

# WHAT IS OPEN SCIENCE?

*Leaflet for the exhibition “Open UP!  
How digitisation changes science”*

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OPEN  
UP!

***Intro:***

What is Open  
Science?

Basically, Open Science is about improving the trustworthiness and the quality of research in a digitally linked age. The most important instrument for this is openness, resp. transparency. On one hand, research findings and methods are presented comprehensively and accessibly from the first conception of an idea to publication, so that other researchers can verify them or reuse them for their own work. On the other hand, researchers leave their “ivory towers” and research opens up towards social players from politics, business, culture and society. This opening up means that these players are actively involved in research processes, and research findings are communicated directly.

Open Science thus follows established principles of good scientific practice and transfers them into the present era of linked-up research by means of the potentials offered by digitisation.

***Which***  
Open Science  
movements are  
there?

Open Science is a general term for many different movements. The most important of these are:

- **Open Access:** Scholarly publications are freely accessible to all and are not hidden behind publishers' pay walls.
- **Open Data:** Research data are provided and published according to open principles.
- **Open Educational Resources:** Materials in education are provided in such ways that teachers and students can freely use, change and disseminate them.
- **Open Methodology:** Scientists document and publish the scientific methods they use.
- **Open Peer Review:** Processes within Peer Review, which is an essential instrument of scientific quality control, are transparent and verifiable.
- **Open Source:** Researchers use open source technologies (soft- and hardware) and offer their own developments as open source for others.

***Why*** is  
Open Science  
useful?

Open Science enables increased efficiency and better quality control in research. Especially in the field of research data, much is still closed and therefore not accessible to others. Research data that are more accessible and easier to find can be reused in more ways. The double collection of data can be avoided. The more documentation and publication of data, software and methods, the better the verification and reproduction of research findings. If this happens with partial findings or even at the planning stage, quality control can set in much earlier.

Open Science creates transparency that enables society to gain a deeper insight into science. This can create trust and strengthen credibility. Currently different models are being tried to engage social players more actively in research processes.

*Limits* of  
Open Science



Although openness and transparency are the main goal of Open Science, a rate of 100% “open” cannot always be implemented. Sometimes there are good reasons for staying closed, for which research data are exemplary. Data protection takes precedence, for instance in the case of personal data in medical research. Such data cannot simply be published. However, safe frameworks for using such data can be created if the affected persons agree. Access could be limited to defined groups, and data must be presented in anonymised or aggregated forms. In research with business data, intellectual property rights must be safeguarded. The important thing is that the existence of data must be known, they must not necessarily be instantly and mandatorily retrievable.

***What are the  
challenges  
facing Open  
Science?***

Open Science signifies a fundamental change of the established science system. This requires a joint effort from all involved stakeholders. Publishers must develop new publishing models, infrastructure institutions must create corresponding working environments, researchers must adapt their criteria for scientific output, and science policy must establish a corresponding framework for the development of Open Science. This change is complex and time-intensive. It has taken several years for Open Access to find broad acceptance. Open Data is the next step where intensive work is currently under way to build the necessary infrastructures.

One of the essential challenges is the cultural change in a science system geared to reputation. At the moment, citations of publications are the only valid currency. The measuring and the recognition of scientific output must be adapted to the digital age within the context of Open Science, in order to create incentives for researchers to use open practices. There is no record of citations or re-uses of research datasets. When researchers blog about their work, such activities in social media are not mapped. Neither is their use of other platforms to exchange ideas, and thus their transfer of knowledge which is one of the core missions of science. Last but not least, Open Science is still insufficiently established in scientific training curricula.

*What is the  
history of Open  
Science?*

It has always been a basic principle of scholarly work that research methods and findings must be published in a verifiable form and in open discourse. Open Science transfers this principle into the digital age with its concomitant potentials as well as challenges. The concepts of Open Science have been around for some time, but only the establishing of corresponding infrastructure has given them impetus. The beginnings of Open Access go back to the early 1990s when arXiv was created as the first archive for so-called preprints (early versions of an article to be published) from physics. Thirty years later, Open Access is widely established and has fundamentally changed the entire scholarly publication system. The concepts of Open Data go back even farther to the 1950s, when the first data centres were built to foster the exchange of scientific data. This movement has become truly relevant only in the last few years.

The principle of openness is not confined to science and originated not only there. Open Educational Resources are connected to the Open Education movement which demands broad social access to education. Open Source also has a long tradition reaching back to the 1960s and is often regarded as a pathfinder for other movements that advocate the principle of openness.





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**Key activities:**

- Science 2.0/Open Science
- Social Media

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