

What can and should it do?

The changing forms and expectations of peer review



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Essay

Why Most Published Research Findings Are False

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Summary

There is increasing concern that many current published research findings are false. The probability that a research finding is true may depend on study power and bias, the number of other studies on the same question, and, importantly, the ratio of true to no relationships among the relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; where there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance. Simulations show that for most studies designs and settings, it is more likely

nature

Vol 438 | 22/29 December 2005

SPECIAL REPORT

Korean scandal will have global fallout

The possibility that Woo Suk Hwang's cloning experiments were faked threatens to undermine confidence in stem-cell research.

In one of the biggest scientific scandals of recent times, South Korea's star cloner Woo Suk Hwang last week asked to retract his landmark paper on the creation of embryonic stem cells from adult human tissue. The request, along with new doubts about his earlier work, confirms what researchers in the field were already starting to realize — that the advance marked by Hwang's research, with all it promised for therapeutic cloning, may amount to nothing.

Worse, scientists fear that the episode will damage not only public perceptions of stem-

Hwang claimed to have extracted the first stem-cell line from a cloned human embryo (W. S. Hwang *et al. Science* 303, 1669–1674; 2004), figures supposedly showing cloned cell lines are identical to those in an earlier paper showing normal embryonic stem cells (J. H. Park *et al. Molecules and Cells* 17, 309–315; 2004). *Nature* has also announced an investigation into Hwang's paper on the first cloned dog (see 'Dogged by doubts', page 1059).

Hwang admitted on 16 December that there were errors in the 2005 stem-cell paper, but denied fraud. He maintains that 11 patient-





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Who's Afraid of Peer Review?

A spoof paper concocted by *Science* reveals little or no scrutiny at many open-access journals

On 4 July, good news arrived in the inbox of Ocorrafoo Cobange, a biologist at the Wassee Institute of Medicine in Asmara. It was the official letter of acceptance for a paper he had submitted 2 months earlier to the *Journal of Natural Pharmaceuticals*, describing the anticancer properties of a chemical that Cobange had extracted from a lichen.

In fact, it should have been promptly rejected. Any reviewer with more than a high-school knowledge of chemistry and the ability to understand a basic data plot should have spotted the paper's shortcomings immediately. Its experiments are so hopelessly flawed that the results are meaningless.

I know because I wrote the paper. Ocorrafoo Cobange does not exist, nor does the Wassee Institute of Medicine. Over the past 10 months, I have submitted 304 versions of the wonder drug paper to open-access journals. More than half of the journals accepted the paper, failing to notice its fatal flaws. Beyond that headline result,

subscriptions. Most of the players are murky. The identity and location of the journals' editors, as well as the financial workings of their publishers, are often purposefully obscured. But *Science's* investigation casts a powerful light. Internet Protocol (IP) address traces within the raw headers of e-mails sent by journal editors betray their locations. Invoices for publication fees reveal a network of bank accounts based mostly in the developing world. And the acceptances and rejections of the paper provide the first global snapshot of peer review across the open-access scientific enterprise.

One might have expected credible peer review at the *Journal of Natural Pharmaceuticals*. It describes itself as "a peer reviewed journal aiming to communicate high quality research articles, short communications, and reviews in the field of natural products with desired pharmacological activities." The editors and advisory board

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Pressing questions

- What does peer review aim to regulate?
- How is peer review structured?
- What responsibilities does it have? And what are its abilities?
- How did this develop over time?

Content

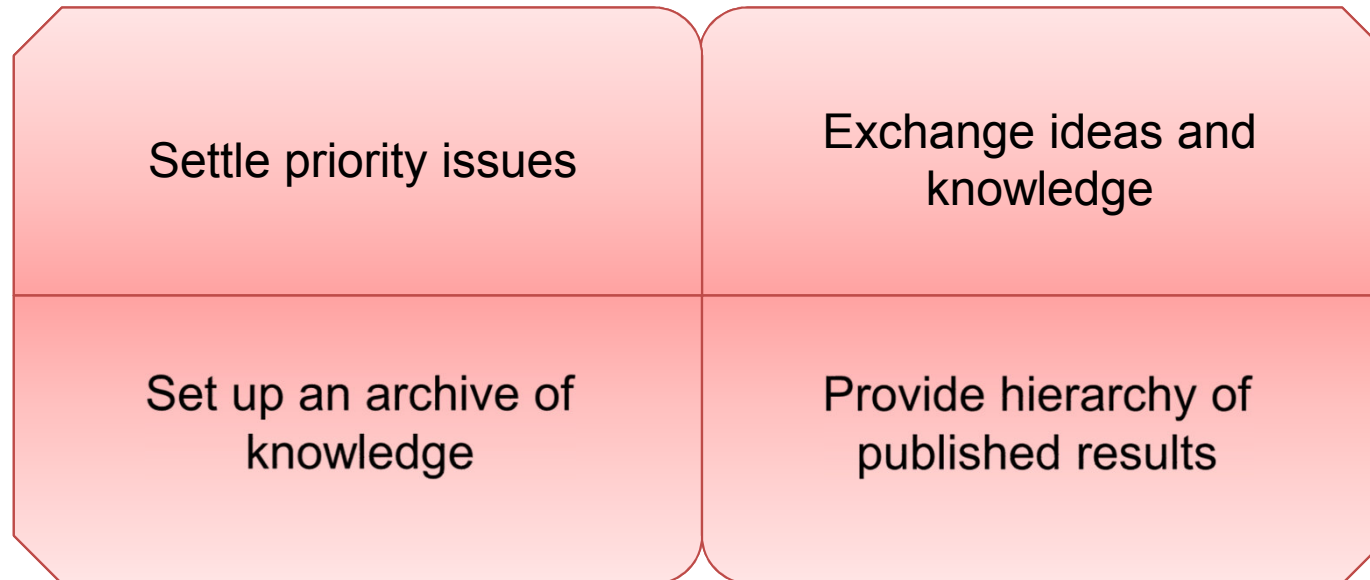
The functions of scientific publishing

The changing forms of peer review

The changing expectations of peer review

Current tensions

The functions of scientific publishing and academic journals



Peer review formats

Who is reviewing?

Single editor (peer? review)

→ Editorial committee

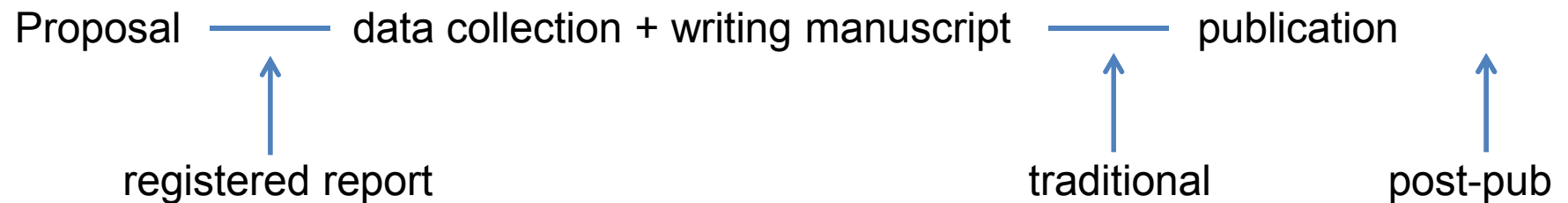
→ External reviewers (1890s – 1960s)

Anonymous or open?

→ Strategies to tackle bias and inequality:
Double-blind or (radically) open review

Peer review formats

When does review take place?



Assistance, cooperation and specialisation

Usage of IT-tools: plagiarism, image manipulation, references, ...

Commercial services and cooperation: badges for 'good science', cascading review

Statistics reviewers: additional reviewer or computer program

The changing formats of peer review

Differences between formats may be classified along four dimensions:

1. The relative timing of review in the publication process
2. The level of openness or anonymity
3. The level of specialisation and cooperation
4. The extent in which technological assistance is used

Preliminary survey results

Innovation is (very) slow:

- + Single blind, pre-publication review is still prevalent
- Open, post-publication, IT-assisted review nearly absent.
- Little registered reports, double blind review, cooperation, involvement of wider community

In general, editors report very little changes in their peer review model since 2000.

Expectations of peer review

What should it do?

1. Assure (and improve) quality – distinguishing ‘good’ from ‘bad’ science
2. Providing hierarchy of published results
3. Assure equal and fair opportunities
4. Detect fraudulent and erroneous research

“The peer review system was never designed to detect fraud”

‘Badges’ for valid research and integrity – New designs seem to be able to detect misconduct

Abilities and expectations: Future directions

- Peer review is increasingly diverse (but innovation is slow)
- Poorly researched, very little evidence on effectiveness
- Future/Current project: Inventory of peer review formats in wide range of journals: **Fill in the survey!**

