistician said, "It's important to clarify that this paper is of poor quality," particularly because the paper was making a "sensational claim" that was likely to draw attention and media coverage.



Still, PNAS is at least peer-reviewed and responsive to the feedback of the scientific community. The danger is that people search PubMed for research and assume that, if it's listed in the database, it must be trustworthy. What many don't realize is that PubMed is just a search engine provided by the NIH. It's very useful, containing research that dates back to at least the 18th century, but it contains 32 million citations and they're not all winners.

Many journals are predatory, publishing articles to make money, and don't use any scientific rigor when curating their content. I often consult Bealls List to help identify poor-quality journals.

4). **Who funded this paper?** Corporate interests often pay for research that makes their products look good. Think of fossil fuel companies manipulating research into climate change or Big Tobacco supporting research that "proves" cigarettes aren't bad for your health. And, of course, the sugar industry successfully hid the dangers of its product for decades and convinced people to cut fat out of their diets instead of sugar.

AMERICA

50 Years Ago, Sugar Industry Quietly Paid Scientists To Point Blame At Fat

September 13, 2016 · 9:59 AM ET

CAMILA DOMONOSKE

A newly discovered cache of internal documents reveals that the sugar industry downplayed the risks of sugar in the 1960s.

Luis Ascui/Getty Images

[https://www.npr.org/sections/thetwo-way/2016/09/13/493739074/50-years-ago-sugar-industry-quietly-paid-scientists-to-point-blame-at-fat]

Just a note: getting funding from a corporation doesn't necessarily mean that an experiment is bogus but corporate dollars should raise your skepticism meter a little.

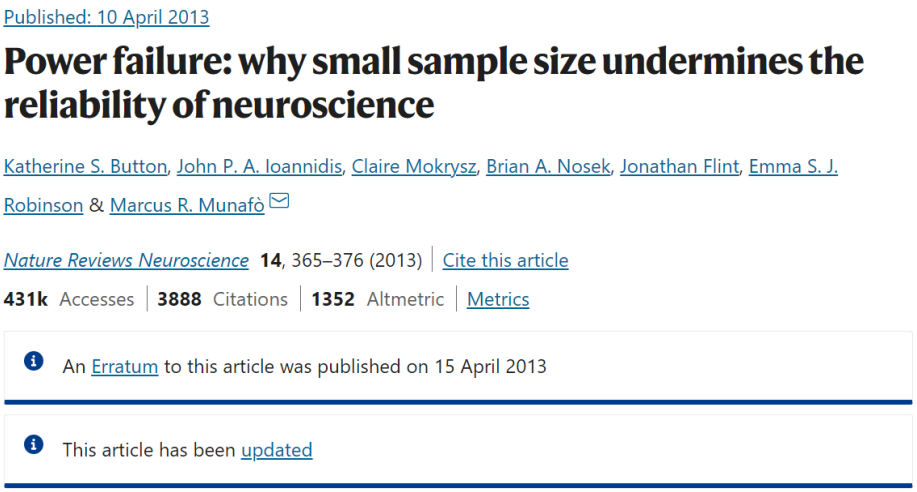
So, let's say the paper is relevant to your interests AND it's written by a qualified scientist (or scientists) at reputable institutions AND it's published in a credible journal. Now, it's time to look at the paper itself.

STEP TWO: Identify exactly what question the study authors are asking. You can find this in the Abstract, or Author Summary, and the Introduction, and other places. Generally, I jump to the Abstract and write down the question as articulated by the authors.

STEP THREE: Read their methods. On whom were they testing? The conclusion is very different when it's based on human testing than when it's based on experiments using laboratory mice or rats.

How many people were included in the experiment? A 2021 paper from the WHO that used data from 59 different studies (one of those wonderful meta-analyses) that included 1.9 million patients from all over the world carries significantly more weight than the experiment that recruited 12 college students (and then two of them dropped out).

If you feel like going down the rabbit hole, feel free to lift this rock and read through the impassioned arguments among statisticians and ethicists about what constitutes an acceptable sample size. Scientists can get very defensive when they're accused of making broad claims based on results from a couple dozen volunteers in Indiana. Columbia University professor Andrew Gelman sparked a battle royale by commenting on a study of an early childhood intervention: "The authors are doing lots of hypothesizing based on some comparisons being statistically significant and others being non-significant. There's nothing wrong with speculation [NB: using the word "speculation" is a shot across the scientific bow], but at some point, you're chasing noise and picking winners, which leads to overestimates of magnitudes of effects." If you want to read the entire back and forth, start here.



Published: 10 April 2013

Power failure: why small sample size undermines the reliability of neuroscience

Katherine S. Button, John P. A. Ioannidis, Claire Mokrysz, Brian A. Nosek, Jonathan Flint, Emma S. J. Robinson & Marcus R. Munafò

Nature Reviews Neuroscience **14**, 365–376 (2013) | Cite this article

431k Accesses | **3888** Citations | **1352** Altmetric | Metrics

An Erratum to this article was published on 15 April 2013

This article has been updated

[https://www.nature.com/articles/nrn3475]

Next ask, who were the test subjects? Much published research in psychology, sociology, and other social sciences is currently being reconsidered because so many of those studies were based on WEIRD research. WEIRD stands for "Western, Educated, Industrialized, Rich, Democracies." But really, they should replace "Western" with "white," because that's what they mean in most cases.

I don't know what percentage of social science and psychology experiments were conducted using white college students in the US, but it's probably pretty high. WEIRD participants represent only 12% of the world's population, but a wildly disproportionate percentage of test subjects. Bethany Brookshire offers some advice in a piece from 2013: "The next time you see a study telling you that semen is an effective antidepressant, or that men are funnier than women, or whether penis size really matters, take a closer look. Is that study WEIRDly made up of college psychology students? And would that population maybe have something about it that makes their reactions drastically different from yours? If so, give the study the squinty eye of context. As we often add '… in bed' to our reading of the fortunes in fortune cookies, it's well worth adding '… in a population of Westernized, educated, industrialized, rich, and democratic college students' to many of these studies."

Also, how long did the experiment last and did the authors check back on the participants? Diet studies are notorious for showing remarkable weight loss results, but we have no idea if the loss is sustainable over time (it probably isn't) because the experiment only ran for three months, and the researchers didn't conduct any follow-up surveys.

STEP FOUR: Find the responses to the paper. Sometimes you can simply Google the name of the paper itself and find critiques, but you can also search for it on Google Scholar. Search for the paper and then click on the "cited by" link. You will see how that study has been used in other research, as well as reviews and published critiques. While reviews are not always helpful as standalone sources, they can be informative when consulted as pushback on a paper you've read.

STEP FIVE: Read the Introduction and the Findings/Results. Now, sit back and think about how you would conduct this experiment. Go back to the original question. Let's say the researchers want to know if physical activity makes human beings happy. How would you test that if you were designing the study? What are the pitfalls to look for? What are the weaknesses in the paper's methodology? Does this experiment answer the question the scientists are asking?

STEP SIX: Read the Discussion or Conclusion. Does their interpretation of the results match the findings? What questions do you still have?

Now, you're done! You have read a paper and, hopefully, understood its generally limited implications. You now know that the research does *not* say eating chocolate will help you live longer or men are inherently funnier than women. When someone you know talks about "what the research says" to support an outlandish opinion, you can smile smugly and say, "You don't know what you're talking about, Robert. Do you even know how to read a scientific study?"

If you're interested in this subject and want to learn more, check out this article about the anatomy and physiology of a scientific paper, from the excellent website: *Ask a Biologist.* I also highly recommend the website called "Calling Bullshit" where two college professors in Seattle teach people how to recognize bullshit when they see or hear it. Honestly, take a look at the syllabus (they teach this course at the University of Washington for 3 credits) and I bet you'll be hooked, too. One more source to check out, Kevin deLaplante's wonderful web series called "Critical Thinking About Science".

Enjoy.