

Science and Sustainability

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Sustainability in science is nothing new. The term sustainability science was probably first used in 2001 (see Wikipedia entry), and the title of this blog post was already used by a 2002 editorial in *Science*. There are both journals (*Sustainability: Science, Practice & Policy*, *Sustainability Science*) and conferences (e.g. [here](#) and [here](#)) about this topic and you can get a degree in sustainability science. The term sustainability is usually used in the context of climate change and the conservation of natural resources.

Here I want to use sustainability in a broader sense, using the original definition: able to be maintained at a certain rate or level.¹ Examples where the way we currently do science will probably no longer be sustainable in the future include grant applications that have a chance of success as low as 1% (the wait continues for NIH Challenge Grant applicants), the ever-increasing costs for access to scholarly publications (the serials crisis), or the exponential growth of drug development costs without any increase in approval for new drugs in the last 60 years (*Drug Companies Since 1950*).

Sustainability in science requires the individual researcher to think about his responsibility, i.e. to go beyond research that is personally interesting and is paid for by someone. I do think that increasing sustainability in science is a worthy goal, and I picked six examples.

Make access to research results affordable

For those not working at an academic institution, many subscription-based journals now make their papers available after a 6-12 month embargo period. Immediate full access to an individual paper in these journals can cost anywhere between \$10 and \$30 (\$31.50 *Cell*, \$15.00 *Science*, \$32.00 *Nature*, \$31.50 *The Lancet*, \$10 *New England Journal of Medicine*). As you can guess from the wide range for these journals alone, these prizes are probably not calculated to cover actual costs. Deep Dyve launched a rental service for scientific content in October. They charge \$0.99 per article rental, but currently include only a limited number of journals.

Most researchers have access to subscription-based journals through their institutions. My university library currently has a budget of about 900,000 € per

year for just over 2000 researchers and 2600 students. Even with this money, our institution can't afford subscriptions to all journals important for my work. And subscription costs are increasing much faster than library budgets. Open Access obviously is one answer to this dilemma, but may not work for all journals. Most of us would probably be happy to pay for journal subscriptions if subscription costs simply remained reasonable. Because a handful of publishers own a large part of scientific journals, this will only happen if someone representing a large group of universities and research institutions sits at the negotiation table.

Reduce the bureaucracy in science funding

We are currently spending too much time trying to obtain research funding compared to the time actually doing research. This is in part because the chances of obtaining a grant are often fairly low and grant applications have to be submitted many times, and because the duration of some grants is too short, e.g. only 2-3 years (sometimes meaning you have to start writing on the extension grant after the first year). Providing funding to excellent researchers for longer periods of time instead of funding projects is one approach to improve this situation. The Howard Hughes Medical Institute has done this for many years with HHMI investigators and the Wellcome Trust last month announced a similar approach with Wellcome Trust Investigator Awards.

Communicate and use research results

A lot of research has practical value, but this practical value has to be explored. One nice example from my area of expertise is an international consortium to improve the outcome of a specific form of acute leukemia in the developing world. The first results were reported at the ASH meeting earlier this month, one of only a handful of abstracts to be picked for the plenary session. But use of research results goes beyond translational research, using them for science education (both in schools and universities) is equally important.

Science blogging could have an important role in communicating research, and this blog post from a few days ago is a wonderful example of how a blog post can enhance a Nature paper. It would be great if more journals would follow the PLoS journals in linking to blog posts about a paper,² and journals should help their authors to blog, e.g. by asking for a blog post (that could be hosted by the journal) on paper acceptance. Conference blogging is another area where science blogging would be a very welcome addition. It was nice to see official conference blogging at the German Genetics Conference this year, and I hope to see more of that.

Develop and promote technologies that make scholarly research more efficient

Obviously I have written a lot about this topic on this blog, e.g. about the article of the future, reference management, paper submission, validation, formatting

and exporting of scholarly content, or researcher identifiers. But I believe that there is still a lot more that can be done, and I expect to see one or more disruptive technologies in the future. Time will tell if Google Wave is one of them, the Open Researcher Contributor Identification Initiative (ORCID) announced earlier this month certainly is a very big step forward.

Preserve research data

Providing and preserving the research data behind a project is becoming increasingly important, and simply writing up a paper is no longer enough.³ In many areas we lack the infrastructure (nomenclature, databases, etc.) and resources for this, especially for long-term preservation. One ambitious project is Elixir, which is trying to develop an infrastructure for biological information in Europe. The CaBIG project at the U.S. National Cancer Institute is trying to do something similar for cancer research. Examples for digital preservation projects can be found at the British Library and the German Nestor project.

Involve people outside of universities and institutions in research

Many areas of research would profit from this approach. A prominent example of citizen science is Galaxy Zoo, where more than 150,000 people are helping with the classification of astronomy images. Involving people is especially in medical research. PD Online Research is a wonderful community site about research on Parkinson disease that launched in June 2009. Personalized genetics can give the patient or healthy individual a more active role in healthcare decisions.

Whether sustainability will ultimately play a greater role in science will ultimately depend on those paying for research. If universities, institutions and funders continue to look mainly at goals that are both too short-term and only an indirect measure of scientific progress (e.g. the Impact Factor of a journal that a paper is published in), and don't honor activities such as data annotation, public outreach, etc., this will be very difficult. I wish you a great start into the new year.

The German word for sustainability is Nachhaltigkeit.

And please, please use the DOI for that.

This blog post was one important inspiration for this post, as was the SciFoo meeting in July, and many small things in between, including of course the Science Online London meeting.