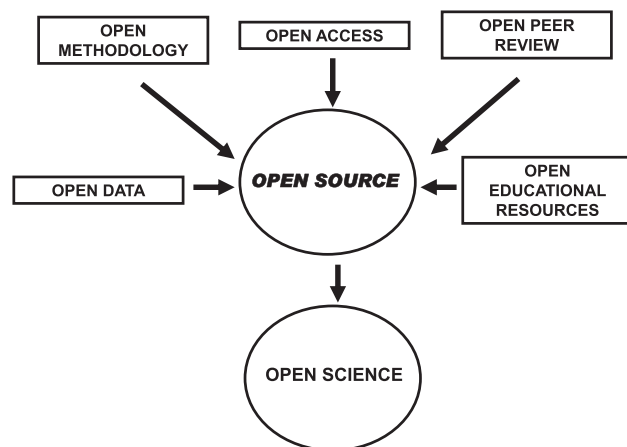


## Open source in cachexia?

### What is open source?

It is the concept of freely sharing technological information so it can be improved through multiple insights and viewpoints. Because the technology is 'open source', the amount of work involved is decreased as many individuals add multiple contributions. The central theme of open research is to disentangle the methodology freely available via the Internet and any data or results extracted or derived from them. This permits a massively distributed collaboration, and anyone can participate at any level of the project. Open 'science' is the application of open source methods to science (Figure 1). Open science removes the traditional hierarchy of research and encourages scientists of all levels—student or professor—to engage and contribute. Ideally, complete data release and collaboration happen in real time, to prevent duplication of effort and to maximize useful interaction between participants.<sup>1</sup>

Figure 1 From open source to open science.



### Why in cachexia? 'None of us is as smart as all of us'

At the 2nd Cancer Cachexia Conference in Montreal (2014), several concerns came up. For instance, the participation of clinical

staff and the possibility to reach out to everybody who wants to learn about the subject, and to those who are going to be the ones that judge and authorize therapies. Let's not forget the industry that funds the ongoing research; especially the non-profit organizations feel much more at ease 'in the open'.

There is also a lot of heterogeneity when it comes to animal models: going to open source cachexia and getting in touch with hundreds of others scientists just with a click may solve the query.

### Who is already using it?

Except in software, other areas are reaching out for it: the open source movement has increased transparency in biotechnology research. A good example is that of Cambia. It is 'an Australian non-profit organization focusing on open science, biology, and intellectual property'. Cambia's efforts to freely distribute scientific tools and techniques gave rise to the Biological Open Source (BiOS) Initiative. Through an open source biotechnology licence and material transfer agreement, BiOS seeks to establish freedom to operate for innovators.

A primary project of Cambia is the free full-text online patent search facility and knowledge resource, 'The Lens'; it allows free searching of almost 10 million full-text patent documents.

Another example is the open source search for the malaria cure (OSM). Veiled in secrecy and often complicated by patents and intellectual property issues, scientists are not always the best at sharing their results, at least not until they are published in peer reviewed journals—and sometimes after letting evidence fall under the table. This means that lots of data, especially 'negative' ones are hidden. Avoiding the loss of vast quantities of data is just one of the reasons behind the formation of the OSM team. The open source drug discovery project began in 2011, when Matthew Todd's lab received funding from the Medicines for Malaria Venture and then from the Australian Research Council in the form of a linkage grant. GlaxoSmithKline (GSK) had just published a revolutionary paper<sup>2</sup> containing potential antimalarial medicines and placed the information into the public domain. Those open GSK data were the starting of the OSM project and led to the team synthesizing and evaluating three different series of compounds.

## The use of open source for drug discovery

Because no drug has ever been discovered using an open source approach, it is difficult to be certain about how this would work. However, it seems likely that the biggest impact of the open approach would be in the early phases before clinical trials have started. Open methods could also have an impact on the process chemistry phase, in creating an efficient chemical synthesis on a large scale.<sup>3–5</sup>

One negative aspect to bear in mind is that open work cannot be patented, because there can be no delays to release of data. Open source drug discovery must operate without patents. The hypothesis is that through working in an open mode, research and development costs are reduced, and research is accelerated. This offsets the lack of capital support for the project. Costs of clinical trials and product registration would have to be sourced from government and non-government organizations. It has to be pointed out, however, that some large pharmaceutical companies (GSK and Novartis) (GSK has even an 'Open Lab' in Tres Cantos, Spain; it provides an opportunity for visiting scientists from leading international institutions to work at the campus for a dedicated period of time, accessing GSK drug discovery expertise as part of an integrated team to discover new medicines.) have used open source. Funding comes from elsewhere, for example the Bill and Melinda Gates Foundation and the Global Fund, and even large multinational coalitions. Interest in cachexia research is growing everyday, and because wasting is present in many diseases, such as cancer, AIDS, COPD, and chronic heart disease, it attracts researchers and pharmaceutical companies; therefore open source should be encouraged (Figure 1).<sup>6,7</sup>

## Open source tools

It is an essential powerful platform for academic researchers who want to develop, finance, and conduct research projects. This platform may sustain the accessibility of academic

research together with new way of research funding. The main tools required are as follows:

- (1) A platform offering distributed revision control and source code management. (e.g. Github).
- (2) Raw experimental data are recorded in an online, openly readable electronic lab notebook.
- (3) A Google+ page to keep up with developments and discussions.
- (4) LinkedIn as a way of connecting with relevant experts.
- (5) A wiki (web application that allows people to add, modify, or delete content in collaboration with others) to host the current overall project status.
- (6) Updates on the project's progress could be posted at a Facebook page, and this is also a place for interaction. Project management is important—assigning tasks, creating deadlines, tracking activity, and posting results.
- (7) Figshare, an online digital repository where researchers can preserve and share their research outputs, including figures, datasets, images, and videos. It is free to upload content and free to access, in adherence to the principle of open data.
- (8) A YouTube channel for posting videos of conferences, to increase cachexia awareness.

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