Module 1
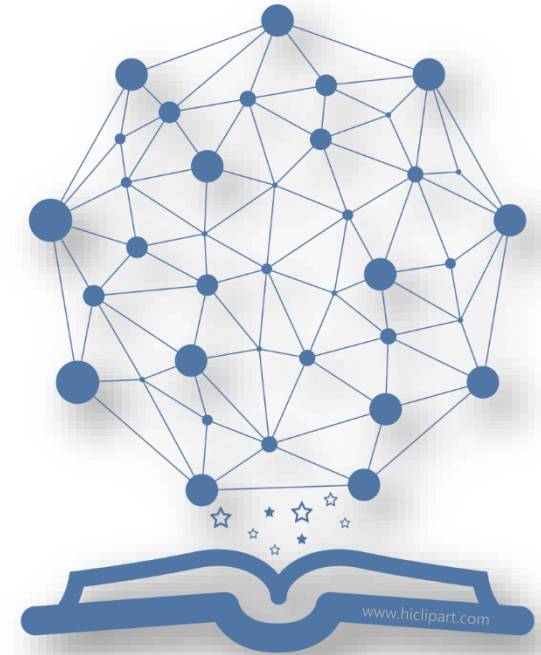Introduction to Research Data Management (RDM)

Stefano Della Chiesa

Before starting

RDM as multidisciplinary knowledge management

- You´ll be introduced on several concepts linked with another (be patient, feel free to ask)

- The training material contains several hyperlinks to other sources

Knowledge network

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Introduction

This first module introduces RDM, giving its context in the Research Data Governance

- Research Data Management (RDM)
- RDM Top Down & Bottom Up
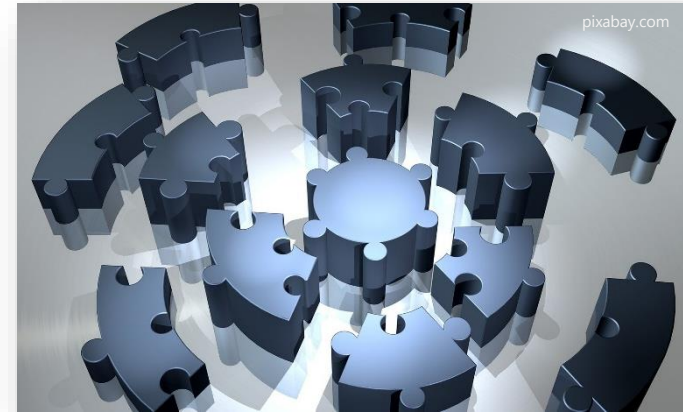- Linked Research Outputs
- Research Assessment
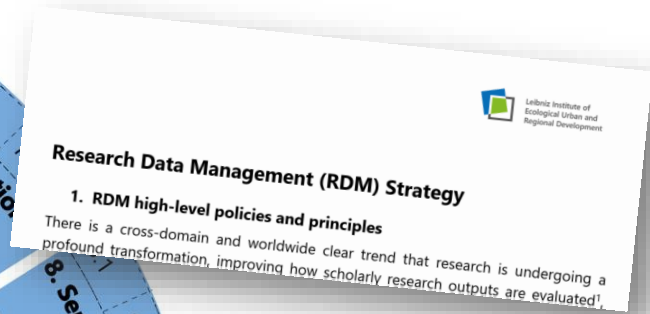
Research Data Management - What?

A Puzzle of knowledge bricks

RDM is a mosaic of **multidisciplinary knowledge** and competencies.

RDM know-how is a **toolkit** to address policy compliance and data management best practices throughout the project lifecycle.

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RDM & Institutional Research Data Strategy

https://doi.org/10.5281/zenodo.7112779

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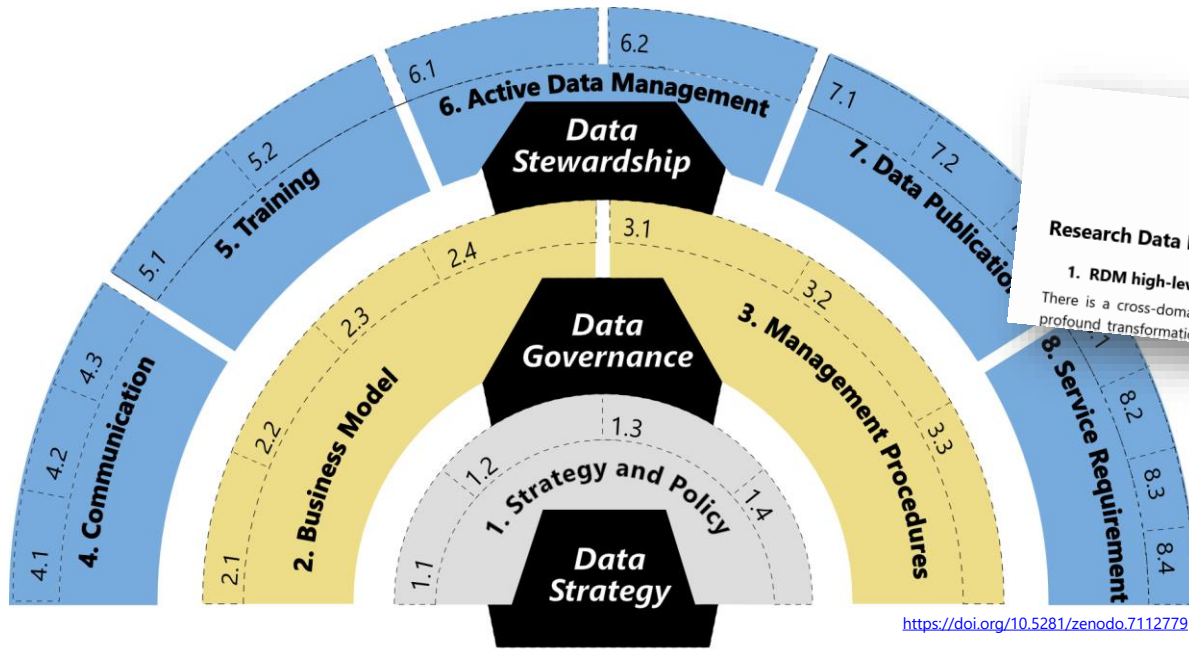
What is Research Data?

## No standard definition available

- Research data is the fundament of any scientific work documenting its results.

- [DFG specifies](): "Research data includes **measurements, audio-visual information, texts, documentation, samples, questionnaires, algorithms, software, simulations**, etc..

- Research data is highly heterogeneous, with subject area having a wide variety of data type and formats.

- Hence: Research Data → **Research Input/Output**

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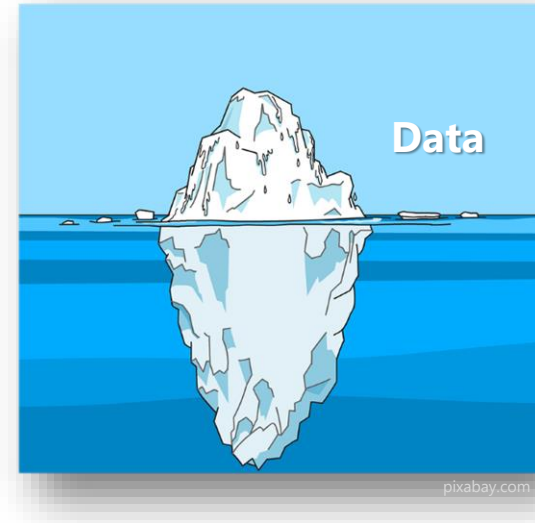
What is Metadata (MD)?

Metadata (MD) is **data about data**.

In research, Metadata represents the **information that describe data** in a <u>structured</u> way the research data.

Structured? It means there are several MD elements that can describe the data: Title, Creator, Abstract, Keywords, Format, Subject, PID, License, Provenance/Lineage, etc.

Metadata

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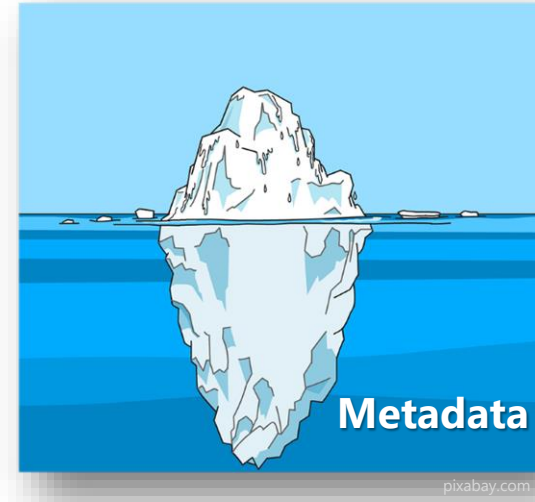
Research Data Management

The research and data lifecycle

Research idea and design planning

Data retrieval (existing or new)

Data processing and analysis

Publishing and re-use

https://doi.org/10.5281/zenodo.6602006
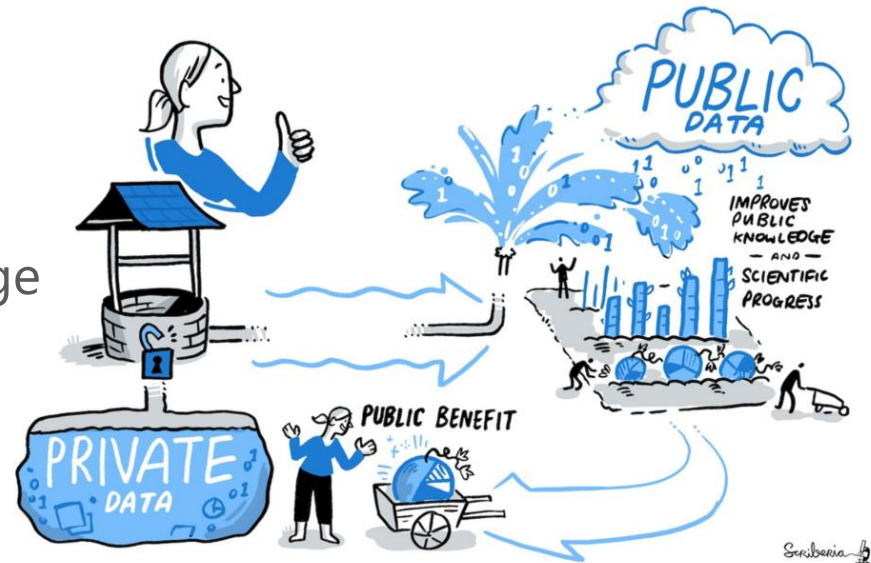
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Research Data Management - Why?

- Assure return of investment

- Efficient spending

- Increases publicly available knowledge

- Community network and beyond

- Provides new unexplored benefits

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Lack of RDM best practices has a price!

~1x 10^{10} arguments

- Huge cost for not having "open/FAIR" data

- Minimum cost ~ €10bn^{-y} (likely cost $\rightarrow$ almost three-fold)

- A perspective (Horizon Europe ~ €13.6bn^{-y})
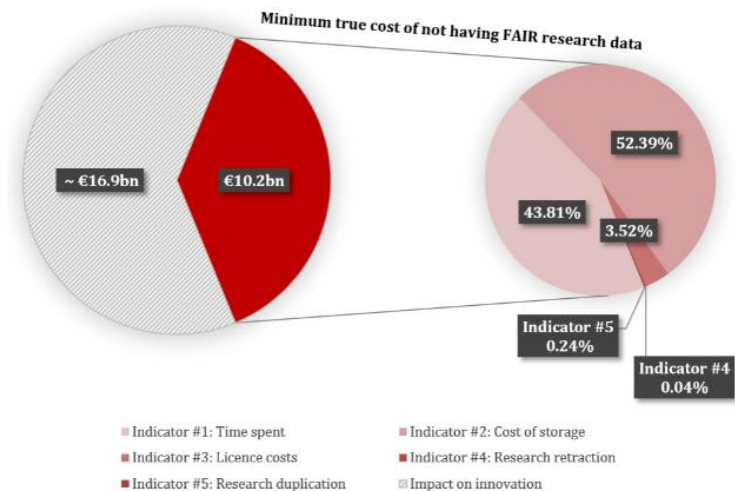
EU Cost-benefit analysis for FAIR research data - https://data.europa.eu/doi/10.2777/02999

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Research Data Management - How?

Enforcement & real needs

Top Down Requirements

Bottom up needs!

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Top Down

Stakeholder Requirements & High level policies

- DMP Funder requirements

(e.g. DFG, Horizon Europe)

- Open Science
- Good Scientific Practice
- Guidelines Handling Research Data
- Open Access
- FAIR Principles

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Bottom Up

Researcher and community needs!

- RDM **Solutions**
- **Find again** your data
- Good practices & Data Culture
- Partnership & Collaboration
- Share, re-use and **get credits**
- Data/Method/Software Paper
- No longer **grey literature**

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Linked Research Outputs

Several research outputs associated with the formal Journal publication are stored & shared online. (e.g. datasets, code/algorithms, protocols, preprints, posters, documentation, etc.)
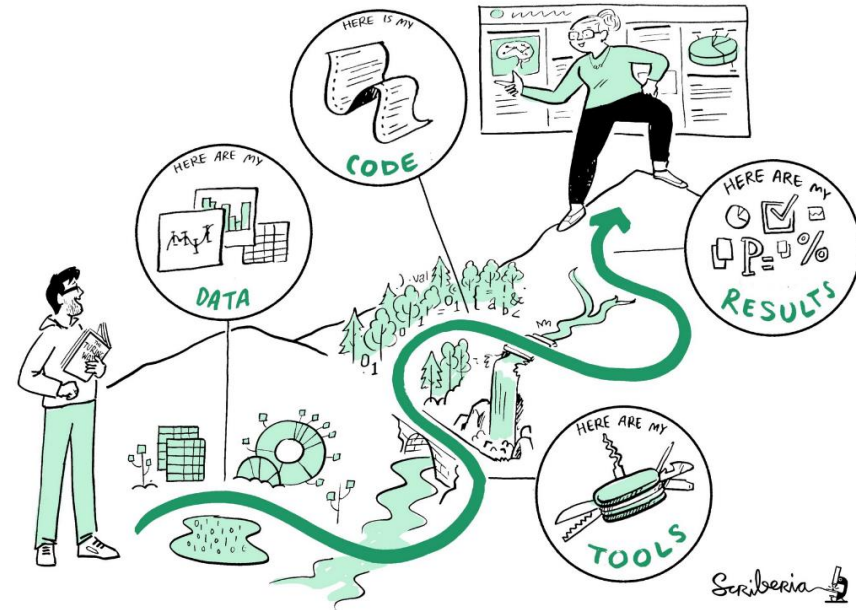
Crossref Blog: "Linking publications to associated research outputs"

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Linked research output

"To peer or not to peer"

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Research Outputs

Peer review

Non-Peer review Workflow (Free)

Peer review publication

Algorithms

Software

Workflows

Peer review Data Paper

Research Outputs

Data*

Peer review Software Paper

White papers

Posters

Documentation

Designs Artworks

* General, Institutional, Disciplinary Repositories

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Research Outputs and Evaluation metrics
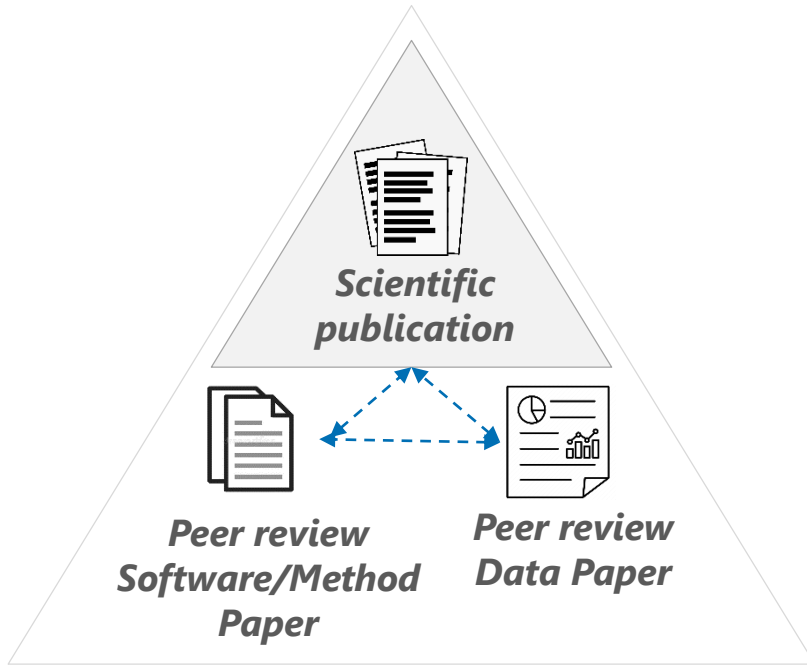
Traditional
ISI- indexed Research Outputs

- Scientific publication
- Peer review Software/Method Paper
- Peer review Data Paper

Emerging
Non-ISI Open Research Outputs

- Algorithms
- Software
- Workflows
- White papers
- Data
- Posters
- Documentation
- Designs Artworks

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Some ISI Data Journals

| Data Journals	Publisher
Data	MDPI
Data in Brief	Elsevier
Journal of Open Research Software (JORS)	Ubiquity Press
Scientific Data	Nature Publishing Group
Research Data Journal for the Humanities and Social Sciences	Brill
Rubrik Data Observer der Jahrbücher für Nationalökonomie und Statistik	DeGruyter - (RatSWD)
Journal of Open Humanities Data (JOHD)	Ubiquity Press
Biodiversity Data Journal	Pensoft
Journal of Chemical & Engineering Data	ACS Publications
ing.grid - FAIR Data Management in Engineering Sciences	TUJournlas
Earth System Science Data - ESSD	Copernicus Publications
Geoscience Data Journal	Wiley
Geoscientific Model Development	Copernicus Publications
Open Data Journal for Agricultural Research	Diverse

Research evaluation

...in addition to research quality and impact factor...

"...so far career-advancement criteria **don't reward open practices but it is changing...**"

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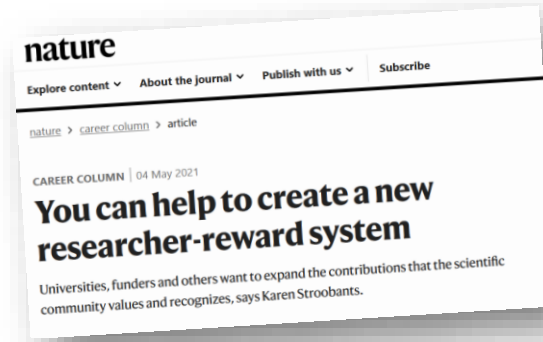
Changing the Research Assessment

[Declaration on Research Assessment (DORA)](#) to Improve the ways in which researchers and the outputs of scholarly research are evaluated!

[Coalition for Advancing Research Assessment](#): a shared direction for changes in research assessment practices
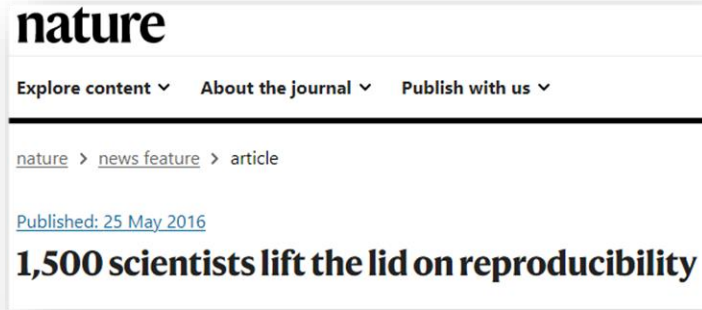
"Research assessment criteria should reward **ethics, reputation**, **teamwork and diversity of outputs**"

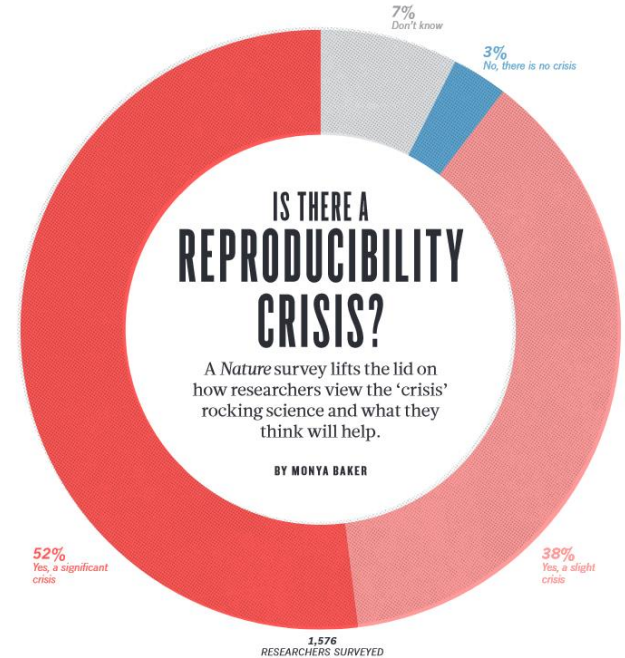[Leibniz IOER is among the ~2800 organizations that signed it](#)

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Why RDM does it matter?

The reproducibility challenge

nature

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Published: 25 May 2016

1,500 scientists lift the lid on reproducibility

*"More than 70% of researchers have tried and **failed to reproduce** another scientist's experiments, and more than 50% have failed to reproduce their own experiments"*

7%
Don't know

3%
No, there is no crisis

IS THERE A
REPRODUCIBILITY
CRISIS?

A *Nature* survey lifts the lid on
how researchers view the 'crisis'
rocking science and what they
think will help.

BY MONYA BAKER

52%
Yes, a significant
crisis

38%
Yes, a slight
crisis

1,576
RESEARCHERS SURVEYED

Baker, M. 1,500 scientists lift the lid on reproducibility. *Nature* **533,** 452–454 (2016).

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RDM Growing momentum

nature

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CAREER FEATURE | 13 May 2019

Data sharing and how it can benefit your scientific career

Open science can lead to greater collaboration, increased confidence in findings and goodwill between researchers.

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COMMENT | 04 June 2019 | Correction 05 June 2019

Credit data generators for data reuse

To promote effective sharing, we must create an enduring link between the people who generate data and its future uses, urge Heather H. Pierce and colleagues.

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EDITORIAL | 06 April 2022

Time to recognize authorship of open data

The open data revolution won't happen unless the research system values the sharing of data as much as authorship on papers.

PLOS ONE

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🔓 OPEN ACCESS | 📄 PEER-REVIEWED

RESEARCH ARTICLE

The citation advantage of linking publications to research data

Giovanni Colavizza, Iain Hrynaszkiewicz, Isla Staden, Kirstie Whitaker, Barbara McGillivray 📧

Published: April 22, 2020 • https://doi.org/10.1371/journal.pone.0230416

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RDM it matters!