

## A conversation with William Gunn on 04/05/13

### Participants

- William Gunn — Head of Academic Outreach, Mendeley Ltd.
- Alexander Berger — Senior Research Analyst, GiveWell

**Note:** This set of notes was compiled by GiveWell and gives an overview of the major points made by William Gunn.

### Summary

William Gunn is the Head of Academic Outreach at Mendeley, which is a service designed for researchers to organize and share their research, and collaborate with one another.

GiveWell spoke with him to learn about opportunities to improve biomedical research. We discussed Mendeley, the Reproducibility Initiative, and other activities to improve biomedical research.

### About Mendeley

Mendeley is a service for scientists to organize their research papers, collaborate with colleagues and learn about the latest research.

Scientists upload their scientific outputs to Mendeley, and Mendeley compiles them into a database, with all of the outputs labeled with metadata that explains how the outputs are related to one another.

Mendeley uses data such as how many people read a given paper on Mendeley to create alternative metrics (altmetrics) of the impact of research outputs.

### The Reproducibility Initiative

William Gunn is working on *The Reproducibility Initiative* together with Elizabeth Iorns (Founder of Science Exchange) and Mark Hahnel (Founder of figshare). This is an initiative designed to compile a curated subset of the most reproducible literature in biomedical research. The process for doing this is to:

1. Poll the authors of publications about whether they or not they want their publications to be replicated.
2. Replicate some of the papers that authors highlight as candidates for replication. Science Exchange will facilitate this.

3. Compile information on papers that authors have flagged for replication, and on those that they don't want to be replicated, as well as which papers reproduce, and which don't reproduce, and analyze all of this data with a view toward finding predictive indicators of reproducibility. Mendeley will facilitate this.

Having a curated set of reproducible literature could:

1. Help companies that work to develop drugs or therapies find more promising published scientific findings that are better candidates for serving as a basis for a new drug or therapy.
2. Help early career scientists, who are at risk of career damage if they spend a lot of time on a research project that relies on findings in the literature which turn out not to replicate.
3. It would improve the efficiency of scientific research in general by saving researchers' time.

The Reproducibility Initiative contrasts with the Reproducibility Project in that the Reproducibility Project primarily focuses on conducting a systematic audit of the level of the reproducibility in a field, rather than on finding the most reproducible papers.

### **The quantity of reproductions needed to have a large impact on a field**

A criticism of the Initiative often offered is that it would be too expensive and time consuming to replicate all the studies in life science research. However, the quantity of studies in a given field that the Reproducibility Initiative would have to reproduce in order to have a large impact on the field is smaller than it may initially seem.

In particular, if one has a list of methodologically similar studies that authors have earmarked for potential replication and one randomly chooses a subset of them and replicates those, then one may be able to use the replication rate to infer the probable replication rate of the collection of all similar studies earmarked for replication. The subset of the studies that are actually replicated would have to be large enough so that studying the sample yields a statistically significant result, but could still be much lower than the total number of studies earmarked for potential replication.

There are some indications that researchers know which of their studies replicate and which don't. One would expect researchers to earmark the studies that they think are most likely to replicate. This suggests that the replication rate of earmarked studies might be high, which would further reduce the number of actual replications that would need to be done in order to create this subset of highly reproducible literature. The theory is that there would be a significantly smaller

number of papers that would fail to replicate in this self-selected subset.

If the inferred replication rate was high, then outsiders could base their research on studies that had been earmarked for replication with some confidence that they do in fact replicate. Researchers might also have higher motivation to work to produce replicable studies with knowledge that they could credibly signal that their study is replicable by flagging it for potential replication.

## **Other topics**

### **Reproducibility as a promising area for additional funding**

Gunn considers reproducibility to likely be one of the types of efforts to improve biomedical research that is most likely to have a large impact.

### **Altmetrics**

Alternative metrics (altmetrics) of the impact of a research output such as number of downloads, number of Facebook shares and number of Twitter references could be very useful. This isn't as trivial as it might first seem, as Priem et al. have shown that there is a significant number of scholars who use Twitter and cite research thereon. <http://dx.doi.org/10.1002/meet.14504701201>

It takes a long time for papers to build up a citation record, whereas one can get data on the number of scientists who view a paper much faster. Mendeley has found that the number times scientists view a given paper is somewhat correlated with the number of citations that it gets later on. This suggests that counting the number of views could be very useful proxy for the paper's ultimate influence. Altmetrics also allow more refined analysis than usual metrics do, such as how indicators of a paper's impact vary over time, and altmetrics also show the impact the work has had on the non-publishing audience, such as doctors, nurses, and small business.

Altmetrics could provide funders with more information, which could help funders choose the best projects to fund. The National Science Foundation (NSF) has begun requesting that researchers provide information about non-traditional research outcomes.

There is a need for more research on the predictive power of altmetrics. It would also be desirable if altmetrics that are not in the public domain (such as those compiled by subscription only journals) were made available for use by academic departments and funding bodies under a permissive license, such as the Creative Commons Attribution-Only license (CC-BY).

### **Citizen science**

An interesting emerging sector in the scientific community is that of *citizen science*. This is scientific research funded or conducted by amateur and/or nonprofessional scientists in the general public.

Citizen science is attractive because it helps improve public awareness of and involvement with science. Better awareness may be helpful in resolving controversies about subjects where there is a strong scientific consensus but where the relevant research has not percolated into public consciousness. The questions of whether HIV causes AIDS, whether vaccines cause autism, and whether global warming is occurring, are examples of this type. There remains significant debate over the degree to which controversial viewpoints can be changed by supplying more information ( <http://www.mendeley.com/research/case-deficit-model-science-communication/> ) and the opportunity this kind of public engagement provides is to get the public more engaged on a personal level, as opposed to expecting them to accept scientific truth delivered *ex cathedra*.

Some organizations working in this area are:

- Microryza: A science crowdfunding website where members of the public can choose to fund research projects.
- BioCurious and Genspace: These are community biology labs for members of the public who want to do biology students themselves or in collaboration with one another. BioCurious is in the San Francisco Bay Area, and Genspace is in New York City. There is also a DIYBio group in Boston and many other places around the world: <http://diybio.org/local/>

## **Open data**

Mendeley is not working directly on promoting data sharing.

Data sharing is important in biomedical research. If researchers wish to do a meta-analysis of studies on a given subject, they need to be able to aggregate data from the different studies, and this requires that they have access to the underlying data that papers report on. It's also important that data from papers be available in a form that facilitates easy comparison between two data sets from studies of a given topic.

## **The amount of reproducibility failure coming from lab variability**

Some papers that are not reproducible are based on solid research, and fail to reproduce because the conditions under which the study was performed were not reproduced rather than because the underlying research was unsound.

There's been little study of the relative frequencies of papers that don't reproduce due to inevitable variability among labs.

It's difficult for researchers who investigate this subject to publish papers about it, because publishing papers that point out potential problems with others' research can have negative social and professional ramifications.

### **eLife**

The Wellcome Trust and the Howard Hughes Medical Institute are funding a new open access journal for biomedical research and the life sciences. Publishing in this journal is currently free, because the funders want to encourage open access.

### **PeerJ**

PeerJ is a new form of journal which is open access and extremely cheap to publish in (\$99/author). PeerJ has a pre-print server for life science, and is working on open peer review. It has an editorial board of senior scientists and should put out high quality work.

### **People for GiveWell to talk to**

- Brian Nosek of the Center for Open Science
- Dan Whaley of Hypothes.is
- Johan Bollen and Herbert Van de Sompel
- Microryza (Cindy Wu and Denny Luan)
- Jason Hoyt and Pete Binfield of PeerJ

*All GiveWell conversations are available at <http://www.givewell.org/conversations>*