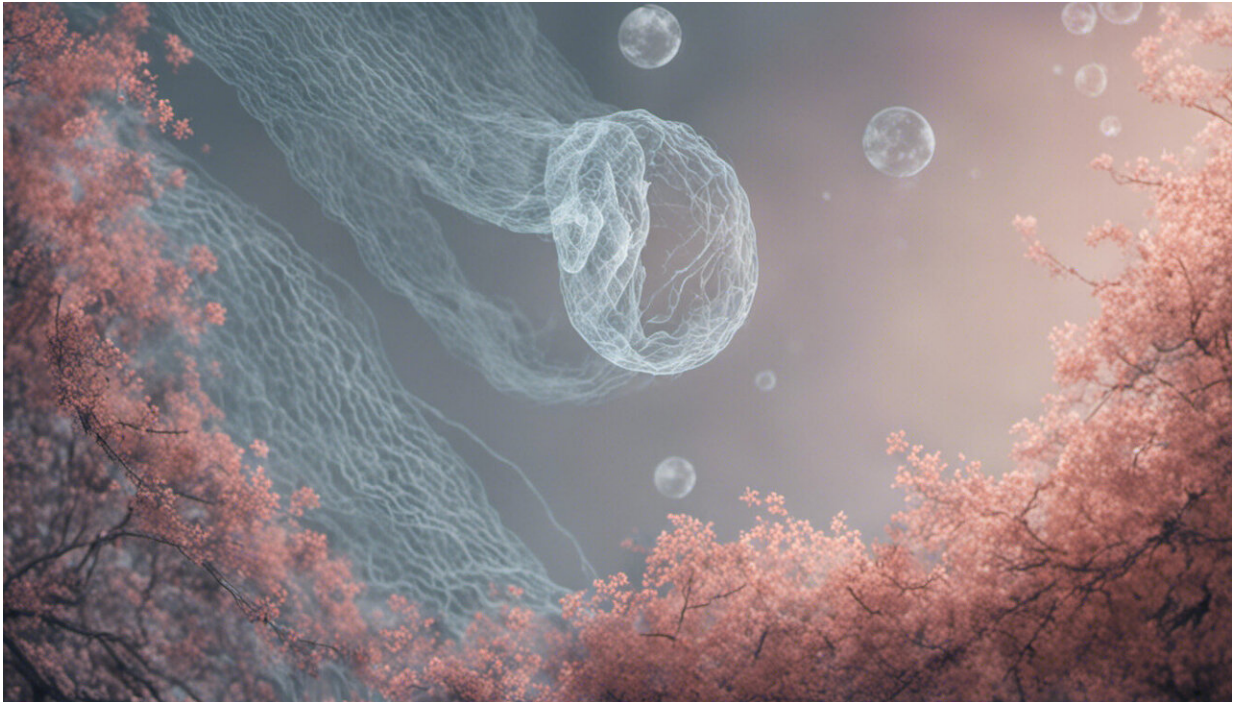


# Five questions about open science answered

May 30 2017, by Elizabeth Gilbert, Katie Corker

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## What is "open science"?

[Open science](#) is a set of practices designed to make scientific processes and results more transparent and accessible to people outside the research team. It includes making complete research [materials](#), [data](#) and lab procedures freely available online to anyone. Many scientists are also proponents of [open access](#), a parallel movement involving making

research articles available to read without a subscription or access fee.

## **Why are researchers interested in open science? What problems does it aim to address?**

Recent research finds that many published scientific findings might not be reliable. For example, researchers have reported being able to replicate [only 40 percent or less](#) of [cancer biology results](#), and a large-scale [attempt to replicate 100 recent psychology studies](#) successfully reproduced fewer than half of the original results.

This has come to be called a "reproducibility crisis." It's pushed many scientists to look for ways to improve their research practices and increase study reliability. Practicing open science is one way to do so. When scientists share their underlying materials and data, other scientists can more easily evaluate and attempt to replicate them.

Also, open science can help speed scientific discovery. When scientists share their materials and data, others can use and analyze them in new ways, potentially leading to new discoveries. Some journals are specifically dedicated to publishing [data sets](#) for reuse ([Scientific Data](#); [Journal of Open Psychology Data](#)). [A paper in the latter](#) has already been cited 17 times in under three years – nearly all these citations represent [new discoveries](#), sometimes on topics unrelated to the original research.

## **Wait – open science sounds just like the way I learned in school that science works. How can this be new?**

Under the status quo, science is shared through a single vehicle: Researchers publish journal articles summarizing their studies' methods and results. The key word here is summary; to write a clear and succinct article, important details may be omitted. Journal articles are vetted via

the peer review process, in which an editor and a few experts assess them for quality before publication. But – perhaps surprisingly – the primary data and materials underlying the article are almost never reviewed.

Historically, this made some sense because journal pages were limited, and storing and sharing materials and data were difficult. But with computers and the internet, it's much easier to practice open science. It's now feasible to store large quantities of information on personal computers, and [online repositories to share study materials and data](#) are becoming more common. Recently, some journals have even begun to [require](#) or [reward open science practices](#) like publicly posting materials and data.

There are still some difficulties sharing extremely large data sets and physical materials (such as the specific liquid solutions a chemist might use), and some scientists might have good reasons to keep some information private (for instance, trade secrets or study participants' personal information). But as time passes, more and more scientists will likely practice open science. And, in turn, science will improve.

Some do view the open science movement as a return to science's core values. Most researchers over time have [valued transparency](#) as a key ingredient in evaluating the truth of a claim. Now with technology's help it is much easier to share everything.

## **Why isn't open science the default? What incentives work against open science practices?**

Two major forces work against adoption of open science practices: habits and reward structures. First, most established researchers have been practicing closed science for years, even decades, and changing

these old habits requires some upfront time and effort. [Technology](#) is helping speed this process of adopting open habits, but behavioral change is hard.

Second, scientists, like other humans, tend to repeat behaviors that are rewarded and avoid those that are punished. Journal editors have tended to favor publishing papers that tell a tidy story with perfectly clear results. This has led researchers to craft their papers to be free from blemish, omitting "failed" studies that don't clearly support their theories. But real data are often messy, so being fully transparent can open up researchers to critique.

Additionally, some researchers are afraid of being "scooped" – they worry someone will steal their idea and publish first. Or they fear that others will [unfairly benefit](#) from using shared data or materials without putting in as much effort.

Taken together, some researchers worry they will be punished for their openness and are skeptical that the perceived increase in workload that comes with adopting [open science](#) habits is needed and worthwhile. We believe [scientists](#) must continue to [develop systems](#) to [allay fears](#) and reward openness.

## **I'm not a scientist; why should I care?**

Science benefits everyone. If you're reading this article now on a computer, or have ever benefited from an antibiotic, or kicked a bad habit following a psychologist's advice, then you are a consumer of science. Open science (and its cousin, [open access](#)) means that anyone – including teachers, policymakers, journalists and other nonscientists – can access and evaluate study information.

Considering automatic enrollment in a 401k at work or whether to have

that elective screening procedure at the doctor? Want to ensure your tax dollars are spent on policies and programs that actually work? Access to high-quality research evidence matters to you. Open materials and open data facilitate reuse of scientific products, increasing the value of every tax dollar invested. Improving [science](#)'s reliability and speed benefits us all.

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