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On Open Access, Impact Factors and boycotting the top science journals: An interview with Randy Schekman

Nicole Skinner,^{1*} Lucía Sapiña,² Manuel Gil³

¹*Contributions to Science*, London, ²Observatory of the Two Cultures, *Mètode*, Valencia, ³*Mètode*, Valencia

***Corresponding author:**

Nicole Skinner
23 Highbury Place
N5 1QP London, UK
Tel. +44-7557857728

E-mail: nicoskinner@gmail.com

In October 2013, US cell biologist Randy W. Schekman (Saint Paul, Minnesota, USA, 1948) won the Nobel Prize in Physiology or Medicine together with James E. Rothman and Thomas C. Südhof, in recognition for their contributions to our understanding of the machinery regulating cell membrane vesicle traffic. In the same week the medals were awarded, Schekman expressed his highly critical views about the prevailing structures for publishing and rewarding science. Writing in *The Guardian*, he announced that the laboratory he runs at the University of California, Berkeley, would no longer send research papers to be published in three of the leading—and commonly regarded as the most prestigious—scientific journals, namely, *Cell*, *Nature*, and *Science* [14].

Basic science, “luxury journals”

Schekman can be considered one of the founding fathers of modern cell biology. Many of the basic premises governing this discipline, which we now take for granted, were established through the work carried out in his lab [3]. He received his PhD in 1975 from Stanford University, working on DNA replication under the direction of 1959 Nobel laureate Arthur Kornberg. The year after, he moved to the University of California, Berkeley [7]. There he began studying cells of the yeast *Saccharomyces cerevisiae* that had malfunctions in their cell transport system and demonstrated that these were caused by genetic defects. In doing so, he managed to dissect the mechanics of vesicle formation and explain how different genes regulate different aspects of cell transport. In other words, how molecules inside vesicles are delivered to the right place at the right time [7,10,11,19].

*Text by N. Skinner. Modified from an interview of R.W. Schekman by L. Sapiña and M. Gil at the University of Valencia, on 3 June 2014, in the context of the Excellency Meetings VLC/CAMPUS, and Schekman's participation as jury of the Rei Jaume I Awards, previously published in *Mètode*. [<http://metode.cat/en/Issues/Interview/Randy-Schekman>].

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Fig. 1. Randy W. Schekman, 2013 Nobel Prize in Physiology or Medicine. (©Miguel Lorenzo, Valencia)

Because nearly all of the vesicle traffic steps are encoded by highly-conserved genes, Schekman and colleagues' pioneering work led to the development of tools to study other types of cells. It turned out that some of the genes Schekman had discovered in yeast were also present in mammals, encoding the corresponding proteins and thus "revealing an ancient evolutionary origin of the transport system" [3,11]. As a result, according to the committee of the Dickson Prize in Medicine, an award he received in 2008, "it is nearly impossible to attend a large meeting in cell biology, biochemistry, genetics or molecular biology and not hear someone mention a homolog of one of the genes discovered by the Schekman lab" [3].

Schekman's scientific pursuits have resulted in the publication of over 250 papers, many of them in leading scientific journals (Fig. 1). However, he is not only well known for his research, but also—especially over the last few years—for his engagement in the Open Access movement. And he is using the newfound prominence that invariably comes alongside a Nobel Prize to urge the scientific community to reconsider where and how they choose to publish their most important research [9]. He wrote: "I have published in the big brands, including papers that won me a Nobel Prize. But no longer." And added: "Just as Wall Street needs to break the hold of bonus culture, so science must break the tyranny of the luxury journals" [14].

By "luxury journals" he is referring to certain leading academic journals that, in his opinion, have distorted how science and scientists operate by limiting publication to arti-

cially low numbers. Schekman's two main criticisms of such journals are as follows. First, he argues that, by following a print-based business model, journals such as *Cell*, *Nature*, and *Science* restrict the number of papers they accept. In the 21st century, with more and more research being made available, distributed, and read online, these limitations are fabricated and lack of space is a meaningless argument—but luxury journals know that scarcity fuels demand. However, Schekman compares their position to that of "fashion designers who create limited-edition handbags" and points out that their behavior contributes more to the selling of subscriptions than to the publishing of the best research [14].

This relates to his second denunciation, that science as a whole is being distorted by the incentives offered by the top journals. In particular, he criticizes the "Impact Factor" (IF), a widespread metric that measures a journal's quality by calculating how often recently published papers in that journal are cited on average. Originally designed by Eugene Garfield as a means to compare different journals within a certain field and help scientists choose where to publish [5, 6,18], the impact factor is now often used inappropriately, for example, to evaluate the quality or influence of individual pieces of research or to assess researchers [16]. Schekman argues that impact factors can introduce biases, for example, because "a paper can become highly cited because it is good science—or because it is eye-catching, provocative, or wrong" [14].

Furthermore, he adds that while luxury journals "publish many outstanding papers, they do not publish *only* outstand-

ing papers. Neither are they the only publishers of outstanding research” [14]. However, scientists remain under huge pressure, from universities, grant committees and funding agencies, to publish in these high-IF journals, and this, he believes, is corrupting the nature of scientific enquiry.

Accordingly, Schekman was one of the first signatories of the San Francisco Declaration on Research Assessment (DORA). Written during an Annual Meeting of the American Society for Cell Biology in December 2012, this set of recommendations represents a serious and determined initiative, championed by scientists and research institutions from around the world, that demands a change in the ways in which the output of scientific research is evaluated by funding agencies, academic institutions, and other parties [1].

Schekman also encourages scientists to make their research more accessible by publishing it online and by choosing Open Access journals [14] that are freely available for anyone to read (Fig. 2). A former editor-in-chief of the *Proceedings of the National Academy of Sciences of the USA* [19], Schekman is currently the founder and editor-in-chief of *eLife* [www.elifesciences.org]. This online, peer-reviewed, Open Access journal for biomedical and life sciences was founded in 2012 with sponsorship from the Howard Hughes Medical Institute (USA), the Max Planck Society (Germany), and the Wellcome Trust (UK). The journal tackles many of the criticisms Schekman makes of luxury journals: they are a unique, non-profit, researcher-driven initiative (thanks to the financial support of the three foundations backing the project); decisions to publish are made quickly (with an average of 90 days from submission to acceptance), and they work to expand and enrich the concept of research impact beyond the IF. Furthermore, articles are published in full length and the editorial board endeavors to cover the broad spectrum of the life sciences, with no bias in favor of what might be considered “glamorous” areas [12].

On 3 June 2014, University of Valencia’s *Mètode* magazine [www.metode.cat] and its Two Cultures Observatory [http://metode.cat/Les-dues-cultures], devoted to the study of the relationship between scientists and the media, interviewed Randy W. Schekman in Valencia. Despite his affable look and permanent smile, Schekman’s is passionate about his mission and profoundly critical of the system it seeks to replace.

You claim that scientific publications such as *Nature*, *Cell*, or *Science* distort the reality of scientific research. But these journals remain the most respected in the scientific community.

Yes, they have a very effective business plan, I would say. They prey on people’s vanity. People like to be part of an exclusive club and this is what these journals encourage by being very selective in what they choose to review. They look for things they think will be hot topics, you know, bestsellers. And then, even after they agree to review a paper, they impose increasing demands on the author to modify things, to somehow make it even more perfect. They consult with a large number of people, and they go through the paper over and over again—a process that can sometimes take over a year—and in the end, they may decide to reject the paper after all. This creates an enormous effort and added expense before the paper gets published, which I believe is a toxic influence. It causes a delay in the publication of science.

Some months ago you announced that you will not publish in those journals, but you have prestige...

Well, yes... I have been saying this for a long time. I actually haven’t published my own primary research in these journals for some years now. I also voiced my thoughts about the impact factor during the five years I was the editor of the *Proceedings of the National Academy of Sciences of the USA*, and the press never interviewed me about my position back then. But I won a Nobel Prize and now I have a louder voice. And I intend to use that voice to express my opinion.

Would it be as easy for researchers who are just starting their careers to refuse to publish in these journals?

Yes, they just have to have the courage to stand by their convictions. There are young researchers who have completely avoided publishing in them. We have a young scholar at Berkeley, Michael Eisen, an expert in genome analysis who was one of the original editors of the *PLoS* (Public Library of Science) journals. He has taken a very strong position against what he calls the “glamour journals,” and he has never published in them. And yet he has had a very successful career, becoming a researcher at the Howard Hughes Medical Institute (Chevy Chase, MD, USA). He is very bright and he is very successful. And he has realized that one doesn’t need to play these journals’ game in order to publish important work.

Does his institution support him in this decision?

Yes, absolutely, absolutely. In fact, at Berkeley, because of his position and because of my position, more and more of our colleagues are submitting their papers to open-access journals. Of

course, they continue to publish in *Cell*, *Nature*, and *Science* as well. But I think that increasingly, at Berkeley, we understand that the discussions about what one publishes in this or that journal have to give way to the real evaluation of knowledge.

In open-access journals, the author must pay to publish.

Do you think that is a conflict of interest?

I mean that maybe it can give rise to a different kind of bias, sidelining groups with lower budgets.

Yes, well, but remember that in many commercial journals, you have to pay to publish too. In *eLife*, however, we do not charge anything. It is completely subsidized for the time being.

But this is not the most common situation.

No, it's not. I think we have an advantage, and I intend to make the most out of it.

Some months ago, John Bohannon, a journalist writing for *Science*, sent a fake paper—full of mistakes—to more than 300 open-access journals and 60 % of them accepted it.

All those journals were open-access, yes... But he might as well have sent it to all the commercial journals too...

Are Open Access journals less rigorous?

The question is not whether they are Open Access or not. This is a false distinction. There are other journals that are commercial or run by scientific societies that may also have low standards. And I do not think that just because a journal is open-access, this makes it somehow more suspicious. It is true that there are businesses out there looking to exploit the Open Access movement to make money, and the buyer must be aware. As I said earlier, if you want to publish in one of these new journals, look at the composition of the editorial board and see who is actually putting their time in to make it a successful venture. This should be the deciding factor.

Is it sustainable to have so many scientific publications? Do you think we are faced with a bubble that could burst at any moment?

Before the Open Access movement there already were thousands of titles, there were many journals. Now, it is tough to

survive because libraries have budget cuts and they have to look very carefully at what they subscribe to, or what they get licenses for. And it is possible that many journals will disappear, but maybe this is a good thing.

What is the role of the Internet in the increasing number of journals?

Oh, it's crucial. I mean, it signifies a complete change in the way that we read things. Most young scholars do not even peruse journals anymore; a hard copy of a journal is like a dinosaur. And the only reason why *Nature* and *Science* continue to flourish is because people want the journal to read the 'front half' sections, as opposed to the 'back half' where the research is found. People read the current scientific events, not so much the papers. As a matter of fact, reading a paper in *Nature* or *Science* is a very unpleasant experience.

Really?

Yes, because it is like a tiny little advertisement of the actual paper. For most research published in *Science* today, the bulk of the paper is relegated to the supplementary material, which is only available online and not in print. When you submit a paper to *Nature* or *Science*, it is normally a full paper. And if you manage to get it accepted, they will usually tell you to cut out most of the stuff and include it in the supplementary information. And again, this is because their model is based on the print version and they are trying to save money on the print. For me, this is a completely artificial commodity in the 21st century. They should not be doing this. Papers should all be available online in the full form so that people can read them.

A great deal of papers are not read and many experiments are not replicated. Without confirmation and the subsequent debate, where does all this knowledge go?

We have a problem. Some people claim that important papers cannot be replicated. In my opinion, this is the argument used by pharmaceutical companies who make observations in the scientific literature but then cannot reproduce the results. But I wonder whether they are really trying to reproduce these experiments or they are simply trying to develop a drug in an animal model without repeating the experiments described in the publication exactly. It is unknown what fraction of the literature is wrong, so we are conducting an experiment. We have been approached by an organization called the Reproducibility Project, where a pri-



Fig. 2. Covers of different publications: subscription journals (upper row), and open-access-only journals (lower row).

vate foundation has agreed to fund experiments to replicate fifty high-impact papers in cancer biology published between 2010 and 2012, and the work will be carried out independently by a network of expert labs (to learn more, visit The Reproducibility Project: Cancer Biology [https://osf.io/e81xl/wiki/home/]). We have agreed to handle this and eventually publish the reproducibility studies in *eLife*, so we will know, at least for these fifty papers, how many of them are really reproducible. We are just getting started with this, so it may be a couple of years, but it's what we'd like to do.

How did your life change after the Nobel Prize?

I get interviewed by the press much more. I travel a bit more... people somehow listen to me more than they used to. Unfortunately, the downside is that I have less time to spend in my lab. That is the downside, that I have less time for my lab and my life is much more hectic. I hope that everything will go back to some normality, perhaps in a year or so.

In *Mètode*, we started the Two Cultures Observatory [http://

metode.cat/en/The-Two-Cultures-Observatory] in order to analyze the relationship between science and the media. Do you think that science publications set the agenda for the general media?

Yes, this is a problem that has developed over the years. There used to be many more science journalists, hired by newspapers, who would look at the papers published in various journals. But increasingly, unfortunately, these newspapers have fired, gotten rid of their science journalists. So now many newspapers are dependent on the press releases issued by the journals themselves to describe the work they publish, and this may be good for the journals, but I don't think it is good for the general public.

The number of papers has increased a lot. How can a journalist find what is really interesting without being influenced by the journals or the research groups?

Well, it's tough. That is why it is important to have science journalists working in newspapers who have the time to go and read the literature. I agree that it is a daunting task, though.

Some scientists consider that journalists are too sensationalist, but can the scientists themselves sometimes exaggerate their research?

Oh, absolutely. In order to get their papers published in *Nature* or *Science* they exaggerate the importance of their work, absolutely. Researchers are under pressure to get their work funded and so they think that if they get more publicity for their work, even in the media, this will help them obtain funding, or help them attain recognition, fame and glory. I mean, why should scientists be any different than other people?

And what do you think about media coverage of cell biology?

It does not get much attention. Science journalists tend to focus on research related to health and disease, or on discoveries such like planets and satellites in other planetary systems. Unfortunately, I find most science articles in newspapers unsatisfying, even those in leading publications such as *The New York Times*. Let's say that a journalist talks about the discovery of a new drug for cancer, a topic that interests me. Generally, he or she does not say anything about how the drug works—its mechanism of action—and I find this very discouraging, because that is what I really care about, that is what science is. But I suppose they feel that for most people, for the majority of readers, that would be too much information.

Could you explain in layman terms, if possible, the importance of vesicle traffic in our cells?

Sure. Our genome encodes around 23,000 genes. That means that our cells manufacture at least that number of protein molecules. Proteins are the molecules that catalyze the chemistry of life, they are all the little machines in our cells that allow them to grow and divide. And all the proteins in a cell are manufactured inside it, but some have to be shipped outside of the cell, like insulin, growth factors or the proteins in your blood. However, there is a barrier—the cell is surrounded by a membrane—and proteins like insulin, which are water-loving molecules, cannot just swim through the membrane, which is a water-hating barrier that doesn't allow soluble proteins to just go through.

So the proteins that are going to be transported outside of the cell, such as antibodies, have to be encapsulated inside the cell by little carriers called vesicles. And these carriers transport proteins like insulin up to the cell surface and then the vesicle, which is a membrane itself, merges with the

cell membrane by a process known as “membrane fusion.” When that happens, the inside of the vesicle becomes the outside of the cell, this special compartment opens and its contents are poured outside the cell. This is what is called “secretion” and cells execute this pathway through “vesicular traffic.” And this is responsible for all secretion from all cells, not only protein molecules but also brain neurotransmitters are secreted through this same pathway.

What we discovered was that yeast cells use the same mechanism to grow and we devised a genetic approach to isolate and identify the genes that organize the process, and it turns out that these genes are the same in humans. The very same genes that allow a yeast cell to secrete its proteins are the genes in the human genome that allow the secretion or the transport of neurotransmitters.

As evidenced by Schekman's skills in explaining his own research, he also believes that to communicate effectively with a broader public is a scientist's responsibility. Following this idea, another interesting addition to every paper published in *eLife*, the journal he edits, is the ‘*eLife* digest’ an accompanying text written for a broader audience in which most of the technical language is removed. It is aimed at people who might be interested in that piece of research, but who have only a basic understanding of life sciences [8]. At the moment it is mainly the editors who are in charge of this section, but there is hope is, the scientists carrying out the research will eventually take over this task themselves.


How to break free

Schekman's criticisms of luxury journals have not gone without comment. Monica Bradford, executive editor of *Science*, said that there is nothing artificial about their acceptance rates—they are just a reflection of the journal's scope and mission. Emilie Marcus, editor of *Cell*, explained that their *raison d'être* is to serve science and scientists, and offering value to both their authors and readers was a founding principle, not a luxury [13]. Philip Campbell, editor-in-chief of *Nature*, pointed out a longstanding relationship with the scientific community of over 140 years. He acknowledged that the research community tends towards an over-reliance of assessing research by the journal in which it appears, but he also maintained that he and his colleagues have for years expressed their concerns about the dependence on IFs [13,17].

However, as Stephen Curry, Professor of Structural Biology at Imperial College London, pointed out, “it is not sufficient to lay the problem at the feet of the research community when journals are part of that community” [2].

Schekman agrees that journals are only half of the equation. The demand for luxury journals also has to be addressed by the researchers themselves and by the institutions that use them to judge scientific quality. Writing in *The Conversation* he suggests four ways in which we can start to remove the incentives that make it rational to publish under the biggest brands:

1. Academics who participate in research assessment could shun all use of journal names and IFs as a surrogate measure of quality. New practices and processes must be devised and shared so that we can rapidly move forward. His Berkeley colleague Michael Eisen has added an important point: we must speak up in appointment and funding committees when we hear others use journal names this way. Here we need peer pressure as much as we need peer review [4].
2. Researchers applying for positions, funding, and tenure should avoid any mention of IFs in their applications or CVs. Article metrics might have a role to play, but narrative explanations of research significance and accomplishments would be more helpful.
3. Funders, universities, and other institutions should make it clear to their review committees that journal brand cannot be used as a proxy for scientific quality. If reviewers object, they should find different reviewers.
4. The scientists who serve as editors or editorial board members of journals could insist that the publishers of these journals stop promoting IFs. Instead, the journals could emphasize the other valuable services they provide to authors and readers to promote their worth to the community.

Schekman points out that no doubt others will come up with bigger, better, and maybe even bolder ideas to move science away from the problems it is currently facing. He hopes that his words have helped spark a discussion, but now is the time to turn attention to action [15]. 

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