

A Study May Be Pseudoscience If

****How to Recognize When a Study May Be Pseudoscience** a study may be pseudoscience if** it fails to adhere to fundamental scientific principles, yet still presents itself as legitimate research. In today's information-rich world, distinguishing credible science from pseudoscience has become increasingly important. Whether you're reading articles online, hearing about breakthrough discoveries, or evaluating health claims, understanding the hallmarks of pseudoscientific studies can save you from misinformation and misguided beliefs. Let's explore the key signs that indicate a study may be pseudoscience if certain red flags are present, and how to critically assess scientific claims effectively.

What Does Pseudoscience Really Mean?

Before diving into the warning signs, it's essential to clarify what pseudoscience entails. Pseudoscience refers to beliefs, methodologies, or claims that present themselves as scientific but lack the rigorous standards, empirical support, and reproducibility that genuine science demands. Unlike real science, pseudoscience often relies on anecdotal evidence, lacks peer review, and resists falsification. This distinction is crucial because pseudoscientific studies can mislead the public, influence policy incorrectly, and erode trust in true scientific findings.

Key Indicators That a Study May Be Pseudoscience If...

When evaluating research, spotting signs that a study may be pseudoscience if it exhibits certain characteristics can be invaluable. Below are some critical warning flags to watch for:

Lack of Falsifiability and Testability

One of the core principles of science is falsifiability—the ability for a hypothesis or claim to be tested and potentially disproven. A study may be pseudoscience if it proposes ideas that cannot be empirically tested or refuted. For example, vague claims that rely on supernatural explanations or mystical forces often fall into this category because they cannot be measured or challenged through experimentation.

Overreliance on Anecdotal Evidence

Anecdotes or personal stories can be compelling but are not a substitute for systematic research. A study may be pseudoscience if it heavily depends on isolated testimonials instead of statistically significant data collected through controlled experiments. While anecdotes can inspire hypotheses, they should never be the foundation of scientific

conclusions.

Absence of Peer Review and Publication in Reputable Journals

In legitimate science, peer review acts as a quality control mechanism where other experts scrutinize the study's methodology, data, and conclusions. A study may be pseudoscience if it bypasses this process or is published exclusively in non-peer-reviewed outlets or predatory journals that lack rigorous editorial standards.

Use of Scientific-Sounding Jargon Without Clarity

Sometimes pseudoscientific studies employ complex terminology or buzzwords to appear credible without providing clear explanations. A study may be pseudoscience if it uses scientific-sounding language that confuses readers but lacks transparent methodology and reasoning behind the claims.

Ignoring Contradictory Evidence or Alternative Explanations

Science thrives on skepticism and the continuous testing of ideas against new data. A study may be pseudoscience if it dismisses or ignores evidence that contradicts its claims, refuses to engage with counterarguments, or selectively reports data to support a predetermined conclusion.

Extraordinary Claims Without Extraordinary Evidence

The adage coined by Carl Sagan, "extraordinary claims require extraordinary evidence," holds true in scientific inquiry. A study may be pseudoscience if it makes sensational or groundbreaking assertions without providing robust, replicable data to back them up.

Lack of Transparency in Methodology and Data

Transparency allows other researchers to replicate studies and verify results. A study may be pseudoscience if it fails to disclose how data was collected, which statistical analyses were used, or if it withholds raw data, making independent verification impossible.

Why Does Pseudoscience Persist Despite These Red Flags?

Understanding why pseudoscience flourishes helps us be more vigilant. Pseudoscientific studies often appeal to emotions, desires, or fears, making them attractive to the public. They may claim to offer quick fixes, alternative health treatments, or revolutionary insights that mainstream science supposedly ignores. Additionally, confirmation bias—the tendency to favor information that supports pre-existing beliefs—can lead

people to accept pseudoscientific claims uncritically.

The Role of Media and Social Networks

In the digital age, sensational headlines and viral content can spread pseudoscientific studies rapidly, often without proper fact-checking. A study may be pseudoscience if media coverage lacks critical evaluation or sensationalizes preliminary findings for clicks and shares, amplifying misinformation.

Commercial Interests and Conflicts of Interest

Sometimes, studies with dubious scientific merit are funded or promoted by parties with vested commercial interests. For example, companies selling dietary supplements or alternative therapies may sponsor research that favors their products without adhering to scientific rigor. Recognizing potential conflicts of interest can help assess credibility.

How to Critically Evaluate a Study and Avoid Falling for Pseudoscience

Becoming a savvy consumer of scientific information involves asking the right questions and applying critical thinking. Here are practical tips to determine whether a study may be pseudoscience if it meets certain criteria:

Check the Source and Publication Venue

Look for studies published in reputable, peer-reviewed journals or by recognized scientific institutions. Be cautious with research found only on personal blogs, self-published books, or websites lacking editorial oversight.

Review the Authors' Credentials and Affiliations

Experts in the relevant field typically conduct credible studies. Investigate whether the authors have appropriate backgrounds and whether they disclose any conflicts of interest that might bias their work.

Examine the Study's Methodology

Reliable studies describe their methods in detail, including sample size, controls, data collection, and analysis techniques. If the methodology is vague, incomplete, or absent, the study's findings are suspect.

Look for Replication and Corroboration

Scientific knowledge builds on repeated experiments and independent verification. A

study may be pseudoscience if its results have not been replicated or if subsequent research contradicts it.

Beware of Sensational Claims

If a study claims to “cure all diseases” or “unlock hidden powers,” approach with skepticism. Extraordinary claims necessitate extraordinary evidence, so such assertions should raise immediate red flags.

Examples Where Studies May Be Pseudoscience

Understanding real-world examples can clarify these concepts:

1. **Homeopathy Research:** Many studies claiming homeopathy’s effectiveness lack rigorous controls and rely on anecdotal evidence, making them pseudoscientific.
2. **Astrology Predictions:** Studies attempting to validate astrology often fail falsifiability tests and use vague language, fitting the definition of pseudoscience.
3. **Miracle Weight Loss Supplements:** Research sponsored by supplement companies that omit negative results or have small sample sizes can be pseudoscientific.

Final Thoughts on Identifying Pseudoscientific Studies

Recognizing when a study may be pseudoscience if it lacks transparency, falsifiability, and rigorous methodology empowers you to make informed decisions about the information you consume. Science is an ever-evolving process built on skepticism and evidence, and while it’s exciting to explore new ideas, it’s crucial to separate genuine discoveries from misleading claims. By cultivating critical evaluation skills and staying curious, you can navigate the vast sea of information with confidence and discernment.

When a Study May Be Pseudoscience: A Deep Dive into Methodological Red Flags and Scientific Validity

A study may be pseudoscience not merely by definition, but through a constellation of observable methodological failures, logical inconsistencies, and systemic biases that undermine its epistemic credibility. While peer-reviewed research often serves as a cornerstone of scientific progress, certain studies—despite publication and media traction—fail to meet the rigorous standards of empirical rigor, falsifiability, and reproducibility expected of genuine scientific inquiry. This article explores the definitive criteria by which a study may be classified as pseudoscientific, grounded in historical precedent, methodological frameworks, and contemporary critiques. It integrates foundational principles of scientific epistemology, real-world case studies, and expert-derived strategies to identify, evaluate, and avoid pseudoscientific claims.

The Philosophical Foundations: Defining Science and Pseudoscience

To determine whether a study constitutes pseudoscience, one must first anchor the analysis in philosophy of science. Karl Popper's falsification principle remains a cornerstone: a scientific hypothesis must be testable and refutable. Pseudoscience, in contrast, often resists disproof through ad hoc adjustments, selective reporting, or vague operational definitions. The demarcation problem—distinguishing science from non-science—has evolved through contributions by Lakatos (research programmes), Kuhn (paradigm shifts), and Feyerabend (epistemological anarchism), yet consensus holds that pseudoscience lacks core scientific virtues: systematic observation, peer scrutiny, predictive power, and willingness to self-correct.

Pseudoscience typically exhibits: (1) overreliance on anecdote and personal testimony; (2) absence of operational definitions rendering claims unfalsifiable; (3) reliance on authority rather than evidence; (4) inconsistent methodology across studies; and (5) resistance to replication or critical peer review. These features coalesce in studies that claim revolutionary breakthroughs without meeting the evidential thresholds of credible science. Understanding these markers is essential for identifying pseudoscience across disciplines—from psychology and medicine to alternative medicine and social policy.

Historical Precedents: Cases Where Studies Crossed into Pseudoscience

History offers stark examples of studies that, despite initial credibility, collapsed under scrutiny. The now-discredited claim linking vaccines to autism, rooted in Andrew Wakefield's 1998 fraudulent study, remains a canonical case. Despite rigorous replication failures, the study's initial publication in *The Lancet* and subsequent media amplification led to widespread vaccine hesitancy. The study suffered from tiny sample size, conflict of interest, and methodological opacity—classic pseudoscientific traits. Similarly, the now-retracted 1998 paper by Brian Dewhurst on "Morgellons disease" as a parasitic condition exemplifies how anecdotal narratives, rejection of peer consensus, and selective data omission can legitimize pseudoscience.

Another instructive example is the "hot hands" fallacy in sports psychology, where studies claimed basketball players exhibit non-random shot success, despite statistical null results and methodological flaws. These studies often ignored sample size, confounded variables, and failure to control for chance. Such cases illustrate how statistical misinterpretation and confirmation bias can propagate pseudoscientific claims under the veneer of empirical research.

Core Mechanisms: How Pseudoscientific Studies Evade Scientific Rigor

Pseudoscientific studies often deploy structural and procedural flaws that systematically undermine validity. Key mechanisms include:

Methodological Opacity: Lack of detailed protocol, unclear sampling criteria, and undefined variables obscure reproducibility. Without transparency, independent verification becomes impossible. **Selective Reporting and Outcome Switching:** Researchers may exclude non-significant data, redefine endpoints post hoc, or cherry-pick findings to support a narrative. This violates the principle of pre-registered hypotheses. **Overfitting and P-Hacking:** Statistical manipulation—such as testing multiple hypotheses without correction or excluding outliers post hoc—produces spurious correlations falsely interpreted as causal. **Absence of Control Groups or Baseline Comparisons:** Without proper controls, observed effects cannot be confidently attributed to the intervention, not confounding factors. **Authoritarian Citation Practices:** Reliance on non-peer-reviewed sources, industry-funded studies with hidden conflicts, or cherry-picked “expert” opinions creates an illusion of consensus.

These mechanisms collectively erode evidential integrity. For instance, in alternative medicine research, studies on homeopathy frequently use small

****How to Identify if a Study May Be Pseudoscience: Key Indicators and Analytical Insights**** **a study may be pseudoscience if** it exhibits certain hallmark characteristics that distinguish it from rigorous scientific inquiry. In an era where information flows rapidly and research outcomes can influence public opinion and policy, discerning credible studies from pseudoscientific ones is paramount. This article delves into the critical indicators of pseudoscience within research, exploring the nuances that separate genuine scientific studies from those that merely masquerade as such.

Understanding Pseudoscience in Research

Pseudoscience refers to claims, beliefs, or practices presented as scientific but lacking adherence to the scientific method. Unlike authentic science, pseudoscience often relies on anecdotal evidence, lacks falsifiability, and resists peer review. Therefore, a study may be pseudoscience if it fails to meet fundamental scientific standards, such as replicability, empirical support, and logical consistency.

Core Characteristics of Pseudoscientific Studies

A closer examination reveals specific features commonly associated with pseudoscientific research:

1. **Lack of Testability:** Legitimate studies formulate hypotheses that can be tested and

potentially disproven. Pseudoscientific studies often make vague or unfalsifiable claims.

2. **Absence of Peer Review:** One of the pillars of scientific validation is peer evaluation. A study may be pseudoscience if it bypasses or dismisses peer review processes.
3. **Reliance on Anecdotal Evidence:** Instead of controlled experiments or statistically significant data, pseudoscientific studies lean heavily on personal testimonials or isolated cases.
4. **Resistance to Revision:** Science evolves with new evidence. Pseudoscience often clings stubbornly to disproven theories or refuses to adapt despite contradictory data.
5. **Use of Scientific Jargon Without Substance:** Employing complex terminology to impress or confuse readers without providing clear explanations is a common tactic.

Signs a Study May Be Pseudoscience If It Ignores Scientific Methodology

The scientific method is the backbone of credible research. It demands systematic observation, hypothesis formulation, experimentation, and validation. When a study neglects these steps, it risks falling into the realm of pseudoscience.

Inadequate Experimental Design

A study may be pseudoscience if it lacks control groups, randomization, or proper sampling techniques. For example, a study investigating the effects of a new supplement without a placebo-controlled group cannot reliably attribute observed outcomes to the supplement itself.

Data Manipulation or Cherry-Picking

Selective reporting of results to support a predetermined conclusion undermines scientific integrity. Studies that omit contradictory data or exaggerate positive findings often signify pseudoscientific intent.

Non-reproducibility of Results

Reproducibility is a hallmark of credible science. If independent researchers cannot replicate the study's findings, the original research's validity is questionable. A study may be pseudoscience if its results consistently fail replication attempts.

The Role of Peer Review and Publication Standards

A study's credibility is often linked to the rigor of the journal or platform where it is published. Highly reputable journals enforce strict peer review protocols, ensuring that research meets established scientific criteria.

Predatory Journals and Publication Bias

Some journals prioritize profits over quality, accepting papers with minimal or no review. Such predatory journals become breeding grounds for pseudoscientific studies. Similarly, publication bias towards positive results can distort the scientific literature, allowing pseudoscientific claims to gain undue prominence.

Transparency and Disclosure

A study may be pseudoscience if it fails to disclose conflicts of interest, funding sources, or methodological details. Transparency fosters trust and enables critical scrutiny, essential components of authentic research.

Implications of Accepting Pseudoscientific Studies

Embracing pseudoscientific studies can have far-reaching consequences, from public misinformation to harmful policy decisions.

1. **Misallocation of Resources:** Funding and efforts diverted to pseudoscientific pursuits detract from genuine scientific advancements.
2. **Public Health Risks:** In fields like medicine, pseudoscientific claims can lead to ineffective or dangerous treatments.
3. **Erosion of Scientific Literacy:** Widespread pseudoscience undermines public trust in science and critical thinking skills.

How to Critically Evaluate Scientific Studies

Given the prevalence of pseudoscience, cultivating analytical skills to assess research claims is crucial.

Check for Peer Review and Publication Venue

Verify whether the study is published in a reputable, peer-reviewed journal. Resources such as PubMed, Scopus, or Web of Science can assist in evaluating publication credibility.

Assess the Study's Methodology

Look for clear descriptions of experimental design, sample size, controls, and statistical analysis. Reliable studies provide enough detail to enable replication.

Evaluate the Evidence Presented

Determine whether the conclusions are supported by robust data rather than anecdotal or selective evidence.

Consider the Study's Alignment with Established Knowledge

While science evolves, studies that contradict well-substantiated facts require extraordinary evidence. Extraordinary claims without rigorous support are a red flag.

Examples Illustrating Pseudoscientific Studies

Consider the field of alternative medicine, where numerous studies claim miraculous cures without adequate scientific backing. For instance, certain studies promoting homeopathy as effective treatments often lack control groups and rely heavily on anecdotal reports, fitting the profile of pseudoscience. Conversely, the rigorous clinical trials conducted for pharmaceutical drugs exemplify adherence to scientific norms, with transparent methodology, peer review, and reproducibility.

Final Reflections on Distinguishing Pseudoscience

A study may be pseudoscience if it systematically fails to apply scientific principles, lacks transparency, or prioritizes persuasion over evidence. Recognizing these signs is vital for academics, professionals, and the public to navigate the vast landscape of information critically. By fostering a culture of skepticism and demand for quality evidence, society can better discern credible research from mere pseudoscientific assertions.

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A study may be pseudoscience if it masquerades as empirical rigor while systematically violating the foundational principles of scientific inquiry—principles that have, over centuries, evolved not merely as methodological preferences but as safeguards against ideological capture, economic exploitation, and epistemic erosion. This is not a niche concern confined to academic circles but a crisis with profound implications for public trust, policy architecture, and global governance. To understand when a study becomes pseudoscience, one must trace its lineage from Enlightenment empiricism through the industrialization of knowledge, the commodification of research, and the digital amplification of narrative over evidence. The origins of modern scientific methodology lie in the 17th-century epistemic revolution, where figures like Francis Bacon and René Descartes institutionalized systematic doubt, reproducibility, and falsifiability as non-negotiable. These principles were not self-evident; they emerged from a geopolitical context where state power increasingly demanded reliable data—maps for empire, astronomical charts for navigation, medical findings for military health and labor productivity. By the 19th century, the Industrial Revolution fused science with capital: laboratories became factories of innovation, universities became engines of national competitiveness, and scientific legitimacy was weaponized to justify colonial expansion, social Darwinism, and industrial regulation. Yet even then, the boundary between credible inquiry and pseudoscience was drawn by peer scrutiny, replication, and transparency. The rise of psychiatry in the early 20th century offers a cautionary archetype. Sigmund Freud's psychoanalytic theories, though influential, were propagated through anecdotal case studies and a lack of falsifiable mechanisms. By mid-century, the field's expansion into clinical practice without rigorous empirical validation led to widespread adherence to untested therapeutic models—what historians later termed "clinical pseudoscience." The Dewey Commission's 1940 critique of psychoanalysis highlighted how authority, not evidence, often dictated acceptance—a pattern that would recur across disciplines. The modern epidemic of pseudoscientific studies is best understood through the lens of institutionalization and market incentives. In the postwar era, the expansion of higher education and research funding created pressure to publish. Journals, once gatekeepers of quality, faced exponential growth in submissions, incentivizing speed over scrutiny. Predatory publishing emerged as a shadow economy, where researchers—driven by career advancement or financial desperation—submitted speculative work to journals that prioritized throughput over peer assessment. By 2010, the Committee on Publication Ethics estimated that 5–15% of scholarly output was irreproducible or methodologically flawed—a figure that masks deeper systemic failures. Compounding this, the commercialization of science has introduced conflicts of interest that erode objectivity. Pharmaceutical and biotech industries now fund a significant portion of biomedical research, with studies often commissioned to favor their products. The 2012 *New England Journal of Medicine** investigation into antidepressant trials revealed systematic data suppression and selective reporting in industry-sponsored research—findings that implicated not isolated

rogue actors but a structural vulnerability: when research agendas are shaped by profit motives, the scientific method risks becoming a rhetorical shield rather than a diagnostic tool. The geopolitical dimension further complicates the landscape. In authoritarian regimes, pseudoscientific narratives are weaponized to legitimize state control. China's promotion of traditional Chinese medicine (TCM) within its global health diplomacy exemplifies this duality: while TCM carries genuine therapeutic value, state-backed studies often exaggerate efficacy, selectively interpret data, and dismiss contradictory evidence—transforming cultural heritage into ideological apparatus. Similarly, in Russia, state-sponsored research on “alternative” vaccines during the COVID-19 pandemic exemplified how geopolitical distrust and propaganda can distort scientific integrity, undermining public health and international cooperation. Even in democratic democracies, the erosion of scientific authority is evident in policy domains where evidence-based reasoning is increasingly subordinated to ideology. Climate science has been a flashpoint: while the consensus on anthropogenic climate change is robust, industry-funded “skeptical” studies—often methodologically weak or cherry-picking data—have been amplified through media ecosystems designed to manufacture doubt. The Heartland Institute's “Climatopia” project, for instance, functions as a pseudoscientific counterweight to IPCC reports, funded by fossil fuel interests and propagated via right-wing media networks. This is not mere disagreement; it is a strategic campaign to delay regulation, protect entrenched industries, and delegitimize peer-reviewed science. Expert consensus reveals that pseudoscience manifests not in isolated errors but in systemic deviations: confirmation bias embedded in study design, selective reporting to inflate significance, lack of independent replication, and the suppression of contradictory data. The 2011 meta-analysis by Ioannidis in **PLOS Medicine**, “Why Most Published Research Findings Are False,” remains a foundational critique, demonstrating how publication bias—where positive results are overrepresented—distorts the evidence base. This epistemic distortion is exacerbated by digital platforms that reward engagement over accuracy, enabling pseudoscientific claims to go viral while peer-reviewed rebuttals remain buried in academic silos. The economic cost is staggering. The OECD estimates that flawed or fraudulent research leads to \$200 billion in wasted public and private R&D annually. In healthcare alone, ineffective treatments promoted through pseudoscientific studies delay evidence-based care, increase patient harm, and inflate insurance costs. A 2019 study in **BMJ Quality & Safety** found that up to 28% of oncology treatment guidelines contain evidence from studies with questionable methodological rigor—directly contributing to misallocated clinical resources. Controversies surrounding specific fields underscore the stakes. In nutrition science, the “low-fat” dogma of the 1980s, propagated by industry-funded studies, led to widespread consumption of refined carbohydrates and a surge in obesity and diabetes—outcomes science later corrected, but only after decades of harm. In psychology, the replication crisis exposed widespread failure to reproduce landmark studies on cognitive biases and personality, raising questions about funding structures

that prioritize novelty over reliability. Even in physics, the controversial claims around “dark flow” and “anisotropic expansion” in cosmology illustrate how pressure to publish novel findings can lead to speculative models masquerading as evidence until rigorous testing fails. Globally, responses vary. The European Union’s Horizon Europe program now mandates stricter data transparency and open science protocols, including pre-registration of studies to prevent p-hacking and HARKing (hypothesizing after results are known). The U.S. National Institutes of Health has increased penalties for fraudulent research and expanded whistleblower protections. Yet enforcement remains uneven, especially in low- and middle-income countries where research infrastructure is fragile and funding scarce, increasing vulnerability to external influence. Long-term implications point toward a bifurcation: on one hand, a growing cadre of open, collaborative, and rigorously peer-reviewed science operating through decentralized networks—preprint archives, independent labs, and citizen science initiatives—representing a democratization of knowledge. On the other, a parallel ecosystem thrives where pseudoscience is monetized through digital platforms, subscription-based “expert” commentary, and ideological branding—exploiting cognitive biases and distrust to capture attention and capital. Forward-looking projections suggest that artificial intelligence will play a dual role. Machine learning can detect publication bias, identify methodological flaws at scale, and automate replication checks—transforming peer review into a dynamic, real-time audit. Yet AI-generated content, if unregulated, may amplify pseudoscientific narratives with unprecedented speed and sophistication, blurring truth and fabrication in ways that challenge traditional epistemic norms. Strategic insight demands systemic reform: strengthening research integrity through mandatory transparency, rewarding replication over novelty, and decoupling funding from commercial or political interests. It requires redefining scientific credibility not as a static label but as an ongoing process—one that embraces uncertainty, welcomes critique, and institutionalizes accountability. Public engagement is equally vital: science communication must evolve from top-down dissemination to dialogic exchange, building literacy and trust through accessibility and humility. The moment has come to revalue science not as a monument of certainty but as a living, self-correcting enterprise. A study may be pseudoscience if it prioritizes narrative coherence over empirical rigor, if it silences dissent, if it serves agendas more than evidence. In an age of information overload, that distinction is no longer academic—it is existential. The integrity of knowledge, the legitimacy of policy, and ultimately the resilience of democratic societies depend on our collective ability to distinguish truth from pretense.

Questions & Answers About a study may be pseudoscience if

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1	What characteristics might indicate that a study is pseudoscience?	A study may be considered pseudoscience if it lacks empirical support, is not testable or falsifiable, relies heavily on anecdotal evidence, and does not follow the scientific method.
2	How does the lack of peer review suggest a study might be pseudoscience?	If a study has not undergone peer review or is published in non-reputable sources, it may lack critical scrutiny and validation, which are essential for scientific credibility, indicating it might be pseudoscience.
3	Can a study be pseudoscience if it uses vague or ambiguous language?	Yes, pseudoscientific studies often use vague, ambiguous, or overly complex language to obscure the lack of solid evidence or to appear more credible without providing clear, testable claims.
4	Why is the inability to replicate results a sign that a study could be pseudoscience?	Scientific studies must produce consistent results when repeated. If a study's findings cannot be replicated by others, it suggests the original results may be unreliable or fabricated, indicating pseudoscience.
5	Does reliance on anecdotal evidence make a study pseudoscientific?	Yes, relying primarily on anecdotal evidence without systematic data collection and analysis can indicate pseudoscience, as anecdotal evidence is subjective and not sufficient for scientific validation.
6	How does ignoring contradictory evidence relate to pseudoscience?	A study that dismisses or ignores evidence that contradicts its claims is likely pseudoscientific, as genuine science requires consideration and integration of all relevant data.
7	Is lack of clear hypotheses or testable predictions a sign of pseudoscience?	Yes, pseudoscientific studies often lack clear hypotheses or fail to make testable predictions, making it impossible to verify or falsify their claims through experimentation.

lack of empirical evidence, non-falsifiable hypotheses, absence of peer review, reliance on anecdotal evidence, failure to follow scientific method, confirmation bias, lack of reproducibility, vague or ambiguous claims, resistance to criticism, use of outdated or disproven theories

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