

## 6 Judging Research in the Doors of Irreproducibility Crisis Era

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*“Numbers do not exist outside our brains, and even there, inside, they only exist at the conceptual level, and not at the physiological level. In the real world we can see 3 books, in a fictional universe we could see 3 UFOs. But who ever saw a 3, a simple 3?”*  
Mario Bunge [1]

Researchers, since the beginning of their careers have been focussing their attention on a particular number,  $0.05$ . The desired threshold of statistical significance. Several millions of published research articles rely on the capability of this number, to support their conclusions. Interestingly, such statistical measures have little to say about the reproducibility of the reported findings [2]. This fact may raise questions about how research should be judged and how researchers should be evaluated, given that reproducibility is key for the scientific method, and it seems that it is in crisis.

In 2015, the Open Science Collaboration reported an attempt to replicate about 100 experiments published in three academic psychology journals. The results of this attempt of replication showed that only 36% of the studies remained significant after a replication trial [3].

Furthermore, there is a continuous debate about the reliability of the research in the medical field. Begley and Ellis reported that oncologists have a low reproducibility rate of 11% [4]. However, these results are not limited to the field of psychology or medical sciences. According to Monya Baker, 90% of a sample of 1576 researchers from different fields, referred that there is a crisis of reproducibility in science. As well, 70% of them also affirmed that they did not succeed to reproduce the results reported by their peers [5].

Such numbers support the idea that there is a reproducibility crisis undergoing in modern science.

There are a number of reasons of why there is such a widespread inability to reproduce experimental results. In the second part of this essay, I will describe how the way research is judged and the way researchers are rewarded since their very early stage, represent an important cause of such reproducibility crisis.



Figure 1. Bunge's nightmare.

### The “publish or perish” culture

The pressure to publish the greatest amount of content is not an abstract or undeclared force; it is direct and explicit. A minimum or desirable number of publications per year are established in research departments throughout the academic world. Following such recommendations are fundamental to keep a position on academia and build an academic reputation.

Consequently, as any other system based on quotas, some people try to find a “the shortest way” to the goal. Some attach their names to work with which they have little to do. Moreover, this phenomenon has given rise to predatory journals that are willing to publish any article, regardless of the rigor with which the research was conducted, with the sole condition of covering the payment. In the worst case, some researchers have come to falsify their data to obtain a result that is publishable.

The rise of predatory journal, can even be considered as a crisis by itself, but it is important to consider it as an extension of the original problem. The popularity of such predatory journals, as a solution to publish as many articles as necessary, implies ethical issues, such as the misuse of founding to pay such publications fees. The articles published in predatory journals become unlikely to be used to build the background of future research.

This phenomenon was investigated by Bagues and colleagues. They found that only 38% of these journals have published at least 5 articles that have received at least 5 citations in a period of 5 years, even after including self-citations [6]!

It seems that as many other crises, the reproducibility crisis, has as a common root the incentives that have been established for researched. Despite the fact that

such system have a reasonable justification, it seems that it has a limit, perhaps the 30 million citations (until July 25th, 2019) in PUBMED, could be though as such limit.

Therefore, it is necessary to modify the way research is evaluated, for instance, by requesting more solid statistic treatment of the data, upgrading the statistical threshold, or requesting a complementary approach to frequentist statistics, such as Bayesian statistic approach. Nonetheless, as researchers are in the center of research, and not the other way around, the scientific community should propose a more collaborative approach and long term goals, therefore, the yearly productivity, would no be longer the center of attention of researchers.

Consequently, researchers will have the time to work and lately, report, probably under the name of relatively big groups of researchers, studies that already show a high level of replicability and clinical relevance; in such scenario, the number 0.05 will lose its *magic power*.

In conclusion, there is a crisis of replication in science. And this is caused, at least in part, by the publishing pressure, which way is paved by the system of research reward.

There are different methodological alternatives to solve the reproducibility issue, but the key step is to recognize the deficiencies on the current system and to train future researchers with high ethical standards, in order to use their potential to solve real world problems. As the Noble Laurate Françoise Barré-Sinoussi said. “We are not making science for science. We are making science for the benefit of humanity.”

## References

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