The Open Research Movement

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Introduction to the Open Research Movement

- The Open Research movement, often referred to as Open Science or Open Scholarship, is a global initiative aimed at transforming traditional research practices.
- Driven by a set of core principles, it emphasizes openness, transparency, and collaboration throughout the research process.
- In this workshop, we will delve into the key aspects and benefits of the Open Research movement.

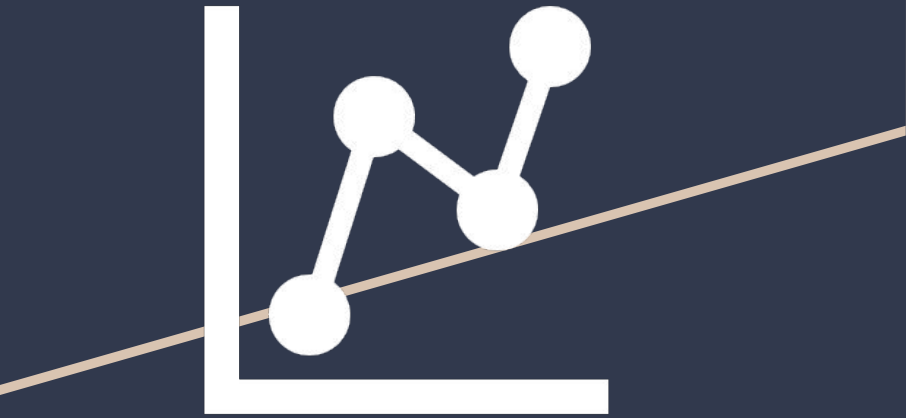
Introduction to the Open Research Movement

- Listen to Andrew Stewart (Institutional Lead for Open and Reproducible Research) speak about the benefits and challenges of conducting Open Research

Key Principles - Open Access

- Open Access is a cornerstone of the Open Research movement. It advocates for the unrestricted availability of research publications, data, and findings to the public.
- Researchers and institutions are encouraged to make their work freely accessible through various means, such as open-access journals, preprint servers, and institutional repositories.
- Open Access promotes the democratization of knowledge by removing financial barriers to access, enabling anyone with an internet connection to benefit from research findings.

Key Principles - Open Data



- Open Data is the practice of openly sharing research data, allowing others in the scientific community and beyond to access, scrutinize, and build upon it.
- Researchers are encouraged to provide well-documented datasets alongside their publications.
- This openness not only enhances the reproducibility of research but also fosters innovation, as diverse perspectives can be applied to existing datasets to answer new questions or explore new hypotheses.

Key Principles - Open Collaboration

- Open Collaboration is a fundamental tenet of the Open Research movement. It encourages researchers to collaborate across disciplines, institutions, and geographical boundaries.
- By breaking down silos and fostering interdisciplinary teamwork, Open Collaboration can lead to more comprehensive and innovative research outcomes.
- Initiatives such as open-source software development and collaborative research platforms play a crucial role in facilitating these collaborations.

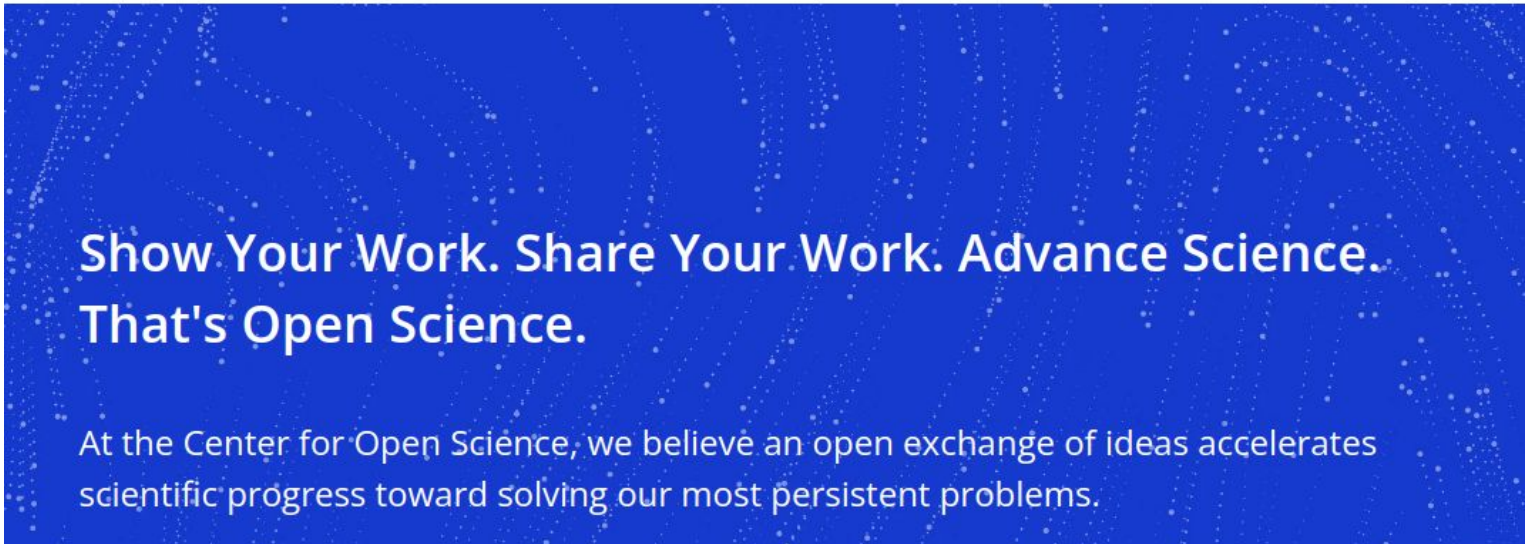
The UK Reproducibility Network (UKRN)

The UK Reproducibility Network (UKRN) is a national peer-led consortium that aims to ensure the UK retains its place as a centre for world-leading research. We do this by investigating the factors that contribute to robust research, promoting training activities, and disseminating best practice. We also work collaboratively with various external stakeholders to ensure coordination of efforts across the sector.

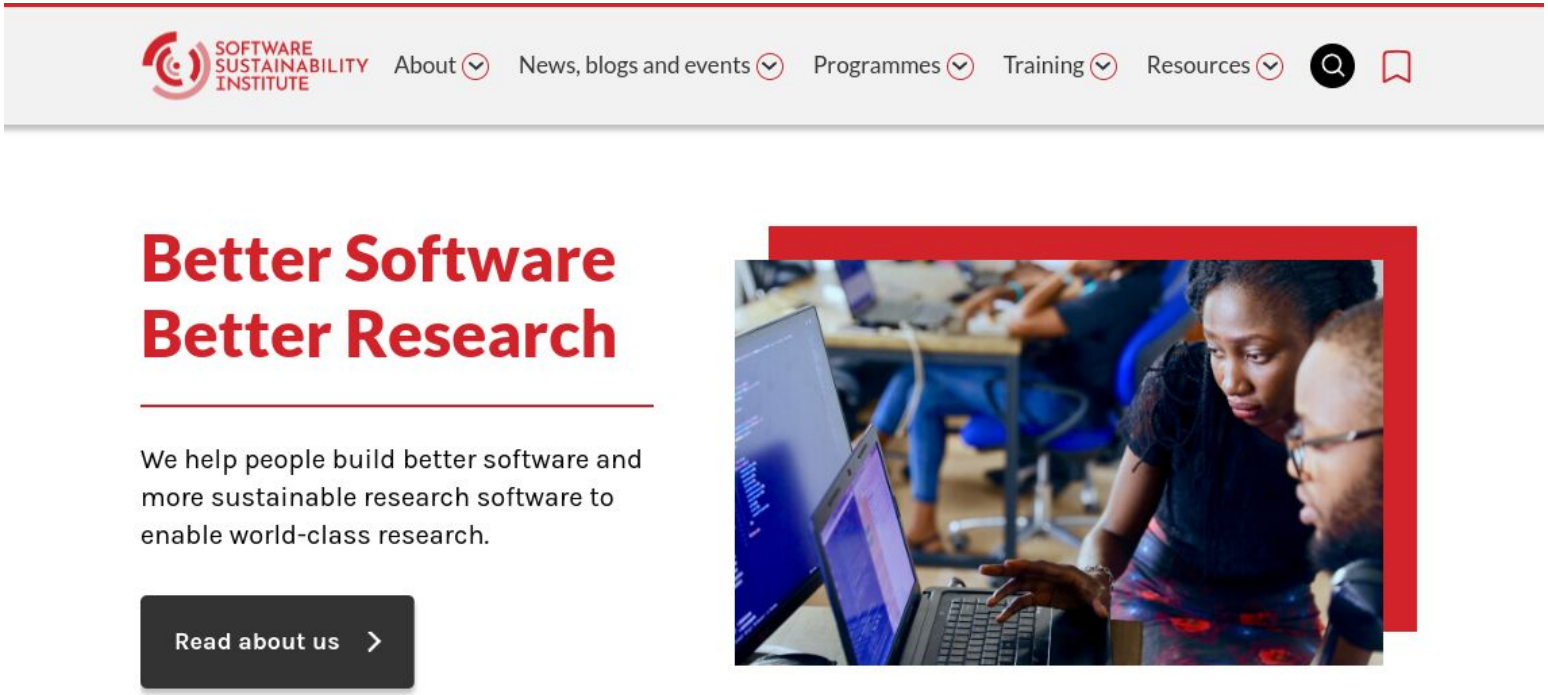
We seek to understand the factors that contribute to poor research reproducibility and replicability, and develop approaches to counter these, in order to improve the trustworthiness and quality of research. These issues affect all disciplines, so we aim for broad disciplinary representation. We believe that ongoing efforts to address these issues represent an opportunity to improve our research by reforming culture and practice.

UKRN is coordinated by a Steering Group and supported by an Advisory Board, with representation across the UK through researcher-led local networks at several institutions, many of which have formally joined UKRN.

Visit https://www.ukrn.org/ to learn more about the UK Reproducibility Network



- Visit https://www.cos.io/
  to learn more about the Center for Open Science



- Visit https://www.software.ac.uk/
  to learn more about the Software Sustainability Institute

Advantages - Reproducibility

- One of the central advantages of Open Research is reproducibility. By making research methods, data, and code openly available, researchers can ensure that their work is transparent and accessible.
- This transparency allows other researchers to validate and reproduce findings, enhancing the credibility and reliability of scientific research.
- Reproducibility is essential for building a solid foundation of knowledge upon which future research can be built.

Advantages - Innovation

- Innovation thrives in the open research environment. Openly accessible data, findings, and collaborative opportunities enable researchers to leverage existing work to drive new discoveries and advancements.
- The ability to build upon the work of others accelerates the pace of innovation and can lead to breakthroughs in various fields, from medicine to technology.

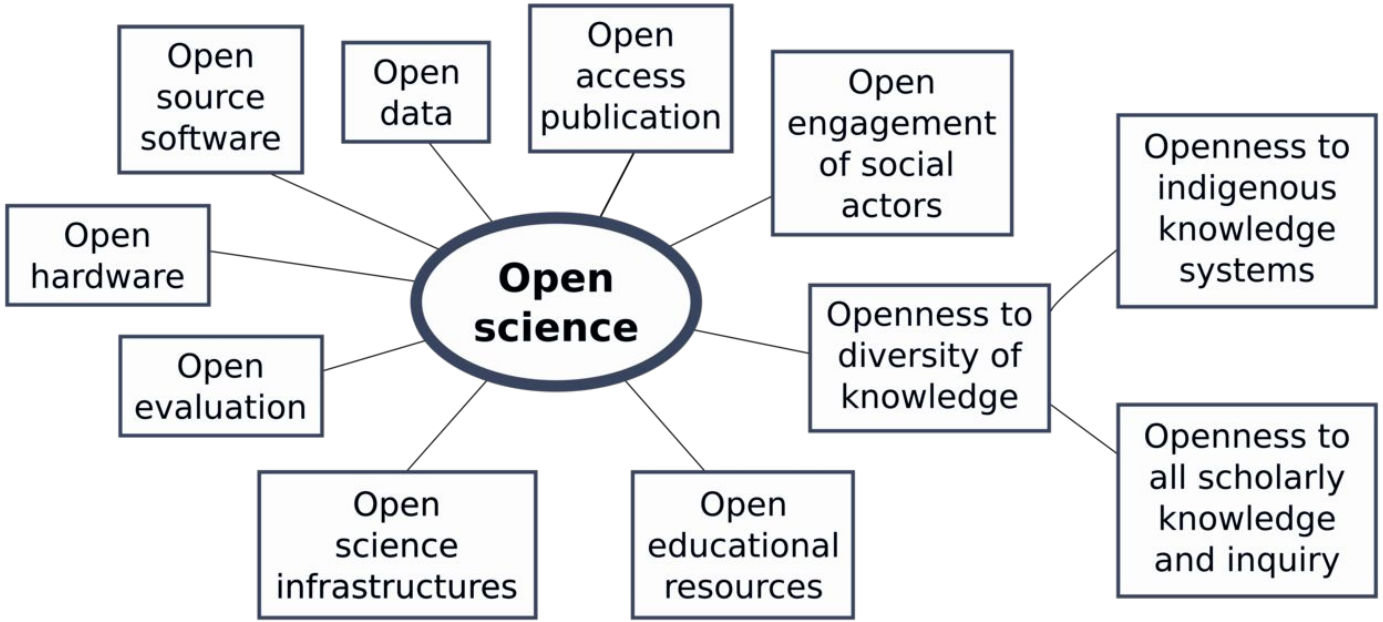
Advantages- Democratizing Access

- Open Research promotes accessibility by making research outputs available to a broader audience, including individuals outside the academic community.
- Policymakers, educators, and the general public can benefit from access to research findings, leading to evidence-based decision-making and societal progress.
- This accessibility has the potential to bridge the gap between academic research and practical applications in the real world.

Challenges and Future Directions

- While the Open Research movement has made significant progress, it faces several challenges on its path to widespread adoption.
- These challenges include securing sustainable funding for open-access publishing, addressing data privacy concerns, and fostering cultural shifts within academia that prioritize openness and collaboration.
- However, the future of Open Research looks promising, with more funding agencies, institutions, and individual researchers embracing its principles.

How to conduct open & reproducible science?



Before – Pre-registration

- Preregistration: Specifying a research plan in advance and submitting it to a registry (e.g. https://osf.io/)
- Separates research into *hypothesis-generating* (exploratory) and *hypothesis-testing* (confirmatory) phases.
- Improves research quality and transparency.
- Aids in clear reporting of the study.
- Benefits others who may want to build on the research.

https://www.pnas.org/doi/epdf/10.1073/pnas.1708274114

PNAS

Check for updates

The preregistration revolution

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Progress in science relies in part on generating hypotheses with existing observations and testing hypotheses with new observations. This distinction between postdiction and prediction is appreciated conceptually but is not respected in practice. Mistaking generation of postdictions with testing of predictions reduces the credibility of research findings. However, ordinary biases in human reasoning, such as hindsight bias, make it hard to avoid this mistake. An effective solution is to define the research questions and analysis plan before observing the research outcomes—a process called preregistration. Preregistration distinguishes analyses and outcomes that result from predictions from those that result from postdictions. A variety of practical strategies are available to make the best possible use of preregistration in circumstances that fall short of the ideal application, such as when the data are preexisting. Services are now available for preregistration across all disciplines, facilitating a rapid increase in the practice. Widespread adoption of preregistration will increase distinctiveness between hypothesis generation and hypothesis testing and will improve the credibility of research findings.

overconfidence in post hoc explanations (postdictions) and inflate the likelihood of believing that there is evidence for a finding when there is not. Presenting postdictions as predictions can increase the attractiveness and publishability of findings by falsely reducing uncertainty. Ultimately, this decreases reproducibility (6–11).

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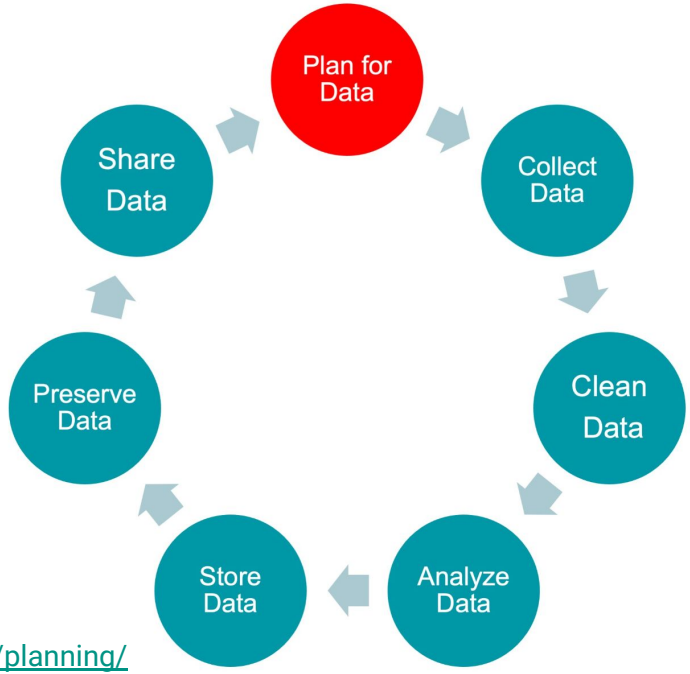
PREREGISTERED

Before – Having a data management plan

- Organizes data handling processes
- Defines types and storage of data
- Ensures data security and integrity
- Facilitates data sharing and future research access
- Required by most funding bodies



https://www.library.manchester.ac.uk/services/research/research-data-management/planning/
https://www.dcc.ac.uk/guidance/how-guides/develop-data-plan

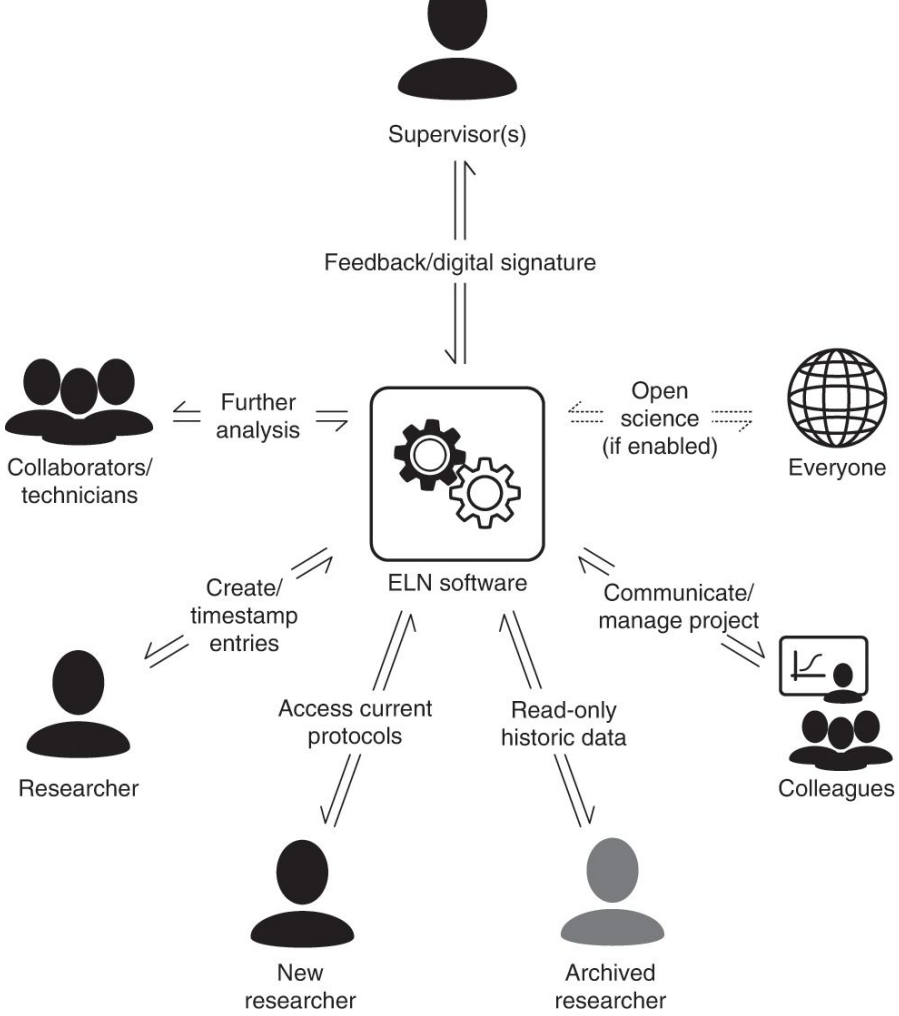
During – Documenting methods & data

- Do not rely on (fallible) human memory to accurately recall details of experiments and results!
- Keeping a good lab book ensures data integrity
- Record details such as dates, names of individuals you've received materials from, exact approaches and calculations for experiments performed
- Ensures accurate capture of protocol information
- Facilitates communication of findings (when it comes time to write up)

Traditional lab book, Katherine Stember (CC BY 4.0)

Electronic laboratory notebooks (ELNs)

- Keeps laboratory notes, protocols etc. and data together
- Supports training and collaboration
- Data backup
- Supervisor oversight



https://www.nature.com/articles/s41596-021-00645-8

During – Using open source software

- Transparent and accessible code, making it easier for others to verify and replicate research results
- Usually free to use, promoting inclusivity by ensuring that tools are accessible to all researchers
- Can modify and customize open source software to suit their specific research needs, leading to a more flexible and adaptable scientific environment

After – Using data repositories

- Data repositories support open science by centralizing data storage and sharing.
  e.g. Figshare, Dryad, Zendoo
- Field-specific or data type-specific repositories cater to specific data requirements.
  E.g. NCBI, ENA
- Moving away from 'available on request' statements in papers, or data stored with manuscripts, which journals may not indefinitely maintain

Not an example of an open data repository!
Photo by Janet McKnight (CC BY 2.0)

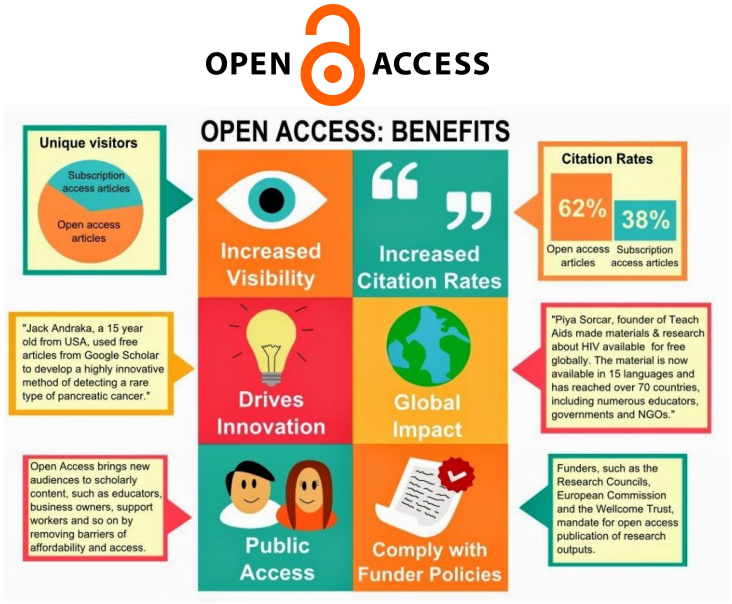
After – Using software repositories

- If your research generates software, you should store it in a software repository
- Centralized storage and sharing for research code, promoting transparency and collaboration (e.g. GitHub, Sourceforge)
- Improved research reproducibility and version control
- Searching of code databases
- Centralised bug reporting
- Encourages open sharing, knowledge exchange, and research advancement

After – Preprints and open access publishing

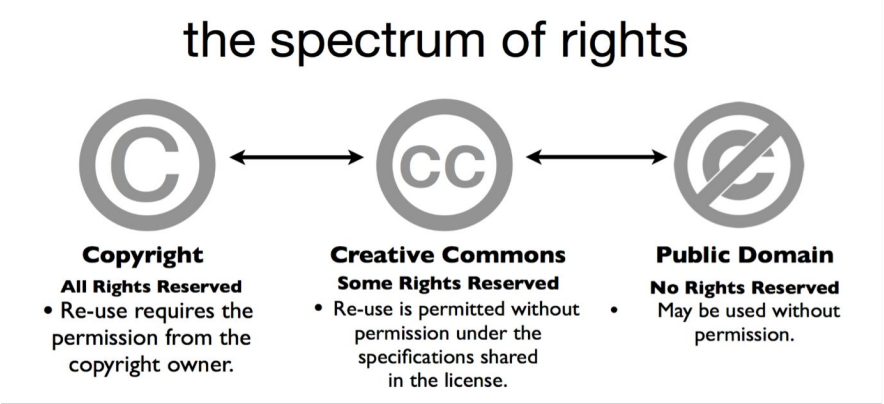
- Preprints provide swift sharing of research findings before peer review
- Open access ensures free and unrestricted access to research papers
  - **Gold** open access = immediately and freely available to the public upon publication, but cost £ to publish
  - **Green** open access = "author accepted manuscript" posted in a repository, or made available by publisher after an embargo period.
- Both promote collaboration, early feedback, and broad knowledge dissemination in the scientific community

arXiv bioRxiv THE PREPRINT SERVER FOR BIOLOGY medRxiv THE PREPRINT SERVER FOR HEALTH SCIENCES

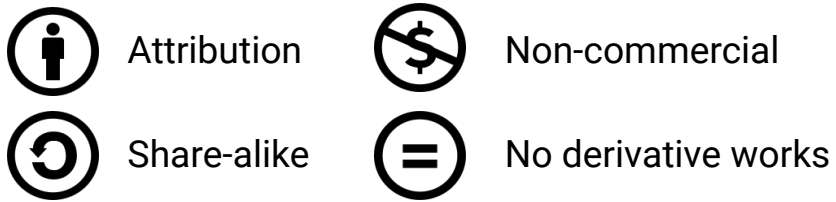


After – Open licencing and content reuse

- Consider publishing your work in journals that support Creative Commons licence options:
  - CC BY 4.0—reuse with attribution (like citation!)
  - CC0—"no rights reserved" or public domain
- Allows work to be adapted and reused
- Journals that support CC BY 4.0:
  PLOS Biology, *eLife*, *PeerJ*, *BMC Biology*, *Scientific Reports*, *Nature Communications* (& other open access titles published by *Nature* Publishing Group)



Optional attributes of CC licences



Open Research at The University of Manchester

- The University of Manchester is an active participant in the Open Research Movement, demonstrating a strong commitment to openness, transparency, and collaboration in research practices.
- The University has embraced Open Access publishing, making a significant portion of its research output freely available to the public, thereby increasing the accessibility of knowledge.
- Moreover, it actively encourages researchers to share their datasets openly, promoting the principles of Open Data.

Initiatives at The University of Manchester

- Listen to Professor Colette Pagan (UoM Vice-President for Research) speak about resources and initiatives undertaken at The University of Manchester

Initiatives at The University of Manchester

- The University of Manchester fosters interdisciplinary collaborations and provides support for researchers to engage in open science initiatives, thus contributing to the ethos of Open Collaboration.
- It is committed to supporting researchers in their open research endeavors, ensuring that the benefits of the Open Research movement are realized within its academic community.
- By championing these principles and actively participating in the Open Research Movement, the University is not only advancing the credibility and reproducibility of research but also fostering a culture of innovation and knowledge sharing within its academic community and beyond.

The Office for Open Research at UoM

- The Office for Open Research represents a substantial investment in the future of publishing, data, and open knowledge by the University of Manchester.
- It is a central hub for Open Research initiatives, positioning the institution at the forefront of this global movement.
- The Office fosters open dialogue with the research community, allowing for the clear delineation of Open Research goals and the accommodation of the diverse needs of various research communities.

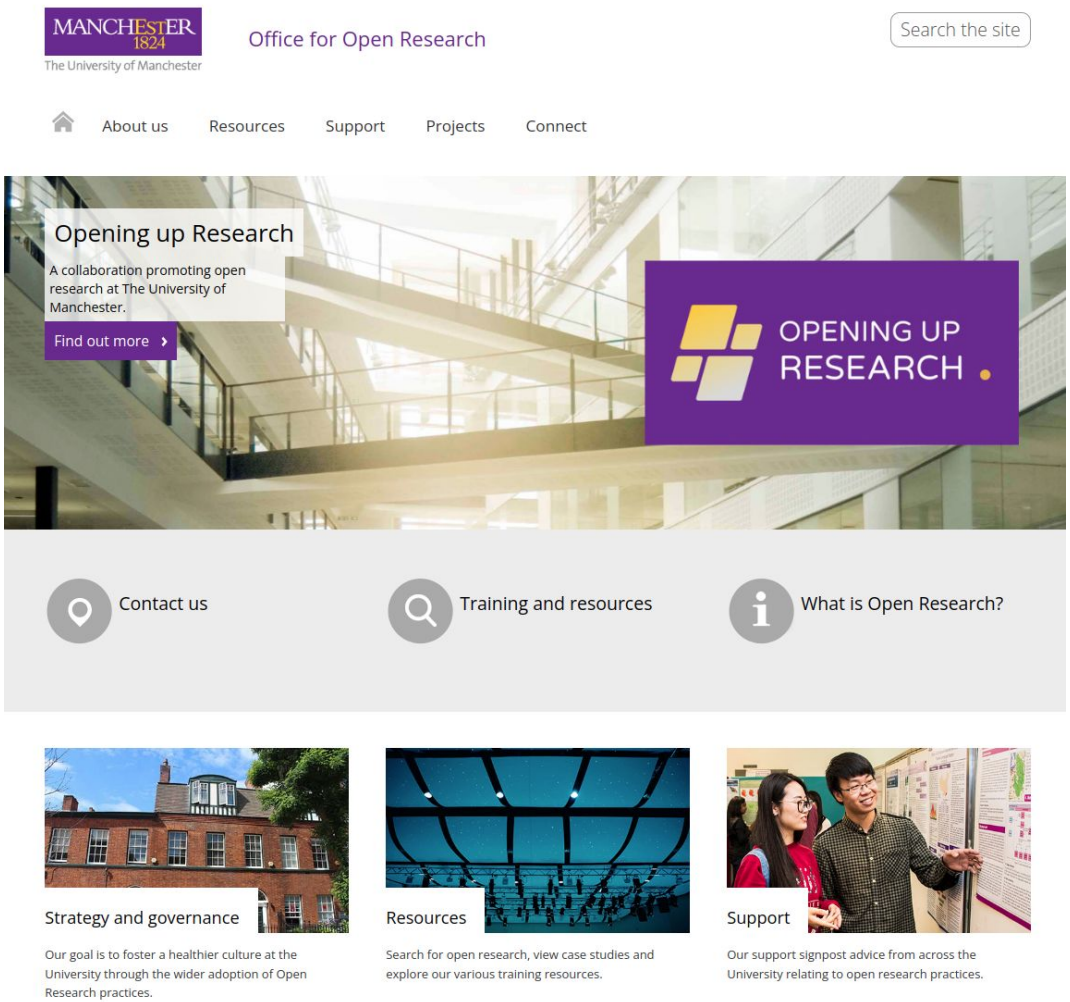
Watch this video about the services offered by the Office for Open Research

The Office for Open Research at UoM

- Listen to Professor Christopher Pressler from the Office for Open Research speak about its role at in promoting and supporting Open Research at The University of Manchester

- Listen to Dr Patrick Manu speak about the process of open research and open research practices

- Listen to Lorraine Beard speak the Open Research Service Partnership and maintaining responsible metrics for research



- Visit https://www.openresearch.manchester.ac.uk/ to learn more about the resources available for supporting Open Research at UoM from the Office for Open Research