# Improving Research Culture and Integrity through Open Science

**Will Cawthorn** (@BMATscientists)
***UoE Centre for Cardiovascular Science***

***Edinburgh Open Research Conference***

***16th May 2023***


The Academy of Medical Sciences
HIRE YOU WAY TTER SCIENCE
MOST PEOPLE IN POWER ARE SYMPATHETIC BUT OVERWHELMED
THEY USUALLY WANT TO HELP
THE INCENTIVE STRUCTURE IN SCIENCE NEEDS CHANGING
DOING GREAT SCIENCE SHOULD NOT BE A HANDICAP!
WE SHOULDN'T BE FORCED INTO CUTTING CORNERS
STANDARD PRACTICES SHOULD NOT WORK TO HARM YOUR CAREER
BAD FOR THE SCIENCE
BAD FOR THE STAFF
BAD FOR THE BUDGET
HIRE WISELY
WILL THE CANDIDATES BRING VALUE TO THE TEAM?
TOXIC HIRES CAN SELF PERPETUATE
WE NEED TO BREAK THE CYCLE
A SCIENTIST
"...BEING AMERICAN IS MORE THAN A PRIDE WE INHERIT, IT'S THE PAST WE STEP INTO AND HOW WE REPAIR IT..." *
POST DOCS
DESERVE EXTERNAL AUTHORSHIP ON GRANTS!
ARE COLLEAGUES
SCIENTISTS
ENGAGE AND LEARN FRO ALL NE
• SUPPORT
• REWARD
• CELEBRATE WHAT WE VALUE
TRANSPARENCY
COLLABORATION
EQUITY OF ACCESS TO ALL OPPORTUNITIES
RESEARCH CULTURE
ENCOURAGE COMMUNITY ENGAGEMENT
RECOGNISE VALUABLE CONTRIBUTIONS
MAKE PEOPLE'S LABOUR VISIBLE
EVALUATE EFFICIENCY WITH A FLEXIBLE MINDSET
RE-FRAME WHAT YOU SEE AS A VALUABLE INVESTMENT!
QUALITY OVER QUANTITY
AIM TO PROMOTE PEOPLE WHO BRING A NET POSITIVE!
EXCELLENT STUDENTS DO NOT ALWAYS EQUAL EXCELLENT RESEARCHERS
IT'S NOT JUST ABOUT METRICS
EXAM GRADES DON'T DICTATE CREATIVITY AND INNOVATION
WE NEED TO EMPHASISE THE FLEXIBILITY OF ACADEMIC CAREERS
CONTRIBUTE TO A TEAM-SCIENCE ENVIRONMENT IN NON-TRADITIONAL WAYS
COLLEGIALITY IS KEY
METRICS SHOULD BE ACCOMPANIED BY A NARRATIVE
IT'S NOT ALL ABOUT PRESTIGE
THE RESEARCH COMMUNITY SHOULD BE RECOGNISED AS ESSENTIAL
* QUOTE TAKEN FROM THE POEM "THE HILL WE CLIMB" BY AMANDA GORMAN
Scriberia

# Talk overview

*A: Open Science and the pursuit of (useful) knowledge*

*B: Unhealthy Research Culture → Bad habits in research practice, communication and assessment*

*C: Consequences of an unhealthy research culture*

*D: Open Science to improve research culture and integrity*

## Ⓐ What is Open Science?

**Open Science = Open Research**



https://www.fosteropenscience.eu

LERU = The League of European Research Universities

***"Open science is the movement to make scholarly research, data and dissemination accessible to all levels of an inquiring society"***

**Open Scholarship**

## A Open Science policies: LERU and the Open Science Roadmap

https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdf

LE RU

Open Science and its role in universities:

A roadmap for cultural change

ADVICE PAPER
NO.24 - MAY 2018

### The 'Eight Pillars of Open Science"

European Commission

https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

## Ⓐ The “Eight Pillars of Open Science”

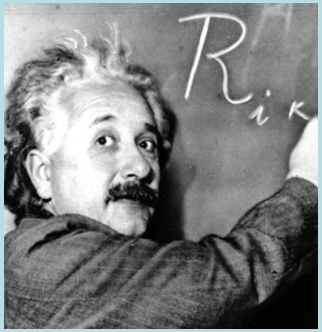
L E
R U

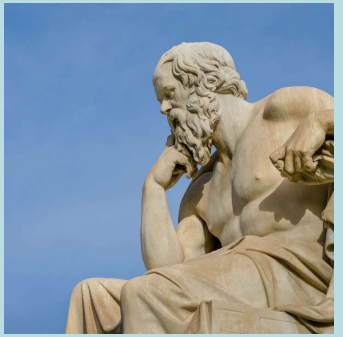
1. Future of Scholarly Communication
2. FAIR Data
3. Education and Skills
4. Research Integrity
5. Next Generation Metrics
6. Rewards and Initiatives
7. Citizen Science
8. European Open Science Cloud (EOSC)

**Why is this important?** → **What is my goal?**

## What is our goal?

## What is my goal?





- Scientist
- Researcher
- Humanities
- Artist
- Philosopher
- Academic? Scholar?
- THINKERS

→ Experiments, Read, Study, Research, Create → Data, Techniques, Theories, Concepts, Ideas

→ THINK → KNOWLEDGE

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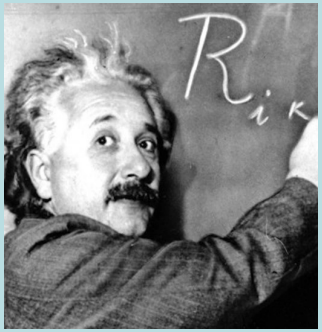

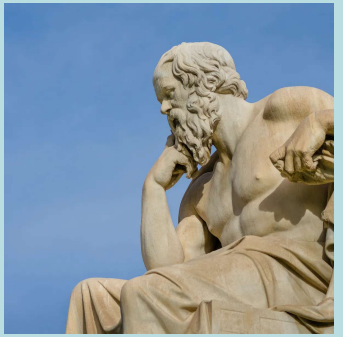

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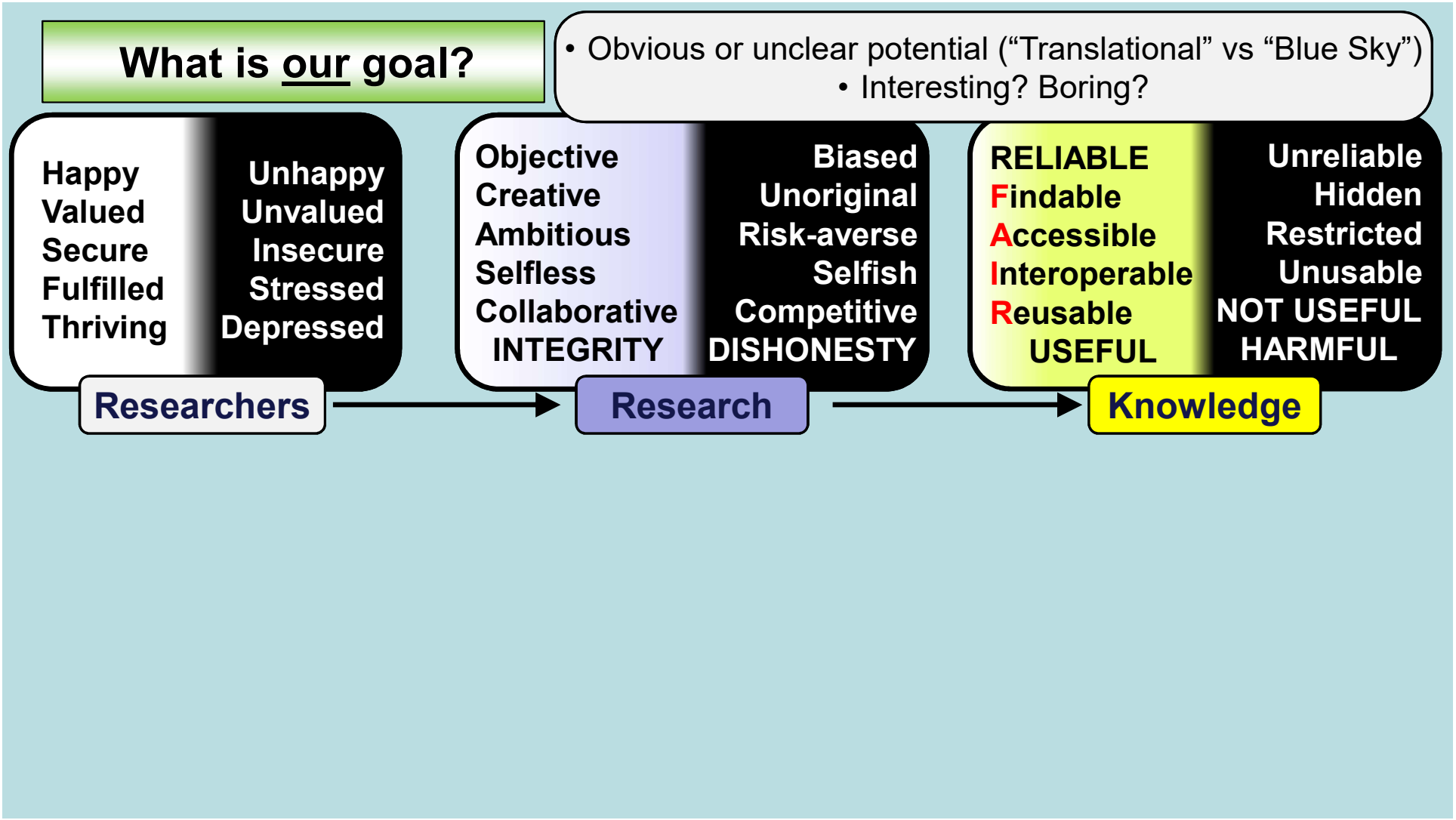
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• Interesting? Boring?
Happy
Valued
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Unreliable
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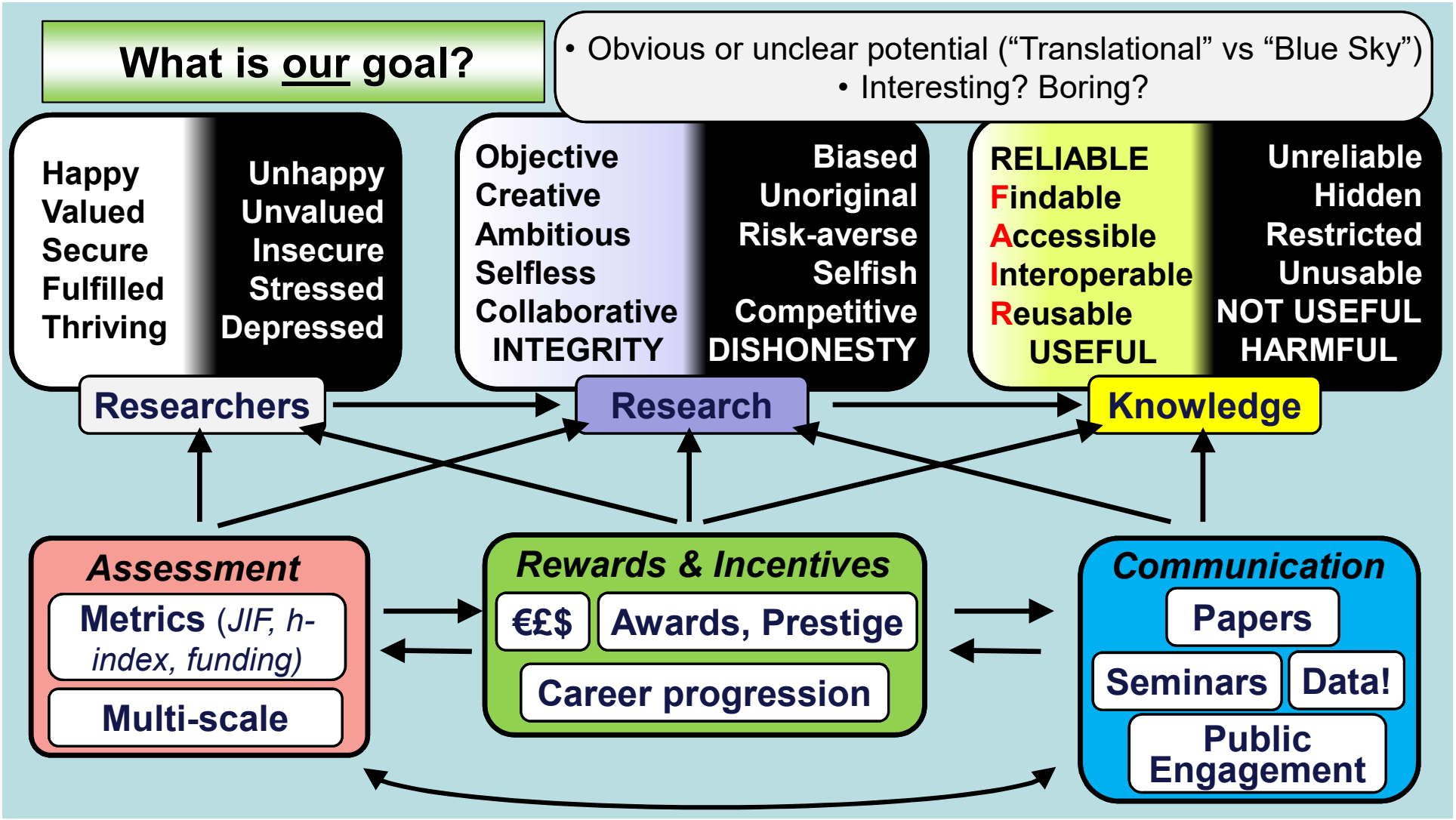
NOT USEFUL
HARMFUL
Knowledge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Career progression
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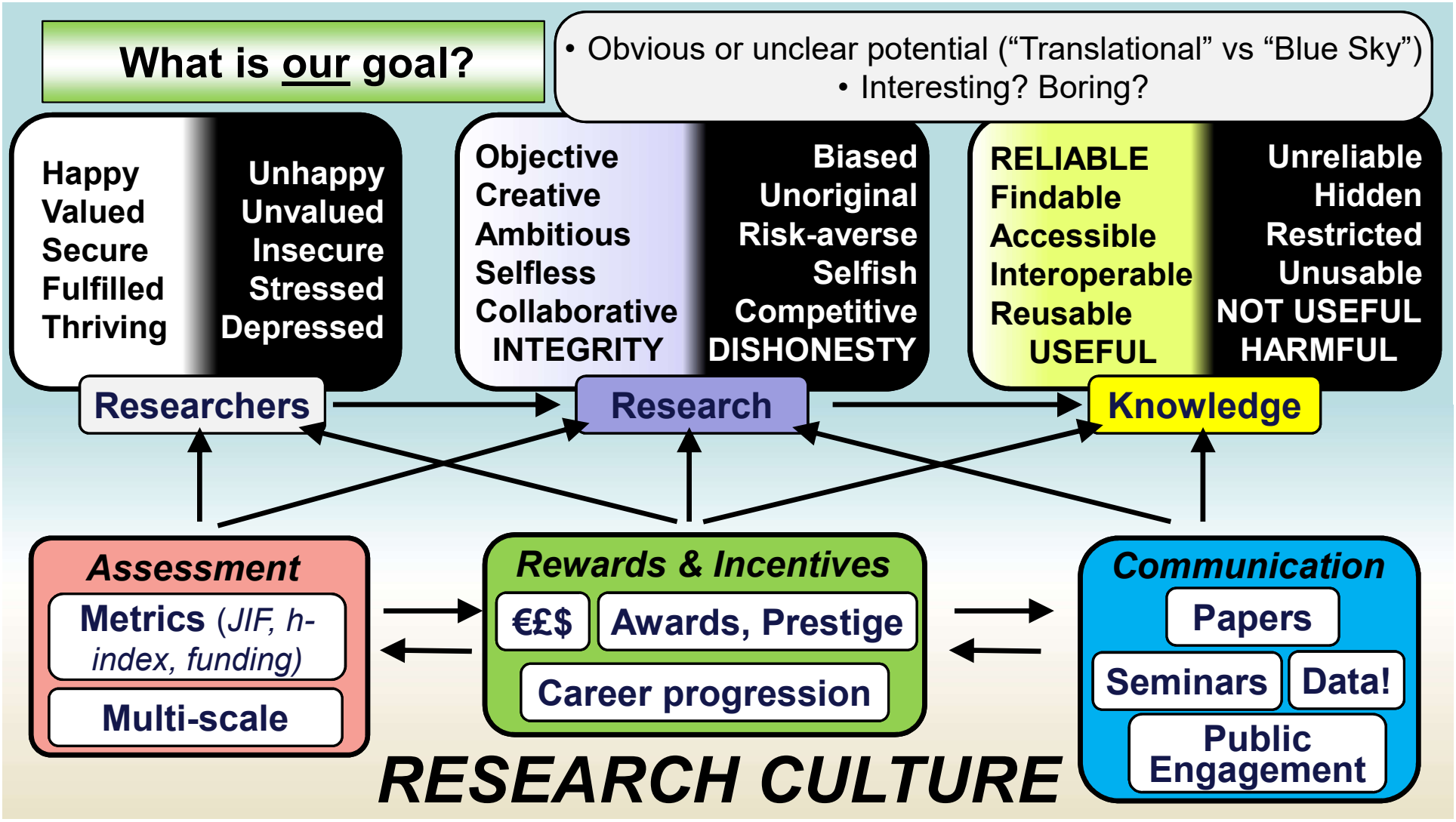
Seminars
Data!
Public Engagement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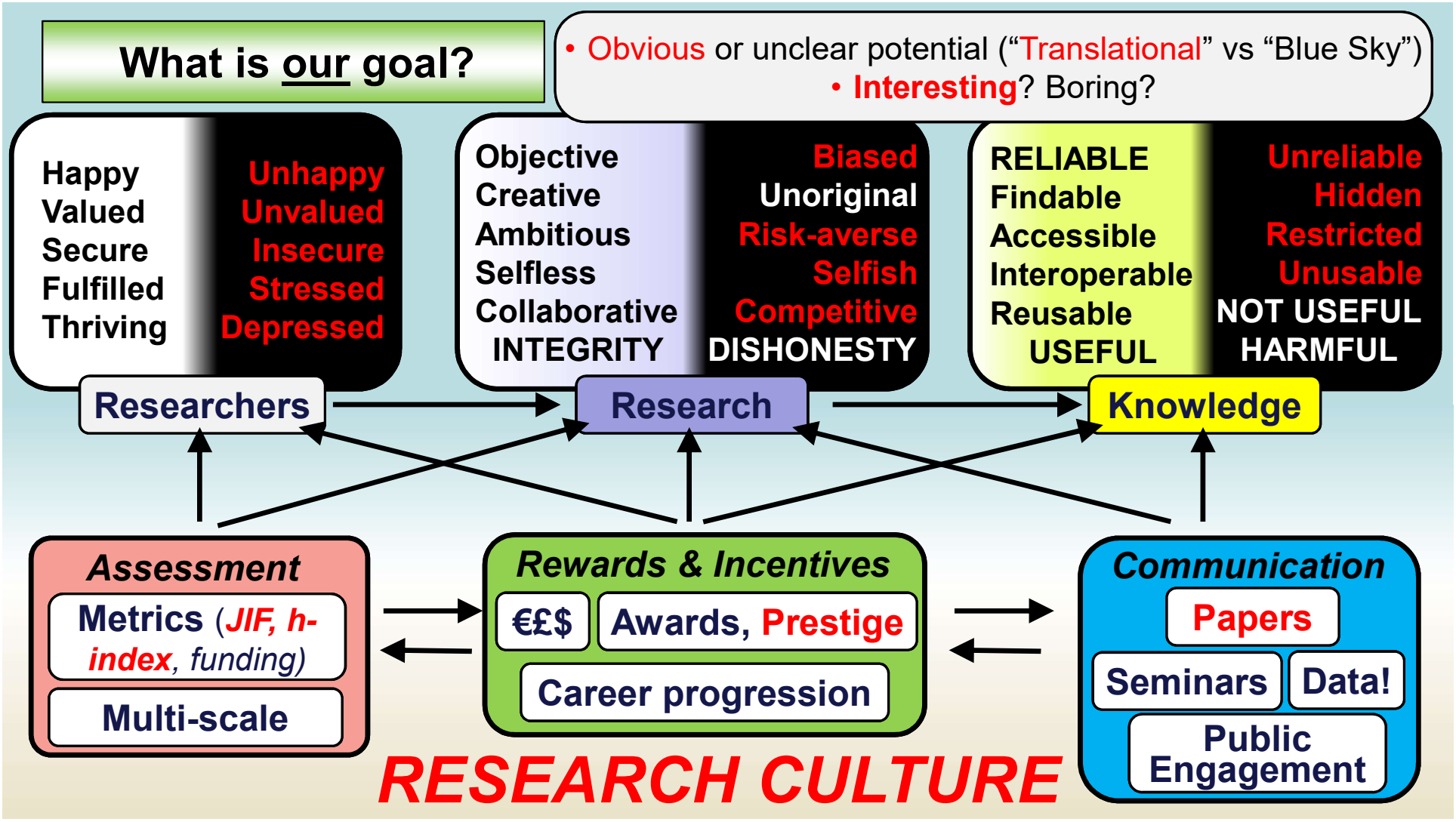
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## (B) Bad habits: Poor Research Culture hurts Research Integrity

*"The research community will be most efficient when failed replication efforts are never due to issues of research integrity or of researcher integrity, as this would allow focus on the scientific reasons for why two apparently similar experiments should reach different conclusions."*

**Table 1** Categories of reasons why attempts to replicate a research finding may be unsuccessful

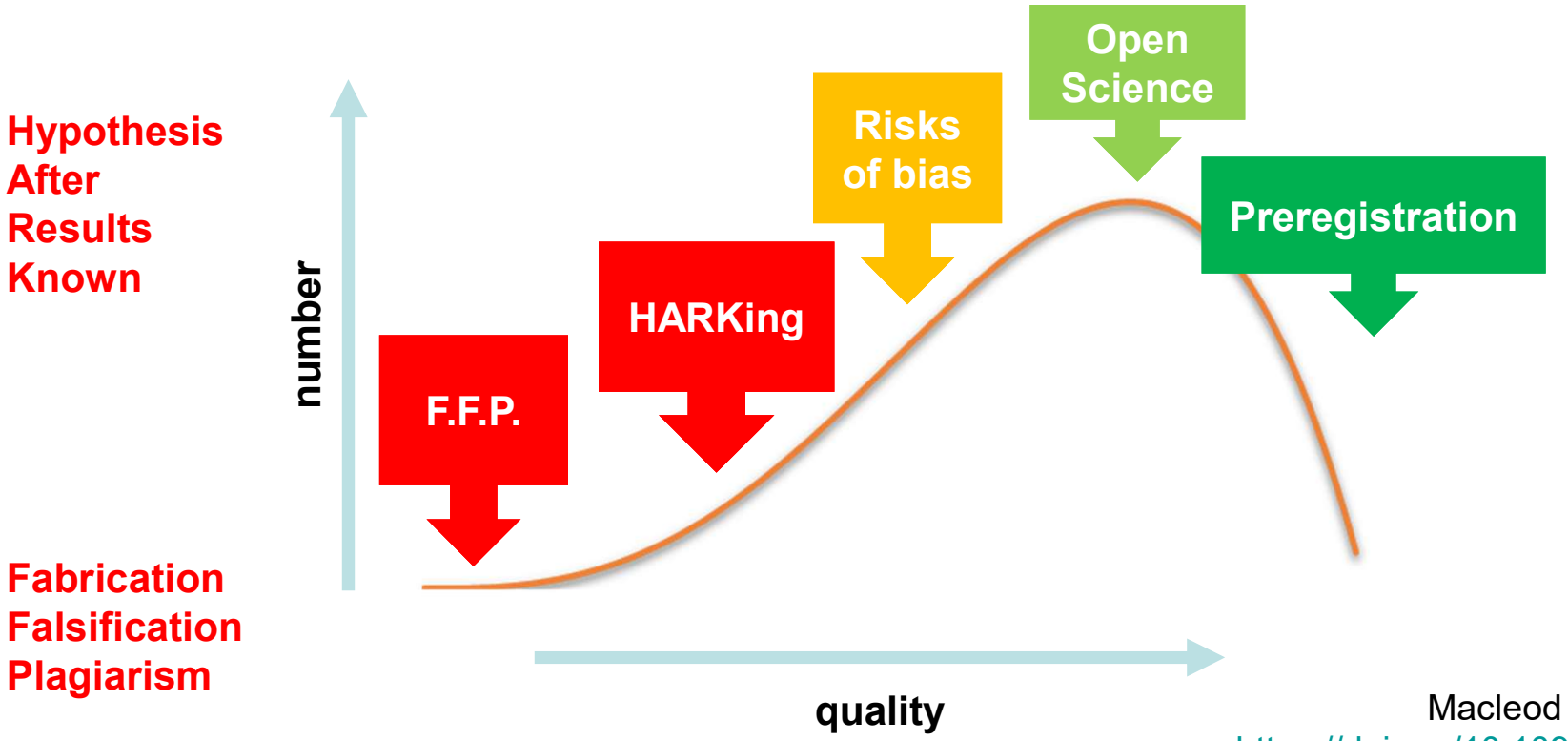
| | |
|---|---|
| Category 1 | A valid research claim was made based on the observed data, but the statistical test had returned a Type I or "false positive" error |
| Category 2 | The claim that was made was valid under the particular circumstances under which it was tested but is not observed under the circumstance in which replication was attempted. These different circumstances may be obvious or subtle, and their impact on the observed phenomena may or may not be important in understanding the question at hand |
| Category 3 | |


From UoE Response to STC Enquiry, published in BMC Research Notes doi.org/10.1186/s13104-022-06030-2

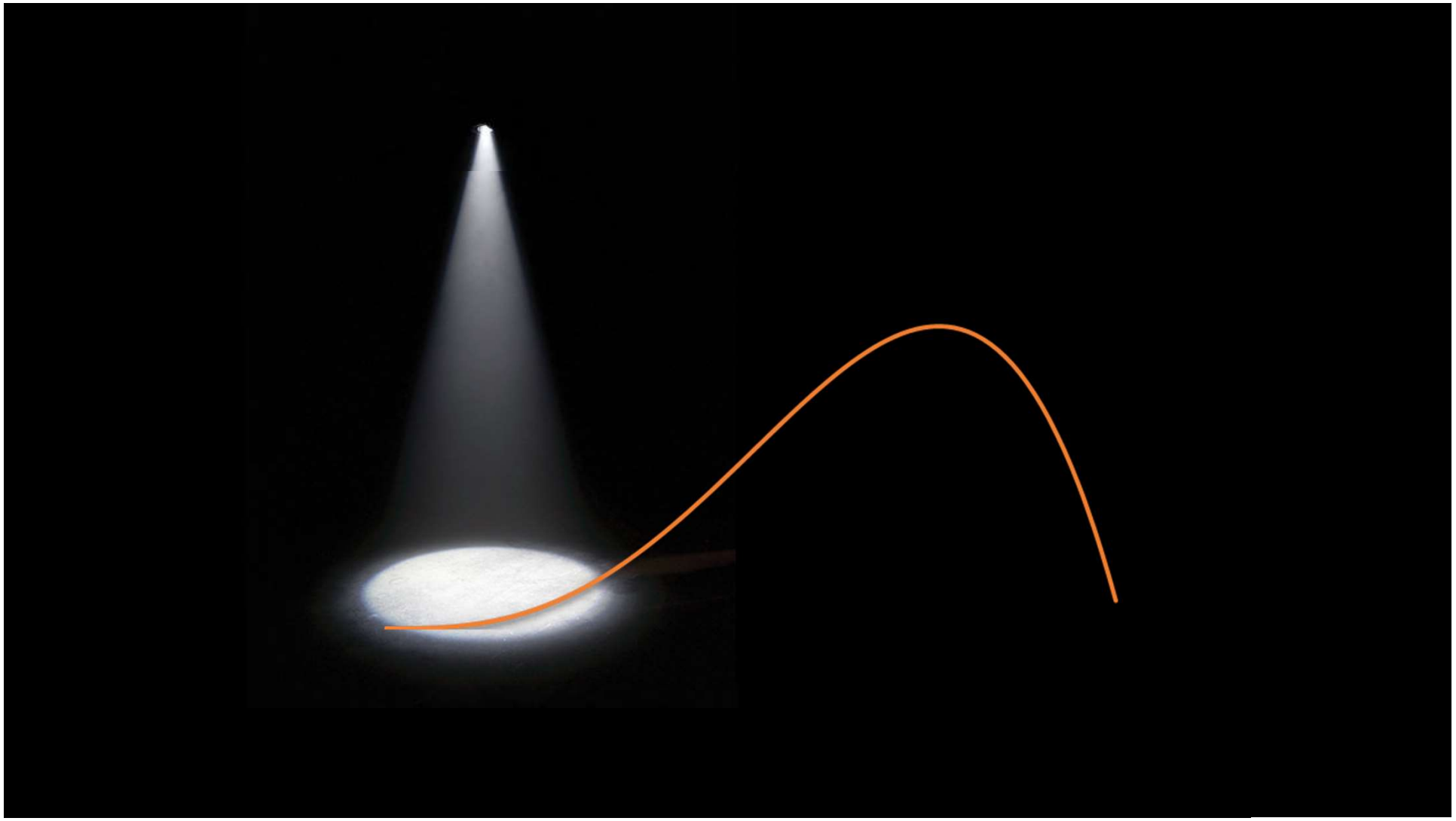
*Slide credit: Malcolm MacLeod, UoE*

## (B) *Bad habits: Poor Research Culture hurts Research Integrity*

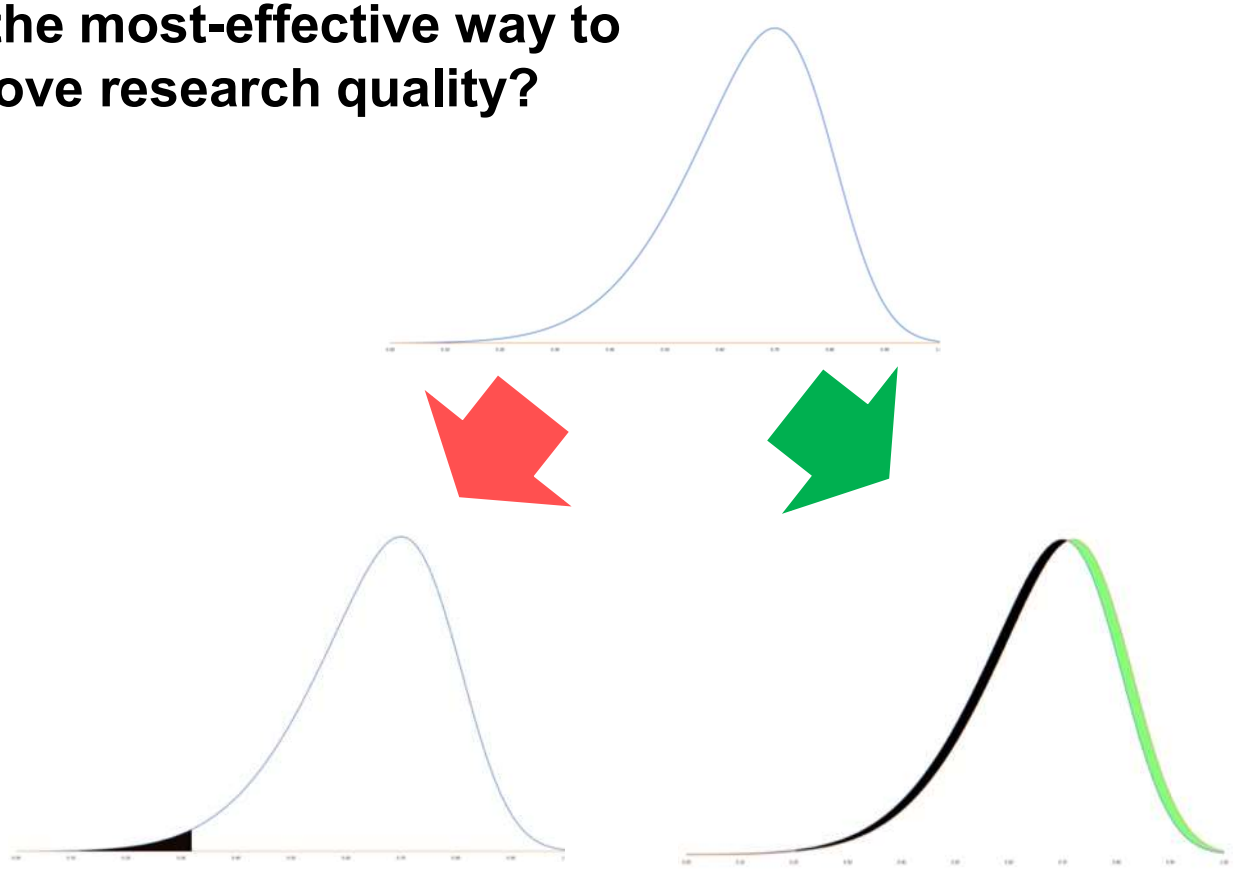
### Researchers are different …




Macleod and Mohan
https://doi.org/10.1093/ilar/ilz015



**What's the most-effective way to improve research quality?**



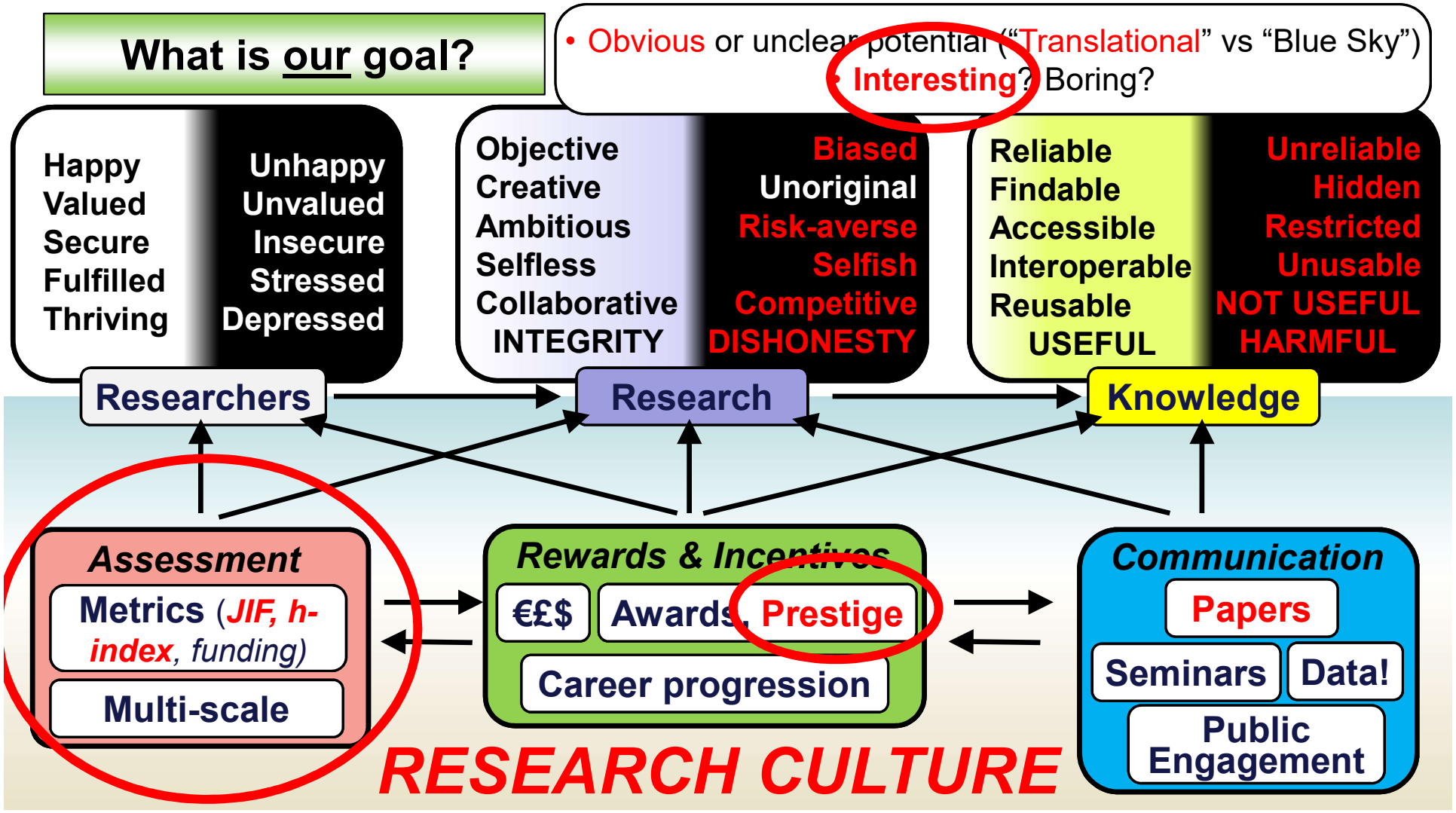
## Ⓑ Research Culture and Research Integrity


- Science is not done by paragons of virtue, but by indivi
  to self-interest as anyone else.
- They can compromise their usually high standards of r
  commercial or otherwise conflicted relationships.
- When resources are scarce and competition is fierce, the
  easiest and quickest—*rather than the best*—ways forward.
- They could judge that they would rather be first than be right.
- When their research hunch turns out to be wrong, many researchers move to the next one rather than going through the painstaking business of reporting negative findings.
- Finally, they could prefer research that they find interesting rather than research that addresses issues of importance to the users of research.

## Ⓑ *Open Research and Research Integrity*

- Nothing is “behind the veil”
- Other people can pick up errors
- The possibility of errors being picked up shifts researcher behaviour

- No single publication has the last word
- Summarising information across several publications gives a more reliable view
- This process is impacted by closed publication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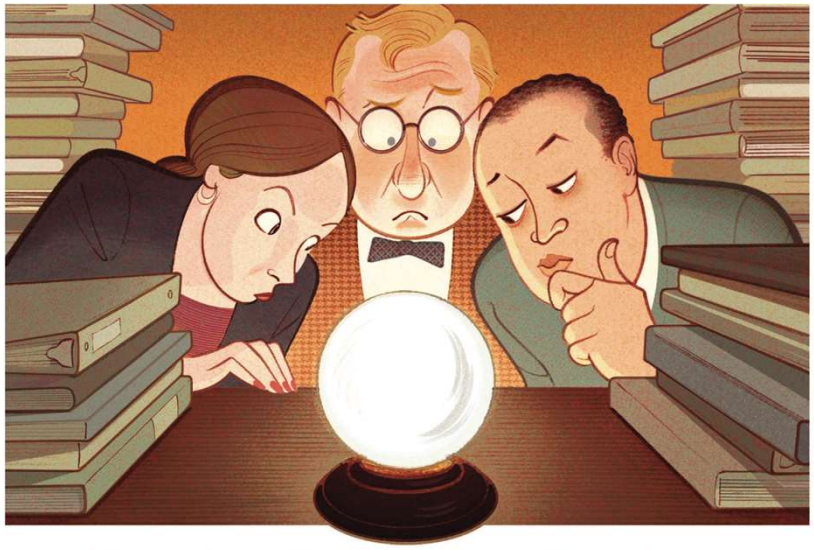
# B Predicting research ‘impact’: a fools’ errand?

**How well are we able to predict the future impact/importance of researchers and their research?**



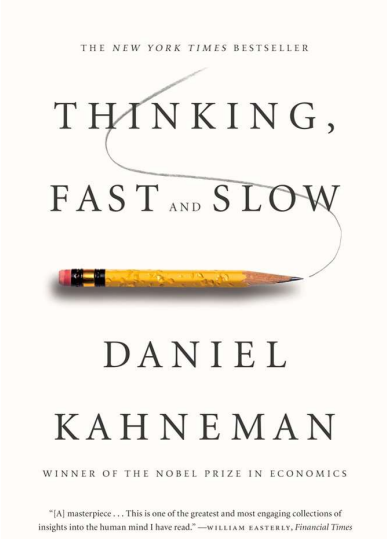
## Peering Into Peer Review

Why don’t proposals given better scores by the National Institutes of Health lead to more important research outcomes?

| | Number of grants | Average percentile score |
|---|---|---|
| Top tier | 487 | 5.7 |
| Middle tier | 574 | 14.5 |
| Bottom tier | 431 | 24.7 |

## B Predicting research ‘impact’: a fools’ errand?

- Expert opinions are often flawed, especially in complex and ‘noisy’ environments.
- We usually cannot predict where new knowledge will lead us!




**Kahneman’s studies about overconfident experts.**

*“What you find is a great deal of confidence in the presence of very poor accuracy: the confidence people have is not a good indication of how accurate they are.”*

**Metrics give a sense of reliability and objectivity to judgements, even if the metrics in question are not fit for this purpose...**

## (B) The mismeasurement of science: an awful irony

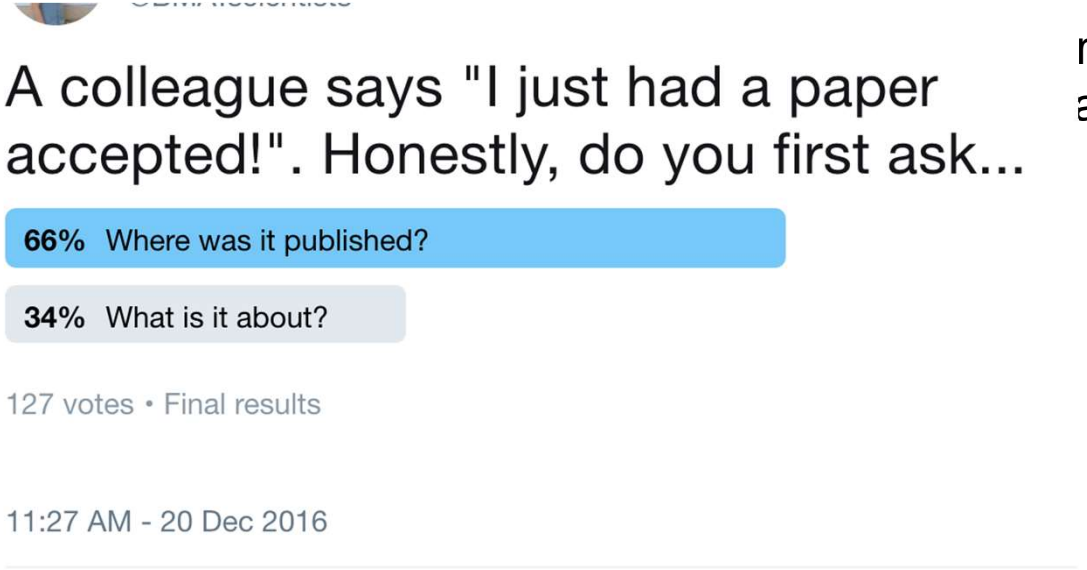
| | Science | Science Assessment *(past & present)* |
|---|---|---|
| **Statistically sound** | ✔ | X |
| **Evidence-based** | ✔ | X |
| **Challenge dogmas** | ✔ | X |
| **Creative approaches & solutions** | ✔ | X |

## C Consequences of the mismeasurement of science

1. **Bias toward reading and valuing only papers in 'high-impact' journals**
   - *a)* Deprive ourselves of the valuable, relevant research published elsewhere.
   - *b)* Get a false impression of how research typically works.
   - **c) Use journal as a surrogate for quality**

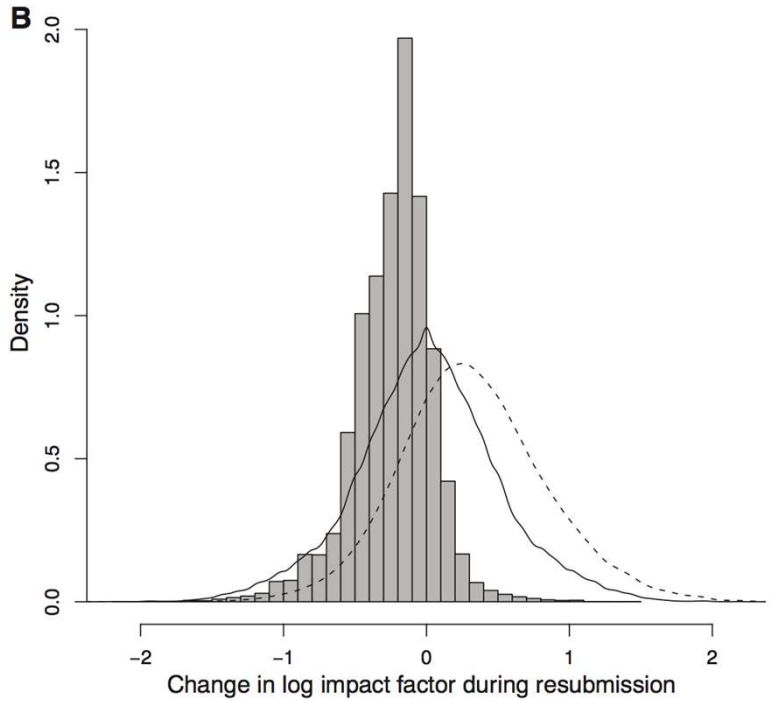
Often these j ry, with little room
for outliers, u ations.
→ ***Certainty***

**Does res**



## C Consequences of the mismeasurement of science

### 2. Delaying and restricting the dissemination of knowledge




Calcagno *et al, Science*, 2012

## C Consequences of the mismeasurement of science

### 2. Delaying and restricting the dissemination of knowledge

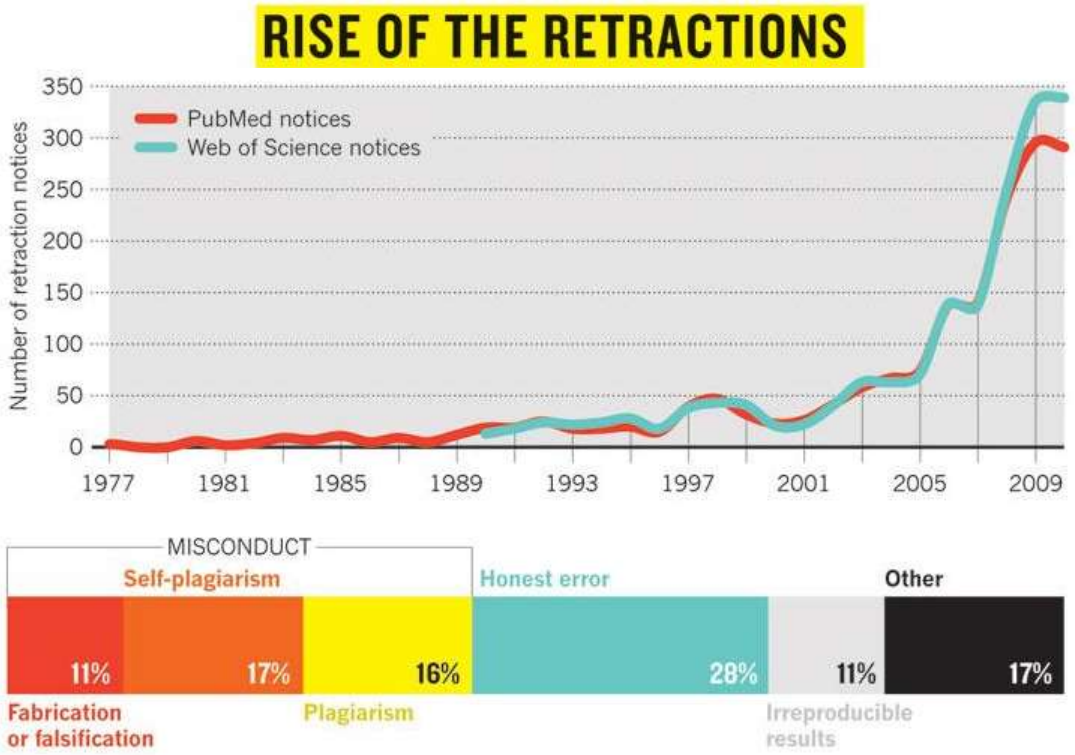
- Many papers are published only after several cycles of rejection and resubmission, as authors chasing impact factors work their way down the journal "rankings".
- This chase delays the dissemination of scientific information — and can be exhausting and demoralising for authors.
- Impact factors hold back the growth of open access by making us beholden to a journal hierarchy that has little evidence base.

*"Playing the game makes fools of us all. We chase prizes that… are awarded prematurely and inaccurately. Worse still,* ***running after these prizes slows us down****.*

***Surely we can do better?"*** *– Stephen Curry*

## C Consequences of the mismeasurement of science

### 3. Impairing the discovery of useful new knowledge?




doi:10.1038/478026a

## C Consequences of the mismeasurement of science

### 3. Impairing the discovery of useful new knowledge?

- Does the pressure to publish in 'high-impact' journals incentivise scientists to subconsciously cut corners *(research integrity),* or to outright misconduct *(researcher integrity*)?

*"Misconduct represents the dark side of the hyper-competitive environment of contemporary science, with its emphasis on funding, numbers of publications, and impact factor.*

*With such potent incentives for cheating, it is not surprising that some scientists succumb to temptation."*

Fang and Casadevall *Infect. Immun*. 2011

## C Consequences of the mismeasurement of science

### 3. Impairing the discovery of useful new knowledge?

- Does the pressure to publish in 'high-impact' journals incentivise scientists to subconsciously cut corners *(research integrity),* or to outright misconduct *(researcher integrity*)?
- Obsession with flawed metrics discourages risk taking and the pursuit of truly novel, potentially ground-breaking research:


Blinkered by bibliometrics

Science panels still rely on poor proxies to judge quality and impact. That results in risk-averse research, say **Paula Stephan**, **Reinhilde Veugelers** and **Jian Wang**.

https://doi.org/10.1038/544411a

*"Boosting scientists' appetite for taking risks means shrinking the use of short-term bibliometric indicators."*

## C Consequences of the mismeasurement of science

### 4. It is bad for the motivation and welfare of scientists

- 43% of academic staff show symptoms of at least a mild mental disorder.
- This is twice as prevalent as the general population.

Education ▶ Schools Teachers Universities Students

Academics Anonymous
Universities

Anonymous academic

Fri 11 May 2018
07.00 BST

Student mental health is suffering as universities burst at the seams

I felt lonely and isolate
degree course, and my

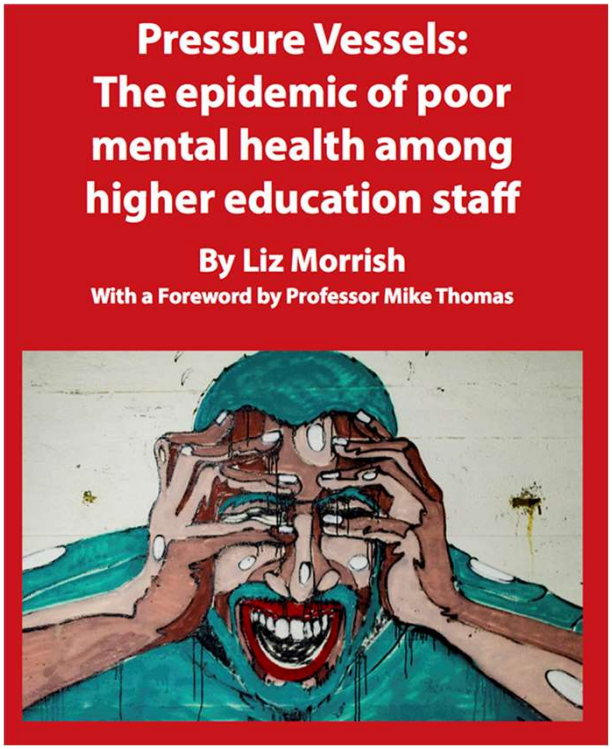


**PhD students have double the risk of developing a psychiatric disorder than the rest of the 'highly educated' population**

LINDSAY DODGSON
AUG 5, 2017, 6:16 PM

## C Consequences of the mismeasurement of science

### 4. It is bad for the motivation and welfare of scientists



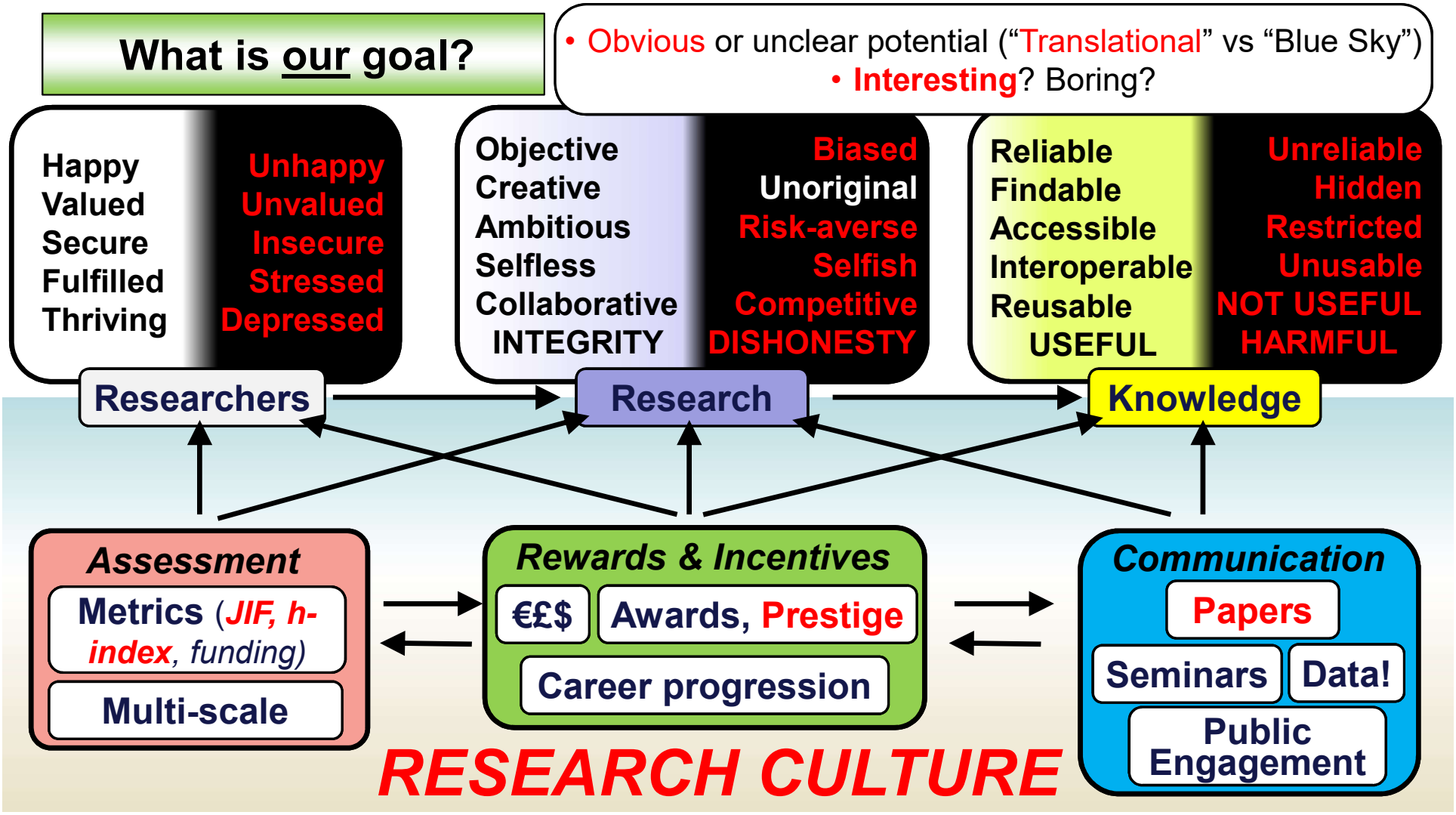

- *"Academics are evaluated by an assortment of research metrics: citation counts, the impact factor of the journal in which it is published, and the amount of research grant money obtained.*
- ***These are all poor proxy measures of research quality, but they are easy to track.***
- *Despite their obvious limitations, academics are forced to accept that metrics have become the currency of performance management in universities. To work there means giving yourself over to forensic surveillance…*
- *That pressure is cumulative and* ***to many, the university has become an 'anxiety machine****'."*

## C Consequences of the mismeasurement of science

### 4. It is bad for the motivation and welfare of scientists

# More than 70,000 staff at 150 UK universities to strike for 18 days

**Industrial action to take place in February and March in dispute over pay, conditions and pensions**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## D How does Open Science work for a researcher?

LE RU

OSF

protocols.io

GitHub

1. Make scholarly publications Open Access

OPEN ACCESS

2. Make the underlying research data openly available so that the conclusions can be checked and verified.
3. Make the research software, used for analysis, available so that the research is reproducible.
4. Consider making the underlying research data and software openly available, even before formal publication.
5. Use standard identifiers, formats and processes to help the findability and re-use of open outputs (i.e. FAIR data)

## D The Benefits of Open Science: a brighter future?

1. Visibility of scholarly outputs is ***increased***
2. Making the underlying data and methods available, in a FAIR way, allows users to replicate the original results and to spot any errors.
   → ***This transparency is good for researchers and good for research***
3. Using established identifiers gives proper recognition to authors, funders and others who have contributed to the research.
   → ***This rewards all stakeholders in the research process, enriching the research landscape***

## D The "Eight Pillars of Open Science"

LE
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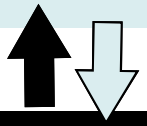
European Commission

THE UNIVERSITY OF EDINBURGH

1. Future of Scholarly Communication
2. FAIR Data
3. Education and Skills
4. Research Integrity
5. Next Generation Metrics
6. Rewards and Initiatives
7. Citizen Science
8. European Open Science Cloud (EOSC)



**CULTURAL CHANGE**

# D University of Edinburgh's Open Research Roadmap

## Roadmap for Open Science – University of Edinburgh Self-Assessment January 2023

The following table contains a self-assessment on the University of Edinburgh's readiness for Open Research, based on the criteria set out in the LERU Open Science Roadmap. This self- assessment has been carried out by staff in the Library Research Support (LRS) Team. This is a working document and we would welcome the views on the accuracy of the self-assessment and the recommendations made.

**Contents**



| | Topic | Question | Assessment of progress | Proposed next steps | RAG Status |
|---|---|---|---|---|---|
| Cultural change | | | | | |
| 1 | Leadership | Has your university appointed a senior manager to lead Open Science approaches across all eight pillars of the Open Science debate identified by the European Commission? | Dominic Tate (Head of Library Research Support) has been acting in the role of LERU Open Science Ambassador (OSA) but Dr. William Cawthorn (Lecturer, Centre for Cardiovascular Science, CMVM) has now taken on this role. Dominic Tate will continue to lead on Open Research for the Library.<br>A number of other senior researchers have taken very active roles in areas of Open Science, including Andrew Millar, Malcolm McLeod (via the UK Reproducibility Network and REIRG) and Emily | Schools and Colleges should consider engaging Open Research Champions at a local level.<br>The Open Research Co-Ordinator will create a network of Open Research champions from across the University. These will primarily be senior academics who have a responsibility for Open Research in their School, and school or college Research Support Staff who have a direct role in promoting and supporting Open Research. This network will work together to ensure coordinated action in designing and implementing strategies for |  |

***36 specific points/goals across these 9 categories***

https://www.ed.ac.uk/sites/default/files/atoms/files/edinburgh_open_research_roadmap_jan2023_v1-1.pdf

# D Future of Scholarly Communication

## Making your research Open Access

Information on Open Access, research funders' policies, including the Wellcome Trust and costs.

"For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version arising from this submission."

| The future of scholarly publishing | | | | | |
|---|---|---|---|---|---|
| 5 | Compliance | Does your university have institutional mandates to support the move to full Open Access and does it monitor implementation of these mandates? | Yes. The University currently has a ca. 92% compliance rate with the REF open access mandate.<br>We are aware of forthcoming requirements regarding Open Access to monographs, which provides an opportunity for Edinburgh University Press.<br>Library Research Support has led a review of the University's Research Publications Policy, and is in the advanced stages of implementing a new policy to support Plan S.<br>The new Research Publications & Copyright Policy (2021) was fully implemented in 2022. Extensive work has been done by Scholarly Communications to inform publishers of our new policy and our use of a Rights Retention Statement in all publications. They have also completed extensive outreach work to communicate the policy to researchers across the university and encourage compliance. | Work will continue to ensure compliance with the new policy so that all publications can be made Open Access at the point of publication. | |

# D Future of Scholarly Communication

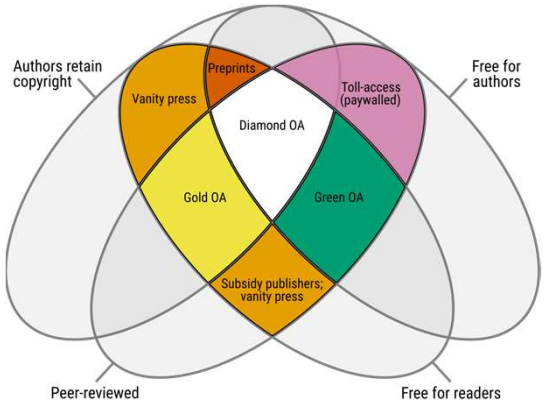
UK Research and Innovation

wellcome trust

Plan S
Making full & immediate Open Access a reality

Octopus
https://www.octopus.ac

ResearchEquals
https://www.researchequals.com

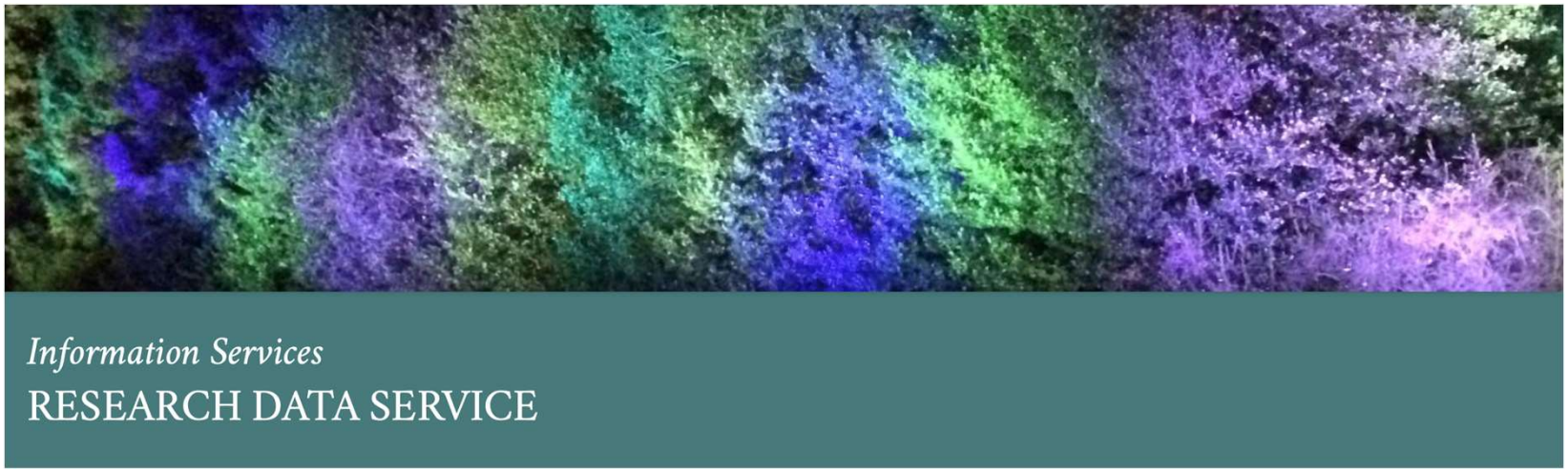



**Diamond Open Access**

Peer Community In
Registered Reports
Free and transparent pre- and post-study recommendations across research fields

https://rr.peercommunityin.org

# D FAIR Data




https://www.ed.ac.uk/information-services/research-support/research-data-service

| | Topic | Question | Assessment of progress | Recommendations for the University | RAG Status |
|---|---|---|---|---|---|
| FAIR data | | | | | |
| 10 | Institutional policy | Has your institution a research data policy or strategy? | Yes, the first policy was passed by Court in 2011 and has been the basis for the development of the Research Data Service.<br>An updated policy is in place from January 2022.<br>See https://www.ed.ac.uk/is/research-data-policy | Review every 12 months. | |
| 11 | Institutional policy | Does your institution research data policy or strategy include FAIR principles? | The new policy includes a section on the FAIR principles, which is fully endorsed and supported by the university. | Library Research Support will update the University's Research Data Policy, as stated above. A significant amount of awareness raising has gone on around the new policy and this will continue. | |
| 12 | Institutional support | Has your institution established a dedicated service to provide data stewardship to its researchers? | Yes, as part of the Research Data Service. Edinburgh DataShare and DataVault are well-established and popular long-term data archives. In addition we encourage the use of external domain or data type specific repositories where these would be more appropriate to the data being produced.<br><br>The University also has a subscription to the protocols.io service, an online platform for the creation, management, and sharing of research protocols or methods. This is available to all staff and students of the University.<br><br>We also subscribe to DMPOnline, to facilitate and encourage users to properly manage data, both during and after their research, and users can use this as a point of contact with the Research Data Support team. | Continue to develop these tools and support researchers to use them. Encourage the use of DMPOnline through training and outreach, and encourage users to use this as a point of contact with Research Data Support.<br>A new training course "Archiving your Research Data" was launched in early 2022 and has proven popular with researchers. This training promotes the proper archiving and sharing of research data and other outputs. | |

## D FAIR Data; Research Integrity; Education and Skills

FAIRsharing.org
standards, databases, policies

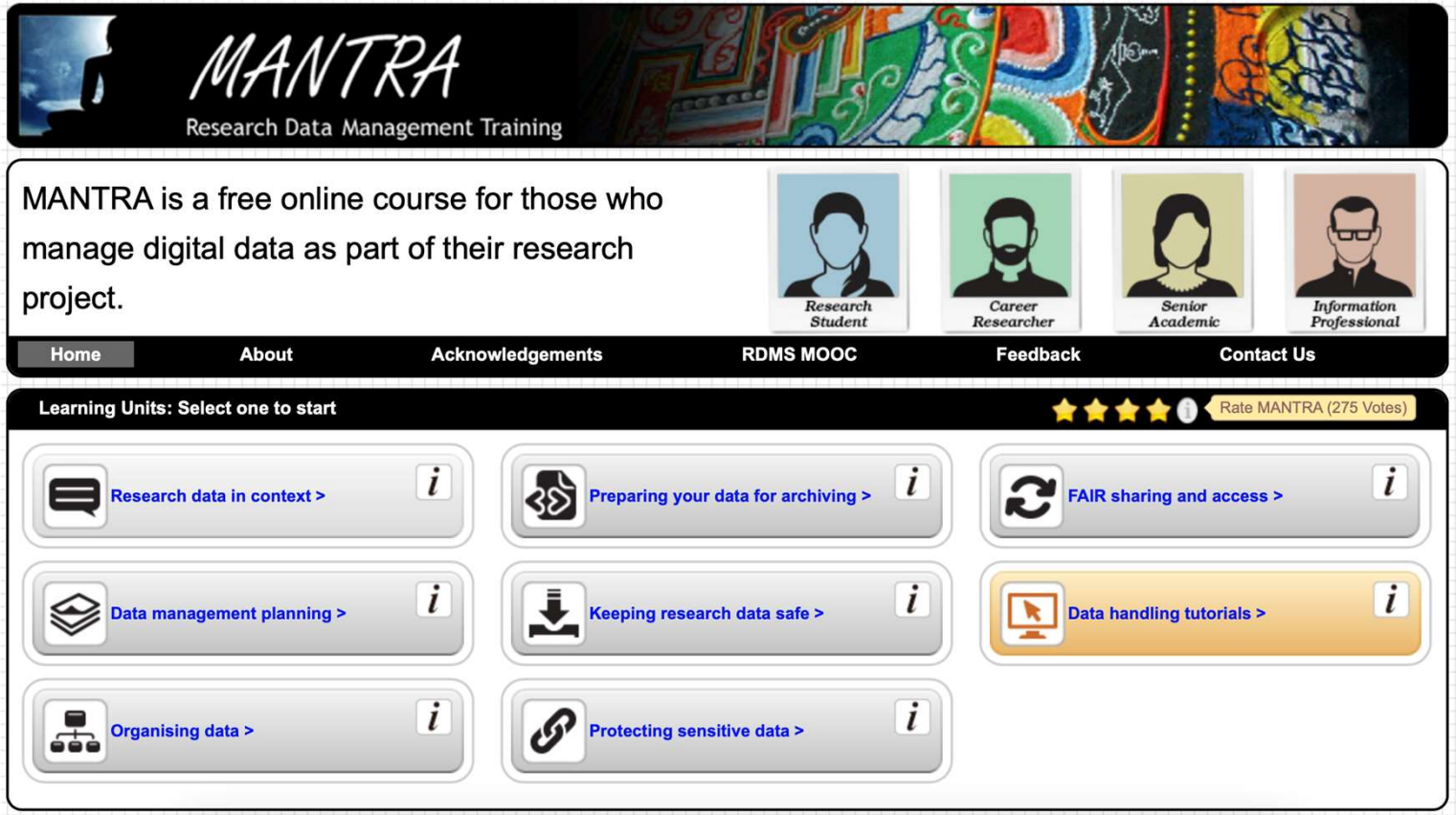
GO FAIR
https://www.go-fair.org

UK RN
UK RN UK Reproducibility Network

FORRT
Framework for Open and Reproducible Research Training
https://forrt.org

EO RI
Edinburgh Open Research Initiative
https://edopenresearch.com

# D FAIR Data; Research Integrity; Education and Skills




https://mantra.ed.ac.uk

# D Next-Generation Metrics; Rewards and Initiatives

DORA San Francisco Declaration on Research Assessment

@DORAssessment

The Leiden Manifesto for research metrics

Use these ten principles to guide research evaluation, urge **Diana Hicks**, **Paul Wouters** and colleagues.

**Next-generation metrics:**
**Responsible metrics and evaluation for open science**

Report of the European Commission Expert Group on Altmetrics

Plan S
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CoARA

**Coalition for Advancing Research Assessment**

## D Next-Generation Metrics; Rewards and Initiatives

DORA San Francisco Declaration on Research Assessment

CoARA

wellcome trust

*"…focus on the content and quality of publications when reviewing applications, rather than their number or the impact factors of the journals in which they were published….researcher assessment requires a far more nuanced understanding of a researcher's skills, qualities and attitudes, and these can never be expressed in a single metric.*

MRC Medical Research Council

Please note that as part of our commitment to the San Francisco Declaration on Research Assessment, MRC reviewers are advised not to use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions. More information on peer review at the MRC can be found on our Peer review webpages.

REF2021 Research Excellence Framework

207. No sub-panel will use journal impact factors or any hierarchy of journals in their assessment of outputs. No output will be privileged or disadvantaged on the basis of the publisher, where it is published or the medium of its publication.

## D Next-Generation Metrics


THE UNIVERSITY *of* EDINBURGH


- *"The University acknowledges that* ***no quantitative data source(s) alone can provide a complete measure of research quality or activity****."*
- *"The expectation, therefore, in all research assessment at the University is that a transparent set of* ***both qualitative and quantitative information is used to support and inform expert human academic judgement."***
- ***"No minimum performance objectives or targets will be set on the basis of a quantitative measure for which the individual cannot reasonably control the outcomes (e.g. grant income alone)."***

# D Rewards and initiatives

## Good Research Practice Week

The University of Edinburgh Good Research Practice Week was held during 14-18 November 2022.

The Good Research Practice Programme of events and awards were set up as part of efforts to improve not just the research we do, but the way we do research.

### Good Research Practice Awards

These awards are intended to recognise and celebrate contributions that provide leadership and act as role models for good research practice. The awards have been organised by a University-wide group.

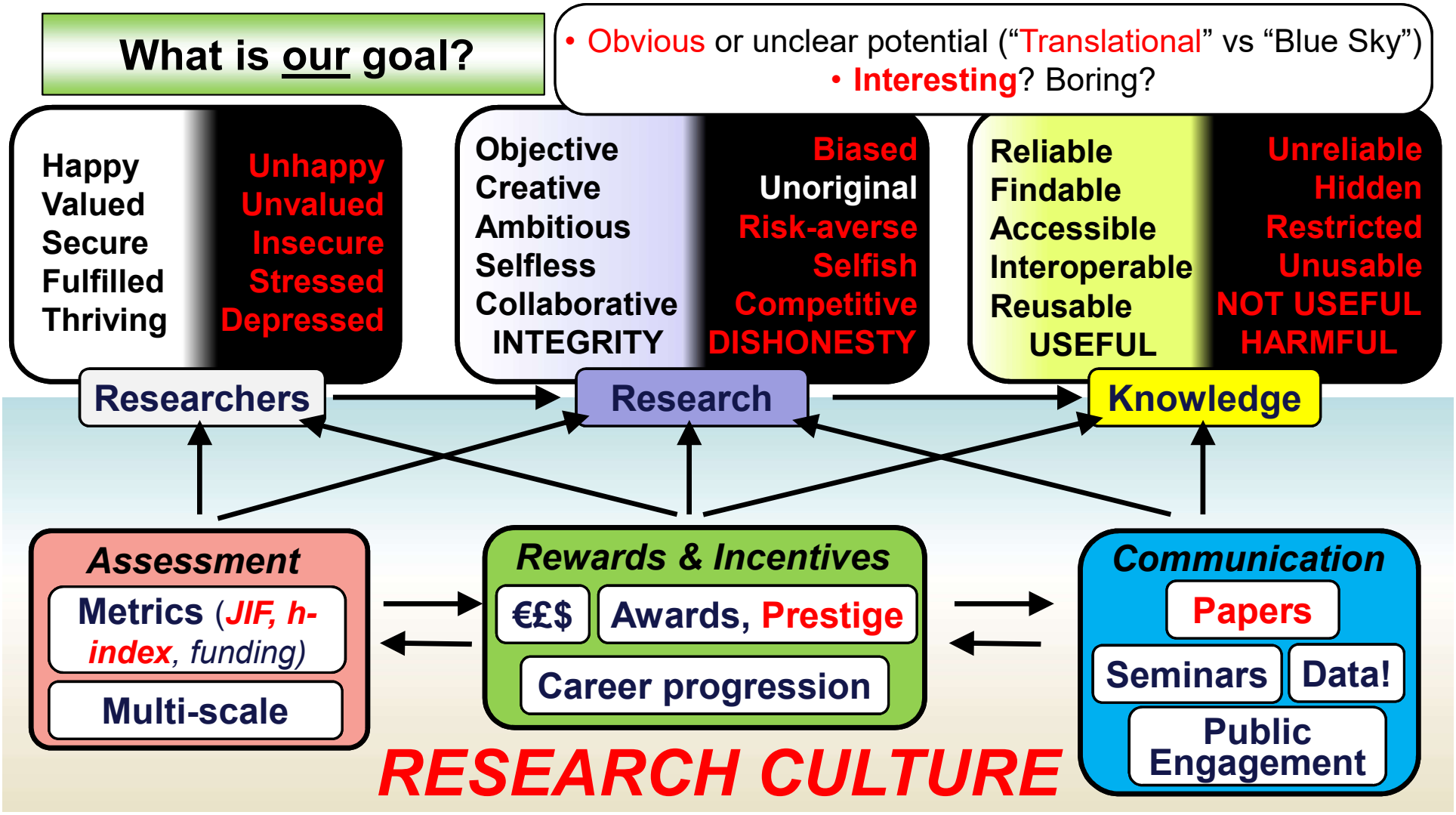
**Edinburgh Open Research Conference 2023**

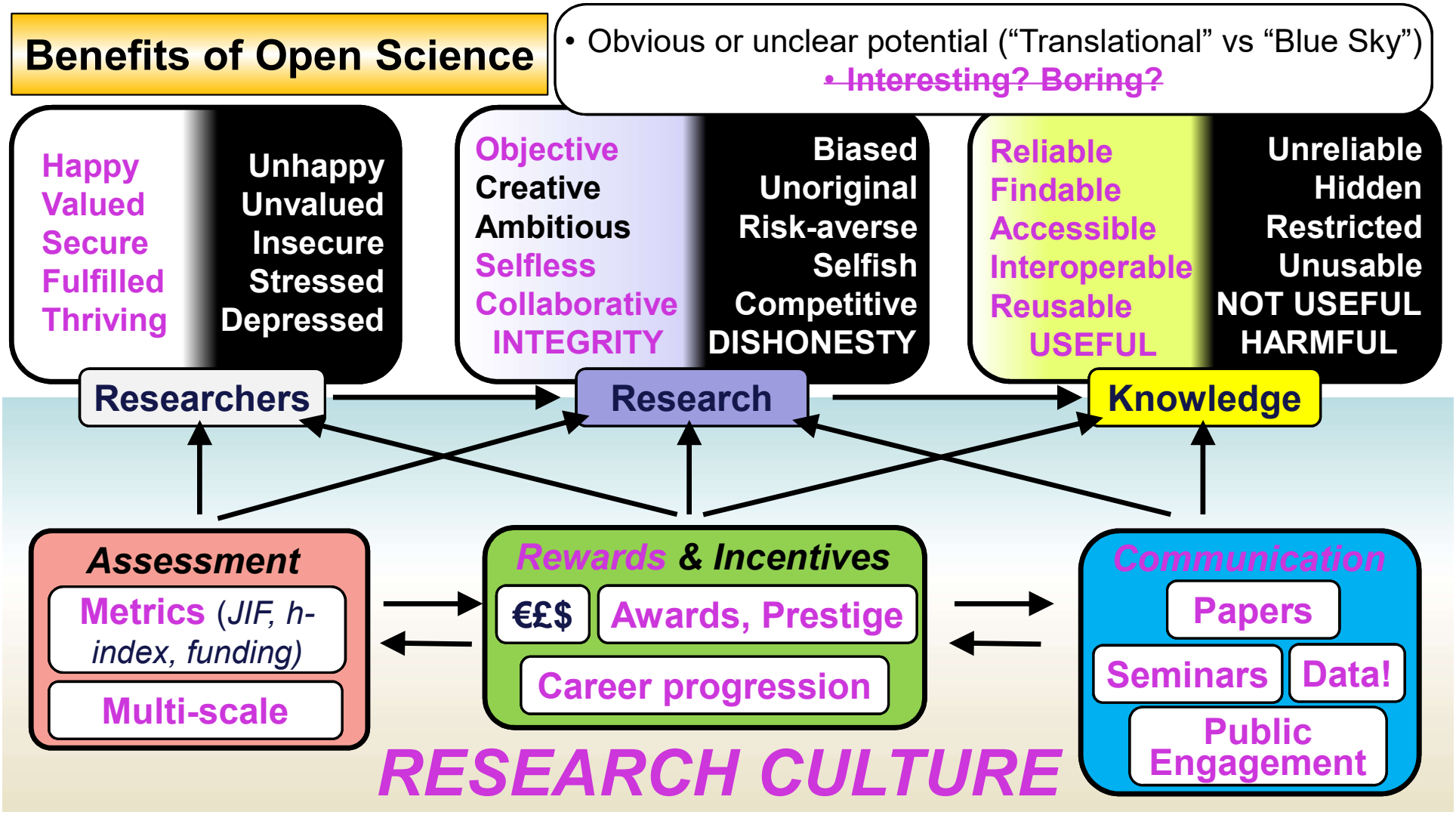
## D Open Science and Research Culture


https://www.fosteropenscience.eu

*"Cultural change is necessary for Open Science to succeed."*

***OPEN SCIENCE IS A PATHWAY TO A HEALTHIER RESEARCH CULTURE***


What is our goal?
• Obvious or unclear potential ("Translational" vs "Blue Sky")
• Interesting? Boring?
Happy
Valued
Secure
Fulfilled
Thriving
Unhappy
Unvalued
Insecure
Stressed
Depressed
Objective
Creative
Ambitious
Selfless
Collaborative
INTEGRITY
Biased
Unoriginal
Risk-averse
Selfish
Competitive
DISHONESTY
Reliable
Findable
Accessible
Interoperable
Reusable
USEFUL
Unreliable
Hidden
Restricted
Unusable
NOT USEFUL
HARMFUL
Researchers
Research
Knowledge
Assessment
Metrics (JIF, h-index, funding)
Multi-scale
Rewards & Incentives
€£$
Awards, Prestige
Career progression
Communication
Papers
Seminars
Data!
Public Engagement
RESEARCH CULTURE


Benefits of Open Science
• Obvious or unclear potential ("Translational" vs "Blue Sky")
• Interesting? Boring?
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