TALES FROM THE FRINGE

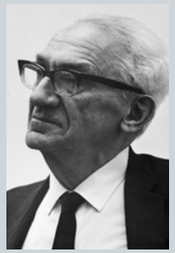
BY JENNIFER WALTER

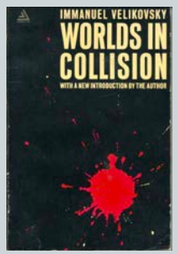
From Bigfoot to the anti-vaccine movement, fringe theories are everywhere, lingering in the shadow of science. Where do they come from?

Imagine a universe rife with cosmic catastrophes: Jupiter ejecting a comet into space that would later become the planet Venus. The comet whizzing past Earth and changing its rotation. The resulting chaos on Earth causing natural disasters of biblical proportions — literally — like the parting of the Red Sea. In the mid-1900s, Immanuel Velikovsky, a psychiatrist and author, claimed that he could prove these radical ideas.

Cryptozoology is a type of fringe science that attempts to prove the existence of creatures from folklore, such as Bigfoot.

Lots of fringe theories don't pose any danger. But others, like the false notion that COVID-19 vaccines can change your DNA, can cause real harm.





In his 1950 bestseller, *Worlds in Collision*, psychiatrist Immanuel Velikovsky claimed that a piece of Jupiter hurtled past Earth, changing its rotation.

Velikovsky laid out his case in *Worlds in Collision*, a 1950 bestseller. But the book wasn't billed as creative fiction or a fanciful hypothesis based on anecdotal accounts of the past; rather, Velikovsky presented these interplanetary theories, and others, as factual.

Many scientists didn't buy it. "That this is a remarkable story no one — proponents and opponents alike — will disagree," Carl Sagan wrote in response to *Worlds in Collision*. "Whether it is a likely story is, fortunately, amenable to scientific inquiry."

And inquire scientists did. Many pointed out that Velikovsky's evidence ran counter to centuries of established astronomy and physics knowledge. His arguments were based on historical texts and legends. The whole affair reignited questions about what's *science* and what's *pseudoscience* — a discussion that precedes the coining of the latter word in 1796.

You don't have to look far to find ideas that seem scientific, but aren't — think of astrology, flat-Earth theory, or the anti-vaccine movement, for starters. But how do we know when an idea is rooted in scientific fact, and when it's a mirage? It can be tricky to tell. The wide umbrella of pseudoscience encompasses ideas that come from a variety of sources, and they generally have little in common except that they've been designated as such by members of the scientific community. "Part of the reason why the fringe is so crazily diverse is because science is pretty crazily diverse," says Michael Gordin, a Princeton University historian.

In his view, these are ideas that linger in the shadow of science. This hints at the complicated relationship between scientific establishment and the fringes. Fittingly, another term for these schools of thought is *fringe science* — one that Gordin prefers, after researching fringe theories since the late 1990s. Many fringe ideas aren't inherently dangerous, but in some cases, they spark valid concern from scientists, such as the claim that COVID-19 vaccines can alter your DNA. When unfounded and false information is presented as scientific to skew the truth or blatantly lie, it can cause real damage in the world. "There are some fringe doctrines where we have very good reasons to be antagonistic [towards them]," Gordin says.

But he also explains that it's not the theories themselves that are the problem; it's that they look true, but aren't. Fringe groups will wield bias-affirming data, anecdotal evidence and the testimonies of people with academic credentials to make a convincing case. Even when these ideas aren't rooted in facts, many people still latch on to fringe theories — and, in some cases, deny contradictory evidence — due to powerful emotional, political and cultural influences.

PREVIOUS SPREAD: CINEBLADE/SHUTTERSTOCK. TOP LEFT: HALFPOINT/SHUTTERSTOCK. PORTRAIT: BETTMANN/GETTY

VIACHESLAV LOPATIN/SHUTTERSTOCK

A TAXONOMY OF FRINGE

While it might be tempting to lump every fringe idea into one category and every scientific idea into another, the theories seldom fit into tidy boxes. And there is no single, universal way they arise.

Take Bigfoot, for example. While myths of wild, humanlike creatures are present in cultures around the world, a newspaper columnist in the U.S. was the first to use the name when writing about Northern California loggers who spotted mysteriously large footprints in the woods. Despite that those footprints came from a jokester making marks in the mud with giant wooden feet, people continued to present videos and even corpses aimed at proving the creature's existence. Today, cryptozoologists search for evidence of mythological creatures using their own methods, taking Bigfoot from folklore to pseudoscience.

On the other hand, astrology and alchemy were once seen as legitimate scientific fields before drifting to the fringe as understanding about the natural world progressed. "The easy example of how we tell what is and what isn't pseudoscience is astrology," says Kean University historian Brian Regal. "It's viewed as pseudoscience, in part, because it has never really evolved over time."

As astrology and alchemy suggest, the barrier between science and fringe isn't a brick wall; ideas previously regarded as scientific have been disproved and dismissed. And in some rare cases, theories that were once disregarded have gained peer-reviewed evidence and support by the scientific establishment.

Atomic theory, for example, was once part of the fringe. Though scholars had theorized since the days of ancient Greece and India that atoms existed, for centuries, the prevailing idea was that matter was continuous — essentially, you could keep breaking it down into smaller and smaller pieces forever. It wasn't until the 1800s that scientists began to record

In astrology, zodiac signs, like those above, are supposed to help devotees draw connections between celestial movements and human activity.

U.S. shops in the 1800s offered phrenology readings, the practice of examining someone's skull to determine their intellect and personality. The bunk science fueled racist ideas for decades.

TOPICAL PRESS AGENCY/GETTY

concrete evidence for the existence of atoms, and more and more research built onto that idea until the theory became widely accepted.

Other scientific ideas we consider common sense today weren't always respected. Physicist Galileo Galilei triggered the wrath of the Catholic Church and scathing rebuke from his 17th-century astronomy peers for proposing that Earth revolved around the sun.

That's also roughly the same time period when Europeans were in the midst of the Scientific Revolution. Though the roots of mathematics, chemistry and astronomy date back to ancient civilizations across the globe, Galileo and his peers began to codify the scientific method and lay the groundwork for modern research institutions. "That's when you start to get this notion of pseudoscience," Regal says, "because you get people who are now going to be operating outside of that sort of growing community of researchers and scholars."

The establishment of modern science created a barrier between insiders and outsiders. And it's important to note how science has routinely dismissed certain groups of people, or actively pushed them to the margins. Researchers, for example, have historically skewed male and white, often overlooking diversity in race or sexual orientation.

Even for Velikovsky, part of his support as a charismatic figure in the 1960s and '70s stemmed from the tension between fringe and mainstream. He was standing up against the "elites" at a time when anti-establishment politics were especially popular, explains Gordin in his 2012 book, *The Pseudoscience Wars*. Followers latched on to his outsider status.

But the non-scientific method plaguing Velikovsky and his followers — and much of pseudoscience today — was a reluctance to modify their ideas when presented with opposing views and evidence. Instead, they clung to them even more tightly. That absolutist, all-or-nothing attitude is central to building a fringe movement. And it opposes how science is supposed to work.

THE FLUID NATURE OF SCIENCE CAN LEAD TO FRINGE THINKING, BECAUSE PEOPLE TEND TO LATCH ONTO WHICHEVER FINDING APPEALS TO THEM MOST. EVEN IF THAT SPECIFIC PART IS LATER DEBUNKED, THEY STILL MIGHT LIKE IT AND HOLD ONTO IT ANYWAY.

HOLDING ON TO THE PAST

Whatever you read in your school textbooks decades ago likely contained outdated knowledge, even if the facts seemed rock solid at the time. And that basic notion of change can be uncomfortable for many. "Most people think science is a body of doctrine that's static," Gordin says. "We figure out something, it's true, and we put it on the shelf." But that's not the case. Scientists are constantly revising their knowledge through new studies, data and discussions. "Stuff that you grew up thinking was true turns out not to be," he adds. "And that disrupts people's faith in science."

Consider, for a moment, Pluto. You may have some strong feelings about the downgraded planet; many people certainly did when the iconic celestial body was reclassified as a dwarf planet in 2006. A panel of 424 astronomers, less than 5 percent of all in the profession across the world, voted to change Pluto's standing based on new criteria for what makes a planet. The controversial recategorization is the official stance of the International Astronomical Union today, even though some astronomers still disagree on what, exactly, Pluto should be called.

"The scientific consensus shifts over time because people are constantly picking at it," Gordin says. "And that's supposed to be science working as normal, but it has this byproduct." The incremental, fluid nature of science can lead to fringe thinking, he reasons, because people tend to latch onto whichever finding appeals to them most. Even if that specific part is later debunked, they still might like it and hold onto it anyway.

One textbook example is the repeatedly debunked claim that the MMR vaccine causes autism. The idea first arose in 1998 when former physician Andrew Wakefield and colleagues published a paper in *The Lancet,* alleging a causal relationship. The journal retracted the study 12 years after it was published when Wakefield and colleagues were found to have deliberately fabricated evidence for financial gain.

In the aftermath of the initial report, though, entire communities began to stop vaccinating their children. Even though scientific reports have shown, over and over again, that there is no causal relationship between vaccines and autism, the damage has been done. Today, anti-vaccine groups abound, and once-eradicated diseases are making a comeback as large clusters of people continue to shun vaccination efforts.

NASA/JHU APL/SWRI/ALEX PARKER

The reclassification of Pluto from planet to dwarf planet is a striking example of how scientific consensus can evolve over time.

EXPERTS AND FAKES

It may seem surprising, but the actual techniques and communication strategies fringe scientists employ can confirm humanity's basic trust in the scientific method. Exploiting that trust to spread false information is exactly how some fringe theorists get people to believe them.

One common technique, explains John Cook, a communication researcher at the Monash Climate Change Communication Research Hub at Monash University in Australia, is relying on fake experts to give the impression that a message is scientifically credible. Fake experts are those with academic credentials who, at first glance, seem qualified to speak on an issue. Maybe they have a "Ph.D." or "Dr." in their title. But their credentials don't match or they lack the expertise in the area of science being discussed. Essentially, someone with a doctorate in psychiatry isn't necessarily qualified to offer expert insight on astronomy.

SPOTTING PSEUDOSCIENCE

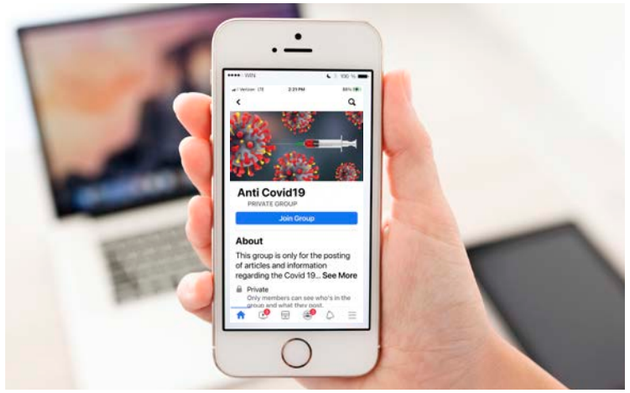
So, how can you tell the difference between science and theories on the fringe? The debate has raged in philosophical circles for centuries, but there are some tangible traits that most pseudoscientific theories have in common.

Historian Brian Regal teaches courses on scientific and pseudoscientific history at Kean University in New Jersey. He breaks down pseudoscience into five traits, the first being that **these theories don't advance or evolve over time**.

"If you take what an astrologer is doing today," Regal explains, "And compare it to what Albertus Magnus was doing back in the Middle Ages or any of the famous astrologers from that time, what they're doing really isn't that much different." Similarly, pseudoscientific theories **do not present any testable evidence**, and **you can't prove or disprove the theories**. Science, by contrast, relies on the verification of evidence to prove or disprove ideas. As new data comes in, things that previously seemed true can be proven false.

And supporters of pseudoscientific theories are often **unwilling to accept contrary evidence**. Think of the so-called "anti-vax" movement: Even though it's been repeatedly proven that vaccines don't cause autism, some people still refuse to accept that evidence.

Finally, pseudoscience is often **based on belief alone**. No matter how many times scientists debunk purported evidence of Bigfoot, enthusiasts will still believe the creature exists because they want to, evidence be damned. —J.W.



Social media groups can become echo chambers for false or misleading information.

PRYKHODOV/DREAMSTIME

DAVID SILVERMAN/GETTY

SKIN DEEP
Scan this code with your phone's camera for more: How Science and Medicine Have Misconstrued Race as Genetics.

Even scientists can help spread fringe theories. When the small percentage of experts who don't agree that humans are partially responsible for global warming appear on TV, for example, they can provide fuel for science denial.

And there are times when even scientists speaking within their area of expertise can muddy the waters. What if a credentialed climate scientist makes claims against the evidence for human-caused global warming? In this case, dissenters can become "lionized," as Cook puts it. While 97 percent of climate scientists agree there is evidence that humans are at least somewhat responsible for global warming, there is still a very small margin of experts who disagree. And when those dissenters are visible on TV debates and testimonies in Congress, they can take an argument with nearly 100 percent consensus and make it seem like it's split down the middle.

If we're already primed to listen to these dissenters, that overriding consensus won't make us change our minds. "If they're saying the stuff we want to hear, we just psychologically tend to think, 'Now *that* person knows what they're talking about,'" Cook says. "And that's why science deniers rely on these fake experts and these dissenting voices."

FRINGE IN THE WILD

It's no secret that social media has become a breeding ground for false information. In many cases, online groups can become echo chambers where bias-affirming posts circulate, regardless of whether they're true or not. Public health expert Sara Gorman doesn't shy away from the sticky, virtual interactions that these posts might prompt. She dives in headfirst, armed with the knowledge that social media is a primary source of information for a lot of us.

Gorman is the CEO of research and education nonprofit Critica, which is conducting a study to see which communication methods work best when interacting with people who share false health and science information on various social media platforms, including Facebook. Her team started specifically with vaccine misinformation, in response to the deployment of the COVID-19 vaccine. Even before it was rolled out, unfounded claims that production of the vaccines was rushed, or that it will cause serious side effects, permeated social media feeds. Gorman and her team use the Critica Facebook page to target comments or posts that circulate unfounded claims. Rather than simply flagging posts as disinformation and including a link to a fact-check — tactics used by Facebook and other social media platforms — her team engages in a conversation with users.

In short, the team predicts that finding common ground with posters will be a more effective strategy, though they're still in the process of collecting data. Gorman says that opening up a conversation does a lot more to foster good communication than trying to lecture someone on why their beliefs are factually wrong. "You might really talk to someone about, well, all right, we have a common goal. We both want to keep children safe," she says. "Then you help the person really unpack how they came to their beliefs." The method works best with people who are on the fence — say they got anti-vaccine information from a friend's post but didn't take the time to vet it.

Another successful technique draws on the idea of "psychological inoculation." Much like a vaccine safeguards you against disease, this tactic prepares people to identify the ways that people twist evidence online to make ideas seem scientific, like employing fake experts. "The main reason it works is because people are averse to being misled," says Cook.

Sometimes those kinds of posts are simply mistakes, and a lot of us make them. Research shows people on social media will often share false information without seeing if it checks out first. One study published in 2020 found that people who share stories with false health-related information on Facebook don't always do so intentionally. In fact, many people share posts with inaccurate information simply because they are distracted — and hit the repost button based on a short description or headline they agreed with.

Gorman says many anti-vaxxers tend to fall into the "on-the-fence" category. However, it would take a lot more to convince someone who is a leader of a fringe group, such as Andrew Wakefield himself, to change their mind. Cook agrees. "It's incredibly difficult, almost impossible," he says. "Not only because they're committed to their ideas, but also it's how they define themselves. It's their identity." That identity can make them feel like they're fighting for a worthy cause, even as they knowingly distort the facts.

But in some situations, when a leader dies or fades away, so do their ideas. After Velikovsky died in 1979, his books and movement sank into obscurity.

And like fringe ideas, even a scientific consensus can lose favor. We often only hear about ideas that have stood the test of time and the rigor of repeated testing to gain wide acceptance by mainstream scientists. "Most things published in 2020 in science are going to be wrong in about 10 years. And that's not a problem," says Gordin. "That's how it's supposed to work." D

GORMAN SAYS THAT OPENING UP A CONVERSATION DOES A LOT MORE TO FOSTER GOOD COMMUNICATION THAN TRYING TO LECTURE SOMEONE ON WHY THEIR BELIEFS ARE FACTUALLY WRONG.

__Jennifer Walter__ is an assistant editor at Discover.