# A Guide to Spotting Bad Science

COMPOUND INTEREST

Evaluating the evidence behind a scientific claim is important, as is recognising flawed reporting or scientific studies. These points help separate the science from the pseudoscience, particularly for articles or studies making health or medical claims.

## 1. Sensationalised headlines

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Article headlines aim to get viewers to click on and read the article. They aren't always written by the person who wrote the main article. They might over-simplify research's findings and at worst, they can sensationalise and misrepresent them.

## 2. Misinterpreted results

News articles can distort or misinterpret the findings of research for the sake of a good story, whether intentionally or otherwise. If possible, try to read the original research, rather than relying solely on the article based on it for information.

## 3. Conflicts of interest

Many companies employ scientists to carry out and publish research – while this doesn't necessarily invalidate the research, it should be analysed with this in mind. Research might also be misrepresented for personal or financial gain.

## 4. Correlation and causation

Be wary of any confusion of correlation and causation. A correlation between variables doesn't always mean one causes the other. Global warming increased since the 1800s, and pirate numbers decreased, but lack of pirates doesn't cause global warming.

## 5. Unsupported conclusions

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Speculation can often help to drive science forward. However, studies should be clear on the facts their study proves, and which conclusions are as yet unsupported ones. A statement framed by speculative language may require further evidence to confirm.

## 6. Problems with sample size

In trials, the smaller a sample size, the lower the confidence in the results from that sample. Conclusions drawn can still be valid, and sometimes small samples can't be avoided, but larger samples often give more representative results.

## 7. Unrepresentative samples used

In human trials, participants are selected that are representative of a larger population. If the sample is different from the population as a whole, then the conclusions from the trial may be biased towards a particular outcome.

## 8. No control group used

In clinical trials, results from test subjects should be compared to a 'control group' not given the substance being tested. Groups should also be allocated randomly. In general experiments, a control test should be used where all variables are controlled.

## 9. No blind testing used

To try and prevent bias, subjects should not know if they are in the test or the control group. In 'double blind' testing, even researchers don't know which group subjects are in until after testing. Not that in some cases blind testing isn't always feasible or ethical.

## 10. Selective reporting of data

Also known as 'cherry picking', this involves selecting data from results which supports the conclusion of the research, while ignoring those that do not. If a research paper draws conclusions from a selection of its results, not all, it may be guilty of this.

## 11. Unreplicable results

Results should be replicable by independent research and tested over a wide range of conditions (where possible) to ensure they are consistent. Extraordinary claims require extraordinary evidence – that is, much more than one independent study!

## 12. Non-peer reviewed material

Peer review is a process where other scientists review and critique studies before they are published in a journal. Research that has not gone through this process may have flaws, but the process is not perfect and peer review alone does not make research irrefutable.