A scientific galaxy lacking replications: on Ioannidis' "In scientific method we don't just trust or why replication has more value than discovery"

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A scientific galaxy lacking replications: On Ioannidis' in scientific method, we do not just trust or why replication has more value than discovery

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Abstract

In this article, I examine and outline a recent lecture at the US National Institutes of by Dr. Ioannidis. In his talk, he argues for the importance of reproducibility in science and emphasizes the immense value of replication over discovery. In his words, in most scientific disciplines, a discovery without replication is a boring nuisance. Also at the conference, Dr. Ioannidis proposes twelve families of solutions to increase the proportion of real research results.

In a recent lecture, Dr Ioannidis shows a statistical graphical model of a cloud of points that includes 20 million papers, 2 million patents, 200.000 disciplines of science from the last 16 years (Ioannidis 2019). This model could be thought of as a galaxy, supporting the idea, which he mentions, that science is a community effort and that no single article could compete with its environment or with science in general.

Ioannidis maintains that this universe has a lot of dark matter. However, what are these empty spaces or black holes made off? These are articles that were written but not published or data that is not available: it was once accessible but then lost. Also, and this is what Ioannidis is interested in emphasizing, empty spaces are made of replicas of studies that were not done because it was thought that it was not necessary; that what was necessary was to investigate, to discover, and not to replicate.

Therefore, how can we expand that universe full of papers we call science? Ioannidis points out that, erroneously, this question has been answered with emphasis on discoveries. Unfortunately, this supposes encouraging a false narrative. This narrative of an oversupply of great and true discoveries is currently unstable. While this approach coexists with certain additional impulses, such as urgency for patients not to die or that replication is a waste of time, he argues that they do not have good results.

Many discoveries have negative scientific value because they have effects that are false negatives. The false negative is the result of a test that indicates that a person does not have a certain disease or condition when in fact, he has it or that a certain pattern is not fulfilled when he actually does.

Ioannidis explains how empirical studies in fields where replication practices are standard (such as genetic epidemiology) suggest that most of the statistically significant effects initially stated are false positives or substantially exaggerated. That is to say, the repetition of the studies, under the same conditions under which they were originally performed, is even more crucial than the supposed discovery, which may ultimately be false (and we will only know this if we replicate it).

He reviews the case of neurological tests with animals that later do not succeed in humans. Someone could argue that this failure is because the genome of animals is very different from that of humans. However, Ioannidis rejects this explanation. Instead, he argues that the cause of the failure is the number of significant biases involved. Once the biases are discarded, only a minimal number of pieces of evidence are valid.

Therefore, the weight of replication is crucial. However, what do we mean by replication or reproducibility? What is the reproducibility of research? Ioannidis distinguishes three main categories: the reproducibility of methods, the reproducibility of results and the reproducibility of inferences. The first is the ability to repeat, as accurately as possible, computational or experimental methods. The second means being able to repeat the study with new participants, new samples and new observations but that the results are as consistent and compatible as the original ones. Finally, the reproducibility of inferences supposes the possibility of comparing what can be inferred from the data resulting from the original study and the replicated study. Nevertheless, bias is a possible threat to all types of reproducibility. The biases change according to the size of the data and the discipline, but in any case, it is necessary to avoid them.

To this end, Ioannidis develops twelve families of solutions (see table 1).

Table 1.Twelve families of solutions for increasing the proportion of true research results

1- Large-scale collaboration research
2- Adoption of replication culture
3- Registration (of studies, protocols, analysis codes, datasets, raw data, and results)
4- Sharing (of data, protocols, materials, software and other tools)
5- Reproducibility practices
6- Containment of conflicted sponsors and authors

7- More appropiate statistical methods
8- Standardization of definitions and analyses
9- More stringent thresholds for claiming discoveries or successes
10- Improvement of study design standards
11- Improvements in peer review, reporting and dissemination of research.
12- Better training of scientific workforce in methods and statistical literacy

These families of solutions create a culture in which research data is shared. If this happens, then a better level of reproducibility can be achieved. Consequently, more research on research is needed. In A manifesto for reproducible science, published January 10, 2017, Ioannidis, among others, argues that an analysis estimates that 85% of biomedical research efforts are wasted, while 90% of those surveyed in a recent survey in Nature agreed that there is a reproducibility crisis. It also gives some possible concrete solutions to solve this crisis: Protecting against cognitive biases by blinding, improving methodological training, implementing independent methodological support, foster collaboration and team science,

Finally, Ioannidis concludes that discovery is an anomaly, an exception. Science becomes worthy above all because of replication. It will then be thanks to transparency, to the sharing of data and the recording of protocols that we can expand our scientific galaxy.

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Alahí Bianchini is a researcher in the Bioethics Program of FLACSO Argentina, a collaborative centre of PAHO/WHO. She works on theories of justice, human health research ethics and research integrity. She has a BA in Philosophy from the University of Buenos Aires. She participates in a research group at the University of Buenos Aires and teaches ethics at various universities. Her advisor is Dr Ignacio Mastroleo.