

PASSPORT FOR **OPEN SCIENCE**



**A PRACTICAL
GUIDE
FOR PHD
STUDENTS**

Index

■ 1. Planning an open approach to scientific work

Using freely accessible resources	p.6
Planning data management	p.8
Planning software management	p.10
Working in a traceable and transparent way: for yourself, for others	p.11

■ 2. Disseminating research

Disseminating your publications in open access	p.16
Making your thesis freely accessible	p.21
Making research data and software open	p.25

■ 3. Preparing for after your thesis, join the movement

Deeply rooted public policies	p.30
Evaluating research differently	p.32

■ Act now

■ Goinf further

■ Glossary

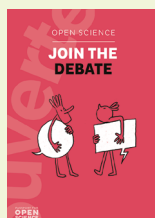
■ Sources

Legend

Underlined text is explained in the glossary.

▼ refers to tools which are given as examples.

To complete your reading, you will ind links to thematic guides and booklets from the Passport for Open Science collection:



Join the debate



Source code and software



Research data



Preamble

Open science was born out of the new opportunities the digital revolution offered for sharing and disseminating scientific content. It essentially consists of making research results accessible for all by removing any technical or financial barriers which may hinder access to scientific publications. It also involves opening researchers' "black boxes" containing the data and methods used for publications to share these as much as possible.

Choosing open science first of all means affirming that research which is mainly financed by public funds must report its results back to the public in as much detail as possible. Openness is a necessary condition for the reproducibility of scientific results and the guarantee of better documented and more substantiated research. Sharing reinforces the cumulative nature of science and encourages its progress.

Open transparent science also helps enhance research's credibility in society and the health crisis of 2020 has indeed reminded us how important this issue is. Finally, open science is the bearer of a profound movement towards democratising knowledge to benefit organisations, companies, citizens and particularly students for whom easy access to knowledge is a condition for success.

Open science policies now have support at the highest level. They are supported by the European Union, which requires open access to publications and data for research it funds, and since 2021, it defines open science as a criterion of scientific excellence. Open science policies are also supported worldwide by the G7 and UNESCO. In France, the First National Plan for Open Science, launched in 2018 by the Ministry of Higher Education and Research, has been reinforced by a second plan, in 2021, which affirms its ambitions through multiple initiatives.

All members of the research ecosystem, through their commitments and practices, embody and bring to life open science. As you begin to prepare your PhD – the last stage of your education and the first stage of your professional life – join the open science movement and use this guide to start a conversation also within your research networks.

The Passport for Open Science is a guide designed to accompany you in any field of study, at every step of your research, from developing your scientific approach to the dissemination of your research results. It provides a set of tools and best practices that can be directly implemented and is aimed at researchers from all disciplines.

We hope this guide will motivate you and provide the means for you to realise the ambitions of open science by sharing your research results and data with as many people as possible.

Marin Dacos

National Coordinator for Open Science
French Ministry of Higher Education and Research



1

Planning an open approach to scientific work

Using freely accessible resources

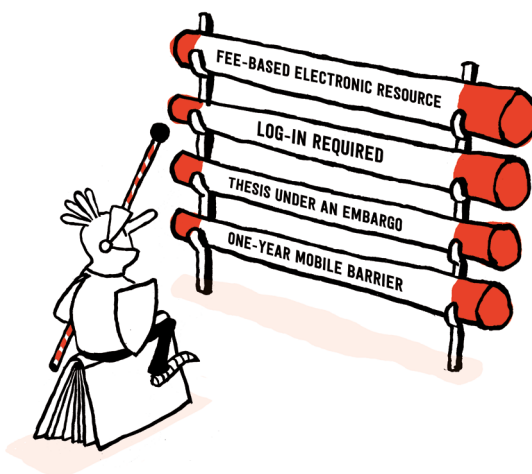
You are beginning work on your thesis. You need access the publications, articles, data and source code and software already produced in your field. This is the beginning of your obstacle course...

Access and reuse

The open science movement's aims are to **facilitate access to scientific content and encourage its reuse**. Often we speak of:

- Open-access resources: thanks to their author and/or publisher, these resources can be freely accessed without researchers or their institutions having to pay.
- Resources that are open for collaborative purposes. As well as being open access, such resources can also be re-used

depending on their distribution licence. For example, free software licences or certain Creative Commons licences authorise the reuse and modification of these resources as long as the conditions set by the data producer are respected. To find out more, you can take a look at ▼creativecommons.org or the French ▼[Etalab](https://etalab.gouv.fr) licences.



LICENCE OUVERTE
OPEN LICENCE

WORTH KNOWING

The fact that a resource is in open access is not a guarantee of quality in itself. It needs to be critically evaluated before being used like all documentary resources.

Where can resources be found?

Open access journal platforms:

Open access journals have diverse business and editorial models. For example: ▼**OpenEdition Journals**, scientific journal incubators as the French **Réseau de pépinières de revues scientifiques** (▼**REPERES**), or ▼**Persée**.

Platforms for pre-prints or working documents:

these enable the most recent work to be shared before and even while it is being peer-reviewed. A good example is ▼**arXiv**, an archive for mathematics, physics and astronomy preprints.



Data repositories

These may be multidisciplinary or specialist in scope. They enable data to be stored securely and disseminated. You can find a repository by exploring ▼**re3data.org** or ▼**FAIRsharing.org**. The ▼**Recherche Data Gouv** ecosystem provides a repository service.

Software forges:

these collaborative platforms for the development of software projects host and provide access to a large quantity of source code and software.

The ▼**Software Heritage Archive** preserves and offers access to software versions whose source code is freely accessible (although not necessarily reusable).



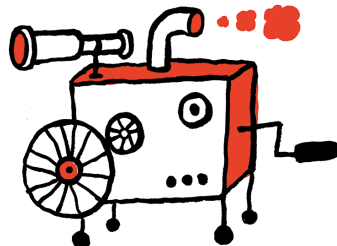
Open archives: researchers can deposit their work in these themselves. These archives may be institutional or thematic in nature. It is a good idea to explore ▼**HAL**, a multidisciplinary archive for French research.

Databases for theses or academic works: visit ▼**theses.fr**, ▼**Dart-Europe** or ▼**Open Access Thesis and Dissertation (OATD)**.

Specialist search engines

like ▼**Isidore** or ▼**Google Scholar** enable you to explore publications. ▼**Unpaywall** is a browser extension that flags open access versions.

Some **catalogues** enable targeted searches for documentary resources (like the French national catalogue ▼**SUDOC**) or for research data (like ▼**Sextant** in oceanography).



Planning data management



WHAT ARE RESEARCH DATA?

Research data are defined as "factual records (numerical scores, textual records, images and sounds) used as primary sources for scientific research, and that are commonly accepted in the scientific community as necessary to validate research findings".

(Source: Organisation for Economic Co-operation and Development – OECD 2007)

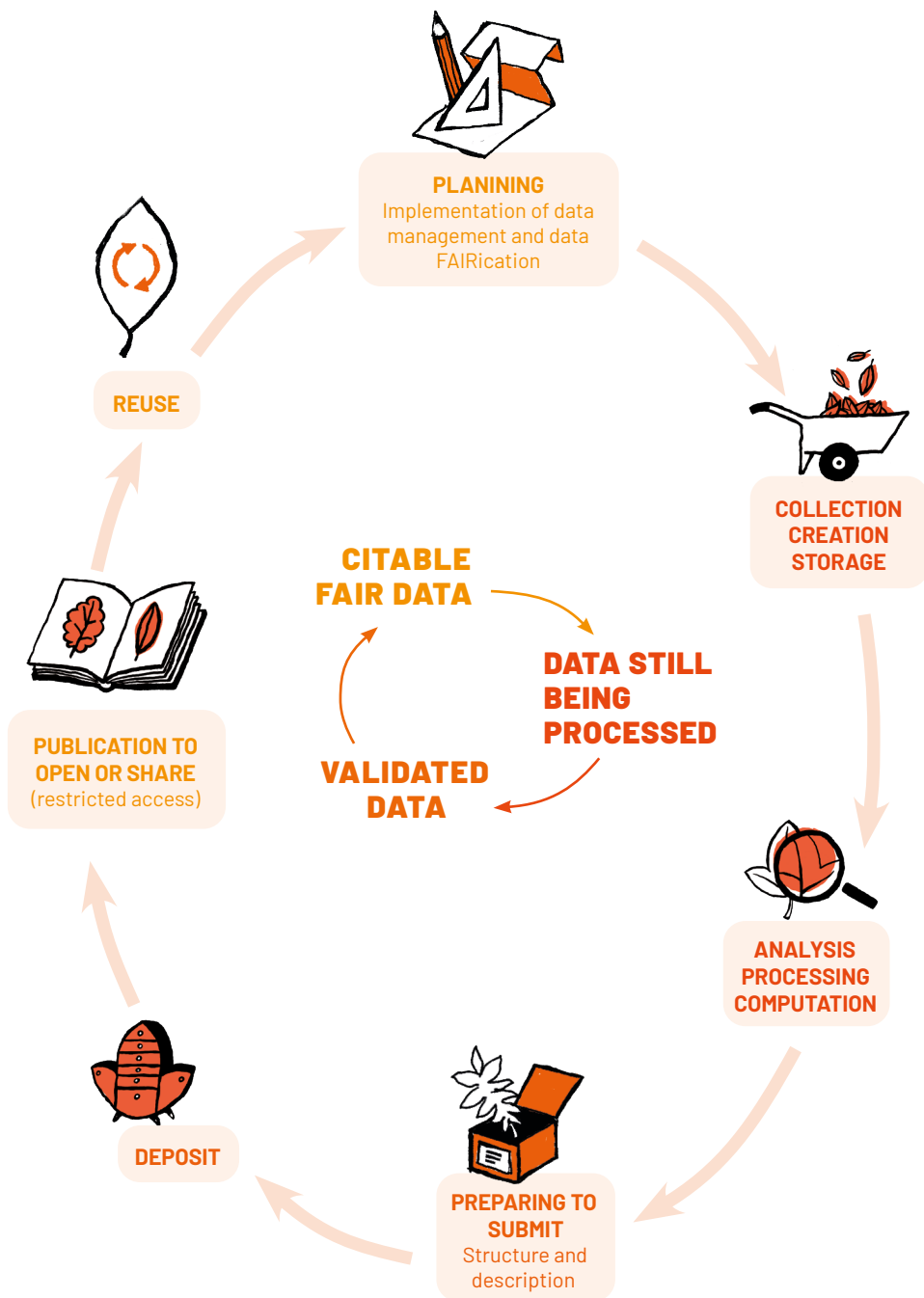
Research data management is required for the entire data life cycle, i.e. data collection, production, description, storage, processing, analysis, access and archiving.

Why manage research data?

Good data management is useful for you and for other people. It makes data more findable, accessible, interoperable by humans and machines and reusable in compliance with the FAIR principles. **See page 26.**

How to manage research data

You should anticipate requirement from the very beginning of a project by creating a Data Management Plan (DMP). This document helps you think about and anticipate how to organise your data during and after the project. A DMP is an ongoing document which needs to be updated throughout your research project. DMPs are often edited collectively, for example using the ▼ **DMP OPIDoR** tool. The main research funding agencies now require you to provide a DMP.



Planning software management

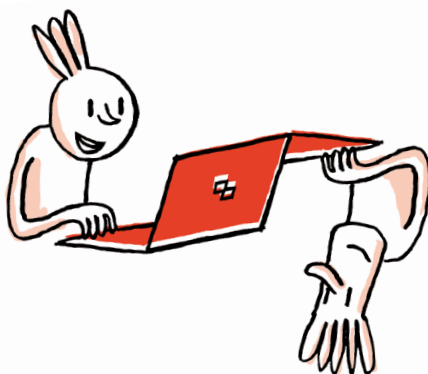


Why manage research software?

Software is a dynamic object that can rapidly evolve through changes made by its original development team or by third parties. It is therefore essential to accurately identify the versions of the software you use as well as any modifications you may make.

How to manage research software

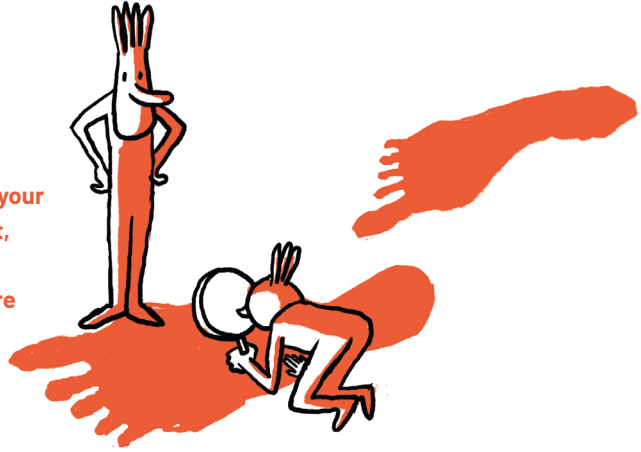
Most research software projects are hosted on software forges which enable you to trace successive versions and modifications. You can create a private or public clone of existing software on a forge of your choice if its licence allows this. A public project favours reproducibility, openness and contributions from third-parties. If your modifications are adopted by the original development team this will enhance the durability and visibility of your work! Choose a forge that corresponds to your requirements – within your laboratory or nationally, thematic or generalist, operated by a private or public stakeholder. To help you select a forge, you can consult the report **▼"Higher Education and Research Forges in France – Definition, uses, limitations encountered and needs analysis"**.



Working in a traceable and transparent way: for yourself, for others

What does it mean?

When your methods, results and all your research processes are transparent, accessible and traceable you are contributing to making science more robust.



Different reproducibility issues are involved depending on the discipline involved. Specific examples could be using the same data and methods to reproduce the same results or simply retracing the method used to obtain results in the interests of scientific integrity.

When you work in a reproducible way, your work is easier to reuse which can in turn bolster and enhance its impact. Greater transparency as regards the methods you use helps build confidence in your scientific approach.

The advantages

Errors are easier to identify and correct. Since de the begining, and with every modification, you keep track of the evolution of your data or software environment.

The results obtained can be more easily attested to by peers. When submitting an article for publication, you will find it easier to meet the demands of your reviewers and demonstrate your scientific integrity.

How to put this approach into practice

Organise your data, files and folders: apply file naming conventions, construct folder trees with a coherent, scalable structure and separate raw data from analysed data. You can use the free ▼**ANT renamer** software.

Use version management tools: whatever your research field, these tools can be invaluable, for example to restore a particular version of a document written over a period of several years.

Use scripts to automate certain recurring tasks: use genuine database management tools to manage large datasets manually rather than spreadsheets. This will help increase the reliability of your results.

Document your methods, procedures, data and code: what is clear when working may be less clear two months later even when you are the author! **Opt for open-source solutions** for greater transparency and long-term access. Ask for ideas from the engineers working on your research team's IT developments.



To learn more about the methodological principles for open, transparent science, go to the MOOC ▼**Reproducible research: methodological principles for transparent science** (French MOOC with English subtitles: <https://www.fun-mooc.fr/en/courses/reproducible-research-methodological-principles-transparent-scie/>)

In the field

Sacha H.,

Lecturer at Grenoble INP-Ense3

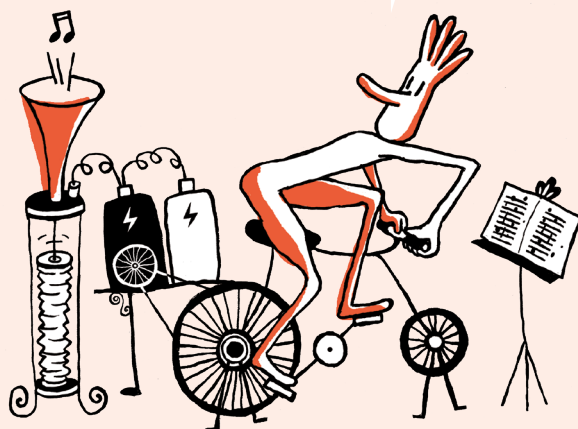
During my PhD, I worked as a research engineer on the development of OMEGAAlpes, an open source tool for the optimisation of energy systems. This tool can be used to model and explore different energy scenarios to determine the best solution for a chosen objective.

I had the chance to work on a residency with an artists' collective called Organic Orchestra which was trying to find technological solutions to achieve energy self-sufficiency while reducing the environmental impact of their digital performing arts show. We worked together to identify the constraints and objectives and then propose energy scenarios.

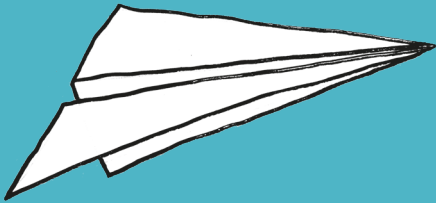
Currently, I'm continuing my work on opening up energy modelling processes and documenting physical objects. I'm convinced it's essential to open up work to respond to the socio-ecological challenges we are facing.

The open aspect of OMEGAAlpes was an attractive point for them. They used an open tool to generate knowledge which could be useful to others.

Open work promotes cross-disciplinary sharing and collaboration by making knowledge more accessible. I find this is a rewarding process that makes us think and forces us to work in a robust and constructive way. Actually, I even see it now as a real paradigm shift in research - working on shared subjects can now represent an opportunity rather than a source of frustration.







Disseminating research

Disseminating your publications in open access



Open access dissemination involves the **immediate, free and permanent availability of scientific publications on the Internet**. This means that all technical and financial barriers that may limit readers' access to content have to be removed. You have several options to disseminate your work in open access - you can publish in an open access journal or deposit your work in an open archive. These are not mutually exclusive practices and you can combine them to ensure the maximum dissemination of your work while respecting intellectual property regulations.

Publishing in an open access journal

In the traditional scientific journal business model, access to articles is reserved for individuals or institutions who have taken out paid subscriptions. Conversely, publishing in an open access scientific journal gives everyone free and immediate access to your article. Different funding models exist to cover publication costs. There are two main categories of such models which are constantly evolving:

- **With cost:** publication costs, often called Article Processing Charges (APCs), are billed. These costs may be paid by your laboratory or home organisation.
- **With no cost:** there are no charges for the author to pay. The journal costs are financed in advance by the organisation that publishes or distributes the publication on the basis of various funding mechanisms (institutional financing, freemium, subscription, etc).

THE DIAMOND MODEL

Diamond open access is characterised by the absence of charges for either the reader or the author. This model has strong support from public institutions. Among the diamond open access publishing platforms in France we can cite the ▼**Centre Mersenne**, ▼**OpenEdition** or ▼**Episciences**.

//////////////////// **Watch out!** //////////////////////

HYBRID JOURNALS

To increase their revenues, some publishers are retaining the traditional subscription access model while offering the paid option of publishing the article in open access. This amounts to charging an institution twice – once for access to the journal and once for publication of the article.

This controversial business model is often used by major commercial publishers. It is not advisable to pay these additional costs especially since you can distribute your article via an open archive.

PREDATORY PUBLISHERS: BEWARE OF APPEARANCES

The development of digital technology has led to the emergence of publishers with dubious practices who contact you to promise your work will be rapidly published. These publishers do not guarantee editorial quality and an effective peer review process but they may charge a fee for publication. As well as the financial costs, your scientific credibility will be damaged. It is sometimes difficult to spot a predatory journal but certain tools can help you to do so. There are also predatory conferences organised in a similar fashion.

▼**Think. Check. Submit.:** This website gives access to a set of checklists to help you assess the reliability of the journal in which you plan to publish your work.



Depositing in an open archive

An open archive allows you to disseminate your scientific work whether it has been published or not. Depositing in an open archive repository is not a substitute for the process of publication in a journal. An open archive guarantees permanent preservation and broad accessibility which is not the case with academic social networks like ResearchGate or Academia.

This is not limited to articles alone – you can also submit a thesis, book chapter, poster, dataset, report, lecture, conference paper, an HDR dissertation or a report



Open archives can be disciplinary, institutional or national. If you have not been given specific guidelines, you can ask your organisation's library for advice on choosing the most appropriate repository.

- ▼ **bioRxiv**, a preprints archive in biology.
- ▼ **RePEc**, a platform for working papers in economics.
- ▼ **Archimer**, the institutional archive of the French Research Institute for Exploitation of the Sea (IFREMER).
- ▼ **HAL**, the multidisciplinary archive for French research.
- ▼ **OpenDOAR** lists open archives worldwide.

THINK ACCESSIBLE!

Digital accessibility involves designing digital content and services that can be understood and used by the disabled. More information can be found in the booklet ▼ **Dissertations, theses, publications: let's make them accessible! (Mémoires, thèse, publications : soyons accessibles !)** which will give you the keys to making all your scientific work and productions accessible. You can also ask your publisher for more information when submitting your manuscript.

You can deposit different versions of an article:

- The version submitted for publication (also called preprint or author's version): this is the version the authors send to a journal prior to the peer review process. The Directory of Open Access Preprint Repositories ▼[DOAPR](#) has all the information to help you choose a platform that suits your requirements.
- The author accepted manuscript (AAM): the version including revisions resulting from the peer-reviewing process but without the publisher's final layout.
- The version of record (final published version, publisher's PDF): the article with the final layout of the editor as published in the journal. The publisher may have exclusive rights to the distribution of this version, depending on the terms of the publishing contract you signed.

What are my rights?

Whichever distribution method you choose, open-access publication stipulates that intellectual property rules must be respected.

- As the author, you possess all moral and economic rights to your scientific text until you sign a publishing contract under which you will assign some of these rights to the publisher of your text.
- If your research is at least half publicly funded, the French Law for a Digital Republic dated October 7th 2016 (article 30, *Loi pour une République Numérique*) stipulates that you can disseminate the author accepted manuscript (the version accepted for publication) in an open archive. Publishers may set an embargo period but the law limits this embargo to 6 months for articles in science, technology and medicine and 12 months for articles in the humanities and social sciences. Also, the rights retention strategy is a tool that enables you to keep sufficient rights to your articles so you can distribute them immediately after publication. The ▼[Implementing the rights retention strategy for scientific publications](#) guide gives details of how to apply this.
- You can use ▼[SHERPA/RoMEO](#) to find out about different publishers' open access policies.
- For other forms of publication, the publishing contract or the publisher's policy applies legally.

WORTH KNOWING

Would you like to deposit a publication in an open archive or distribute data with a license which allows its reuse? You should talk about this with your co-authors.

In the field

Ségoène V.

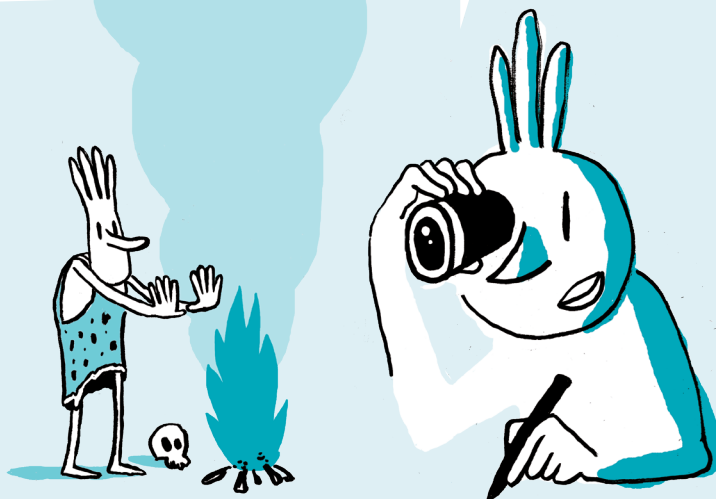
Banting postdoctoral researcher at UQAC - Université du Québec à Chicoutimi

I specialise in geoarchaeology and study the dynamics of occupation of caves by past societies based on soot film sequences recorded in limestone concretions.

While I was working on my thesis, I developed a pioneering method in my discipline called fuliginochronology (soot chronology), which makes it possible to establish the chronicle of occupations of caves with an annual resolution in the best cases.

I use HAL to archive my work on a permanent basis and so make it easily accessible for everyone. Open access dissemination of my thesis means I can make content available that may not all have been published and also helps enhance the visibility of this method. Theses are very rich documents; I like being able to access other people's theses so I make mine available too.

Also, making data available - particularly as part of the construction of collaborative databases - has several advantages. This enhances the visibility of the researchers who produced the data, enables everyone to re-use them (citing the source, rather than continually reinventing the wheel!), gives examples for teaching purposes and acts as a platform for scientific exchange and discussion.



Making your thesis freely accessible

Depositing your thesis

PhD students and doctors are covered by the provisions of the decree (*cadre national du doctorat* in French) dated May 25th 2016 which set out the national framework for doctoral studies (training, awarding the PhD). Your digital thesis must be submitted to your institution.

Your institution will then take care of the permanent archiving and referencing of your thesis in the ▼**SUDOC** national catalogue and the ▼**theses.fr** portal.

Disseminating your thesis

After your thesis has been submitted and processed, it will be disseminated online:

- **freely on the Internet if you give your consent** in the contract you sign with the institution where you defend the thesis;
- otherwise, **restricted access** will be given within the French university community (compulsory).

You can defer the online dissemination of your thesis by putting it under an embargo period during which the file will only be available within the university community.

Theses may not be disseminated if they are deemed to be confidential. Confidentiality is decided by the head of the institution rather than the PhD student and the thesis will be defended behind closed doors. There is always a limit to the confidentiality period.

The institution where you defend the thesis defines the open archive (for example, ▼**HAL-TEL**) used to disseminate your thesis. You can also deposit your thesis in an open archive yourself.

The dissemination of your thesis requires you to respect:

- the intellectual property code: if your thesis contains works covered by property rights, you must obtain authorisation from the right holders to reuse and disseminate these. Works in the public domain are not concerned by this provision;
- the General Data Protection Regulation (GDPR): any personal data concerning third parties in your thesis must be anonymised or pseudonymised.

The stages of depositing and disseminating

1. You defend your thesis.



2. You make all requested corrections and have your thesis approved.



DISSEMINATION
IN OPEN ACCESS



CONFIDENTIAL
THESIS



DISSEMINATION RESTRICTED
TO THE UNIVERSITY COMMUNITY



3. You submit the final version of your thesis and sign the dissemination contract.

4. The university library takes care of processing and disseminating your thesis. You can also deposit your thesis yourself in an open archive.



Why choose open access for your thesis?

Wide dissemination of a thesis is considered a best practice today and is very much encouraged.

- Your work will be much more **visible** and downloaded and cited more by other researchers and students.
- This facilitates your **integration** into the academic community (consultation by a selection panel).
- A thesis that is more widely disseminated is much better **protected against plagiarism** than a work with more restricted dissemination.
- Download statistics can encourage publishers to propose publishing projects. You should however be careful with requests from companies that present themselves as publishing houses but do not actually offer any quality editorial work on the text of your thesis.
- Your thesis will have a permanent and validated online consultation address.



CAN I DISSEMINATE MY THESIS IF I HAVE AN OFFER OF PUBLICATION?

Disseminating your defended thesis is not an obstacle to publication. However, you may have objective reasons for temporarily restricting its dissemination, particularly if rapid publication is planned for an article. In this case, it is advisable to wait for some time before opening access to the thesis. Discuss this with your thesis director or the jury.

Publishing a monograph based on your thesis is a long-term project which requires editorial work, rewriting and adaptation. The original defended version of a thesis is never published as is, which means that disseminating it is not a problem in any way.

Ask your publisher or thesis director for advice.

In the field

Audrey D.,

PhD student in public law at the University of Lille

I work on the European governance of digital health.

During my initial training in pharmaceutical sciences, I used bibliographic databases such as PubMed or Web of science to carry out my research work and my dissertation.

In my day-to-day work as a doctoral student in law, I find that my work habits differ from those in the healthcare field. For my research, I mainly consult French or European legal texts to build up my bibliographic corpus, as well as court rulings. These are public sources, and therefore very accessible. I also refer to doctrine, i.e. the analyses of other researchers or legal practitioners, mainly by consulting journals and books published by well-known legal publishers.

When I published my first article, I chose to deposit the pre-print in LillOA, the University of Lille's open archive. Disseminating my work on this platform has enabled active consultation of my research beyond my own discipline, opening up access beyond the publisher's audience. I believe it's important for research to be widely disseminated, and using LillOA and HAL means my work is better referenced in research catalogs.



Making research data and software open

Why disseminate research data and software?



FOR SHARED TRANSPARENT RESEARCH

Making data and software open allows researchers to **reuse datasets and code produced by others**, increasing the transparency of their research and guarding them against error and fraud.

Open access dissemination helps to **increase the visibility of one's work and to means one is cited more often**. According to one study, disseminating data linked to a publication increases its citations by 25% (Colavizza, Hrynaskiewicz, Staden et al., 2020).

The stakes are both scientific and economic. The cost of creating, collecting and processing data can be very high. Bad data practices may cost a significant amount, estimated at €10 billion per year in Europe (European Commission, 2018). Conversely, society as a whole benefits from open software code (The impact of Open Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy, European Commission, 2021).

Finally, **research financed by public funding must be open to all**. Research data and software are an academic output and part of the common heritage. Opening up data and software strengthens citizens' trust in public research and enables them to get involved, particularly in the context of participatory science and research.

TO COMPLY WITH AN OBLIGATION

The French Law for a Digital Republic (*Loi pour une République numérique*) assimilates research data with public data when public funds are higher than 50% of the funding. Research data are now included "by default" in the principle of open data just like data produced by the French civil service. In principle, **research data must be published on the Internet and made freely reusable**. There are certain exceptions related to the protection of personal data and privacy (GDPR) or intellectual property rights and also to respecting industrial and commercial secrets.

The funders of your research work may also stipulate that your data and software must be disseminated.

Finally, to validate your work and disseminate your article, a publisher may require that your data be deposited in a data repository and your software in a public forge.

How to disseminate your data well



RESPECT THE FAIR PRINCIPLES

The aim of the **Findable** principle is to facilitate the discovery of data through their rich metadata which are readable by humans and machines alike.

The **Accessible** principle encourages the long-term preservation of data and their metadata and facilitates access to them with no technical constraints by specifying the access conditions (open, restricted, under embargo).

The **Interoperable** principle posits data that can be downloaded, used, understood and combined with other data by humans and machines.

The **Reusable** principle encourages stakeholders to specify both the conditions for the (re) use of data by means of a licence and all elements that make that data easier to understand or reuse.

CHOOSING A DATA REPOSITORY

You can consult the **▼re3data** directory to find the right data repository **▼Cat OPIDoR** provides help in finding a thematic repository in your own discipline. You may also choose a repository at your institution if there is one.

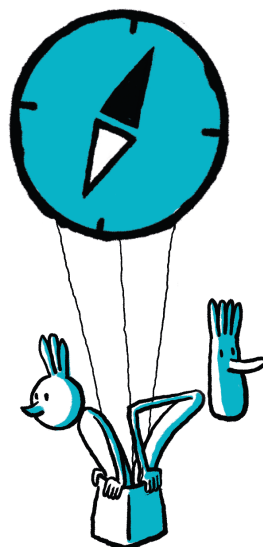
The **▼Recherche Data Gouv** repository is a sovereign publication solution for sharing and opening data aimed at communities that have yet to set up their own recognised thematic repository.

GETTING THE RIGHT SUPPORT

The **▼Recherche Data Gouv** ecosystem also provides research teams with local or thematic support through:

- **▼data management clusters** (*Ateliers de la donnée*),
- **▼thematic reference centres**,
- **▼institutional reference centres** (e.g. **▼INRAE** or **▼SciencesPO**),
- **▼resource centres** which accompany the support systems,
- **▼catalogue** which indicates data that are accessible in other repositories.

You can find out more from the open science contact person at your laboratory, institution, library or doctoral school.



YOU CAN ALSO OPT TO PUBLISH YOUR DATA IN A DATA PAPER

A data paper is a peer-reviewed article that describes an original dataset. It includes a detailed description of the dataset (production context, authors, associated rights, etc.) and gives access to the dataset. The latter is often in the form of a permanent link to the data repository where the dataset was deposited.

How to distribute your software well



Software may be opened for several different reasons, notably to promote it, to call for contributions, to set up academic or industrial partnerships, etc. The type of use intended impacts the choice of the most suitable licence (use only or modification, redistribution, etc.). The rightful owner of the software (laboratory, establishment) chooses the appropriate licence(s) according to the scientific and commercial objectives involved.

The project can be migrated to a more open forge, depending on the extent to which third-party collaboration is sought for. If a community forms around the project, time will need to be invested in leading it and organising the software roadmap for coming developments.

WORTH KNOWING

Forges are not permanent archives. If your software is publicly available, it is a good idea to transfer it to the ▼**Software Heritage** archive for this purpose. This archive provides permanent links to archived content (versions or source code fragments) via a SWHID persistent identifier, which means you can easily cite your own software or those of third parties..



Preparing
for after your
thesis,
join the
movement

Deeply rooted public policies

Open science arose in the 2000s thanks to an initiative led by committed researchers and is now a firmly rooted component of public policies.

France and the world commit to open science!

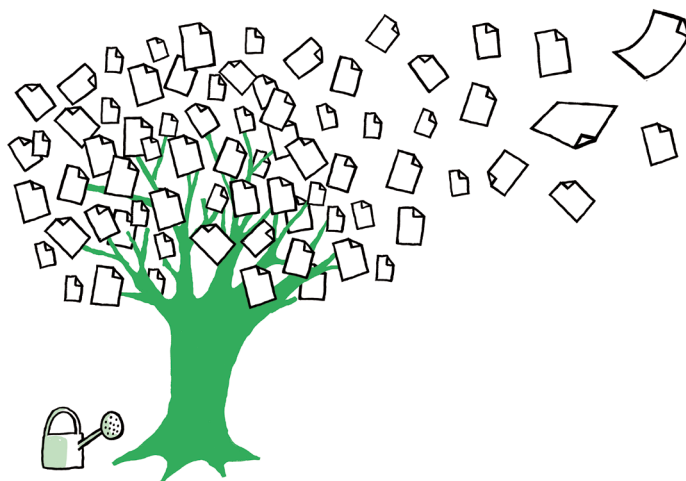
2016, French Law for a Digital Republic (*Loi pour une République numérique*)

This law provides a legal framework for the dissemination in open access of work published in a journal and defines the principle that administrative data should be open by default..

2021, the Second French Plan for Open Science

Following on from the First Plan launched in 2018, this Second Plan defines a set of actions based on four main objectives - to generalise open access to publications; to structure, share and open research data; to transform practices to make open science the default principle; and to open and promote the source codes produced by research.

These policies also encourage research organisations and institutions to adopt open science policies. **Find out if your institution has already adopted an open science roadmap!**



The **French Open Science Monitor** shows the progress made in recent years. 67% of articles, 71% of theses and 20% of research data, codes and software are already available in open access!



Research funding agencies

In 2020 several French research funding agencies including the ▼**French National Research Agency (ANR)** signed ▼**a joint declaration in support of open science**. They call for open access to publications and for a data management plan to be drafted for every funded project and have committed to encouraging the opening of associated data.

L'Unesco

In 2021, UNESCO adopted a ▼**Recommendation on Open Science** which sets out a common definition based on internationally shared values and standards. The Recommendation also put forward action principles for the fair and equitable implementation of open science.

And at the European level?

Funding

▼**Horizon Europe** the European Union's framework programme for research and innovation, has included open science as an evaluation criterion for the projects it funds. It calls for immediate open access to scientific publications, the implementation of FAIR principles for data management and data to be opened as far as possible.

The research funding agencies that make up ▼**cOAlition S** are committed to the development of open science. Through ▼**Plan S**, they defend immediate open access and open licence publishing, the full diversity of scientific publishing business models and the development of high-quality open access journals and publishing infrastructures.

Researchers' practices

The ▼**HR Excellence** in Research (HRS4R) label is based on the code of conduct for the recruitment of researchers which includes open science practices in its "Ethics and good professional practices" section.

Evaluating research differently

Open science represents an in-depth shift in science and research which means evaluation practices are also currently being questioned.

Reinventing peer review

Peer review is a prerequisite for any publication and a guarantee of the reliability of scientific results. This process is usually organised by the journal or publisher who submits the manuscript to other researchers in the same field as the author. However, reviewers often do not possess all the information required to judge the robustness of the results presented in an article. They are subject to inevitable biases and the confidentiality of the reviewing system makes it impossible to discern if this occurred. In this way, this system is not infallible and has certain limits.

Newer, more open and more transparent evaluation practices have now emerged. Pre-publication servers like **▼arXiv** and **▼bioRxiv** enable their users to review the quality of submitted manuscripts. Some journals publish review reports if the article is accepted while others enable comments on articles after these have been published. Making the data, codes and other materials associated with a publication available helps consolidate the review process.

Example

▼Peer Community In is structured by scientific field and organises a formal peer review process for pre-publications disseminated in open access. **When reviews are positive, these are published along with a recommendation explaining the article's merits. Recommended articles may be disseminated by partner journals or in the ▼Peer Community Journal.**

Journals in certain disciplines like biology ask for "registered reports" featuring pre-registered research hypotheses and protocols and evaluate these. They then commit to publishing the results as long as the protocol described has been followed.

Towards a reform of research assessment

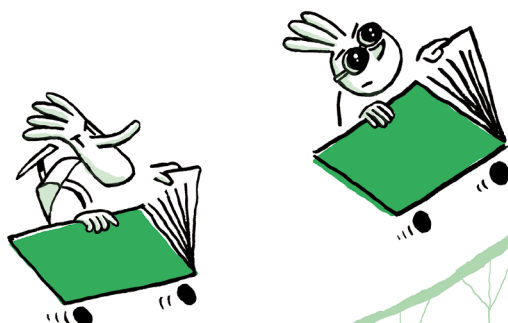
Open science is a driving force for reforming the way research is evaluated, in line with the principles championed back in 2013 by the Declaration of San Francisco (DORA).

In December 2022, the Coalition on Advancing Research Assessment (**▼CoARA**) was created with European Commission support which heralded a new dynamic.

The Coalition includes a wide range of research stakeholders in Europe and abroad who work together to implement the commitments set out in the "Agreement on Reforming Research Assessment" which they all signed. France took an active part in this initiative making the issue a core subject at the Paris Open Science European Conference organised in February 2022 (OSEC) as part of the French Presidency of the European Union and is organized around a national chapter of **CoARA** for collective discussion on this reform to be carried out in each of the establishments.

This reform concerns the assessment of researchers, research institutions and projects. Its principles place a great deal of emphasis on open science:

- to take into account the quality rather than the quantity of scientific contributions and to stop basing assessments on quantitative indicators like the impact factor or the h-index as these are indicators of a journal's reputation rather than the scientific quality of the articles it publishes;
- to promote practices of openness and transparency in scientific methods and results;
- to recognise and promote the full diversity of scientific output, particularly data, source code and software, algorithms, methods, and protocols;
- to encourage cooperation and collective dynamics within the initial scientific community and beyond;
- to share best practices.



Act now

When you can, submit your publications to open access journals.

Deposit your publications in an open archive:

- keep the latest version approved by peers but not yet formatted by the publisher.
- ask your co-authors for approval.
- deposit the latest version approved by the peer reviewers in an open archive.

Take part in discussions within your disciplinary community about pre-publications deposited in open archives.

Document and share research data and/or the source code you developed:

- store data using a perennial system or format in compliance with your team or institution's policy;
- document the data with metadata so that they are reusable;
- deposit the datasets associated with your publications in an online repository;
- use a software forge to efficiently evolve your source code thanks to multiple services: shared access, change management, continuous integration, discussions, etc.

Follow the evolutions of open science and get involved!

ANY QUESTIONS?

This guide to open science has provided you with an overview of all the relevant issues and avenues to be explored for your thesis work. If you wish to take this further, please do not hesitate to contact your university's departments who can answer your questions, provide you with individual support and offer you training in these subjects. Your contacts:

- your doctoral school (in the first instance) and/or your home laboratory;
- your institution's joint documentation service / university library (for training, depositing your thesis subject, management of the open archive portal, access to documentation, etc.);
- the Urfist network (Regional Scientific and Technical Information training French Unit (*Réseau des Unités régionales de formation à l'information scientifique* in French) which provides on-site or distance learning courses;
- the "open science contact" person or department at your university, school or research institution.

Going further

Consult the resources from *Passport for Open Science* collection.

GENERAL RESOURCES

Ouvrir la science : Ressources

Resources and guides distributed by the Committee for Open Science.

<https://www.ouvri.la-science.fr/category/ressources/>

Second National plan for open science

This document presents the French action plan set up by the Ministry of Higher Education and Research. <https://www.ouvri.la-science.fr/deuxieme-plan-national-pour-la-science-ouverte/>

FOSTER Open Science

A portal providing online training on open science (in English) created by FOSTER, a consortium of academic and research institutions in 6 European countries, funded by the European Union.

<https://www.fosteropenscience.eu>

CoopIST (Cooperating on scientific and technical information)

A CIRAD website providing many technical fact sheets on different aspects of open science.

<https://coop-ist.cirad.fr/>

The Couperin site on open science in France

The Couperin consortium provides links and guides concerning several aspects of open science including the dissemination of open access publications. <https://www.couperin.org/>

DoRANum (Research data: digital learning)

A set of free reusable resources (fact sheets and videos) which help with research data management provided by the Urfist network and Inist-CNRS. <https://dorum.fr/>

SPECIFIC RESOURCES

Publications and legal issues

Committee for Open Science. *Je publie, quels sont mes droits ?* 2nd edition. 2020. Available at www.ouvri.la-science.fr

Reproducibility

DESQUILBET, Loïc, GRANGER, Sabrina, HEJBLUM, Boris, et al., *Vers une recherche reproductible*. Bordeaux : Urfist de Bordeaux, 2019. <https://hal.archives-ouvertes.fr/hal-02144142>

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Glossary

APC (article processing charges)

Charges for publishing immediately in open access which may be billed to the author (or his or her institution). See Open access publications.

Article: preprint or author's version

The version of an article sent to a journal by the authors prior to the peer review process.

Article: Accepted author manuscript

The version of an article including revisions resulting from the peer review process but without the publisher's final layout.

Article: version of record

The version of an article with the editor's final layout as published in the journal.

Data Management Plan (DMP)

An ongoing plan written at the start of a research project which sets out how the data will be managed covering its collection, documentation, and storage, as well as managing sensitive data, conditions for opening or sharing data, etc.

Data repository

An online service for storing, describing, searching for and disseminating data sets. These can be multidisciplinary or disciplinary in nature. When they fulfil a series of criteria defined by the ▼ **Criteria for the Selection of Trustworthy Repositories**, they are given the certification label which aims to promote reliable and sustainable data repositories.

Distribution license

Legal text setting out the conditions for distributing and re-using a scientific product (e.g. free software licences, Creative Commons, etc.).

Embargo

Period during which a scientific product cannot be disseminated in open access.

FAIR (principles)

The aim of the FAIR principles is to make data findable, accessible, interoperable and reusable.

French Law for a Digital Republic (*Loi pour une République numérique*)

This 2016 law provides a legal framework for certain versions of journal articles to be made freely available if at least half the funding of the research concerned came from the public sector (including salaries), subject to an embargo period. Similarly, this law considers research data to be public when more half of the funding of the research concerned came from the public sector and also covers the special case of partnership research.

Forge

A software development environment that facilitates collaborative work on a software project. A forge contains tools like a versioned source code repository, discussion forums, an automated testing environment and so on.

General Data Protection Regulation (GDPR)

The legal framework defined by the European Union for the management of personal data. It may be consulted at: <https://www.cnil.fr/fr/comprendre-le-rgpd>.

Metadata

A set of structured information that describes, explains and locates an information resource to make it easier to find, use and manage.

Open access

Unrestricted access with no authentication, embargo or payment required. This can be implemented in different ways like self-archiving in an open archive or publication in an open access journal.

Open access publication

A journal or book that has been directly disseminated in open access. These books and journals have varied business models such as public subsidies, payments by authors' institutions (see APCs), financial contributions from academic societies or university libraries and so forth. Find out more about the ▼**Directory of Open Access Journals (DOAJ)** and the ▼**Directory of Open Access Books (DOAB)**.

Open archive

Thematic or institutional archives in which researchers directly deposit their work so it can be freely consulted with no technical or financial barriers.

Persistent identifier

A unique stable reference for a digital object or subject such as a dataset, article or author. For example a digital object identifier (DOI), or an Open Researcher and Contributor ID (ORCID).

Personal data

Data concerning an individual who is identified or identifiable.

Predatory publishers or journals

Publishers or journals with dubious peer reviewing or business practices.

Reproducibility

The capacity of another researcher to obtain the same results using the same methods and data. This highlights the importance of the methods used to produce such results.

Research data

Factual records (numerical scores, textual records, images and sounds) used as primary sources for scientific research, and that are commonly accepted in the scientific community as necessary to validate research findings.

Software

Text written in one or more computer languages describing calculations to be carried out by a computer. There are a variety of forms of software including code files, graphical assemblies, spreadsheet formulae, computational notebooks and so forth.

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Project leader

Jennèr Morival (1st edition),
Mónica Michel Rodriguez (2nd edition)

Writers

Céline Barthonnat, Johann Berti,
Nadine Couëdel, Romane Coutanson,
Marin Dacos, Alina Danciu, Gabriel Gallezot,
Madeleine Géroudet, Sabrina Granger,
Céline Hernandez, Joanna Janik,
Claire Josserand, Alicia León y Barella,
Émilie Lerigoleur, Jean-François Lutz,
Valérie Mansard, Christine Okret-Manville,
François Pellegrini, Sébastien Perrin,
Noël Thiboud.

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Translator

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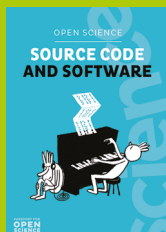
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