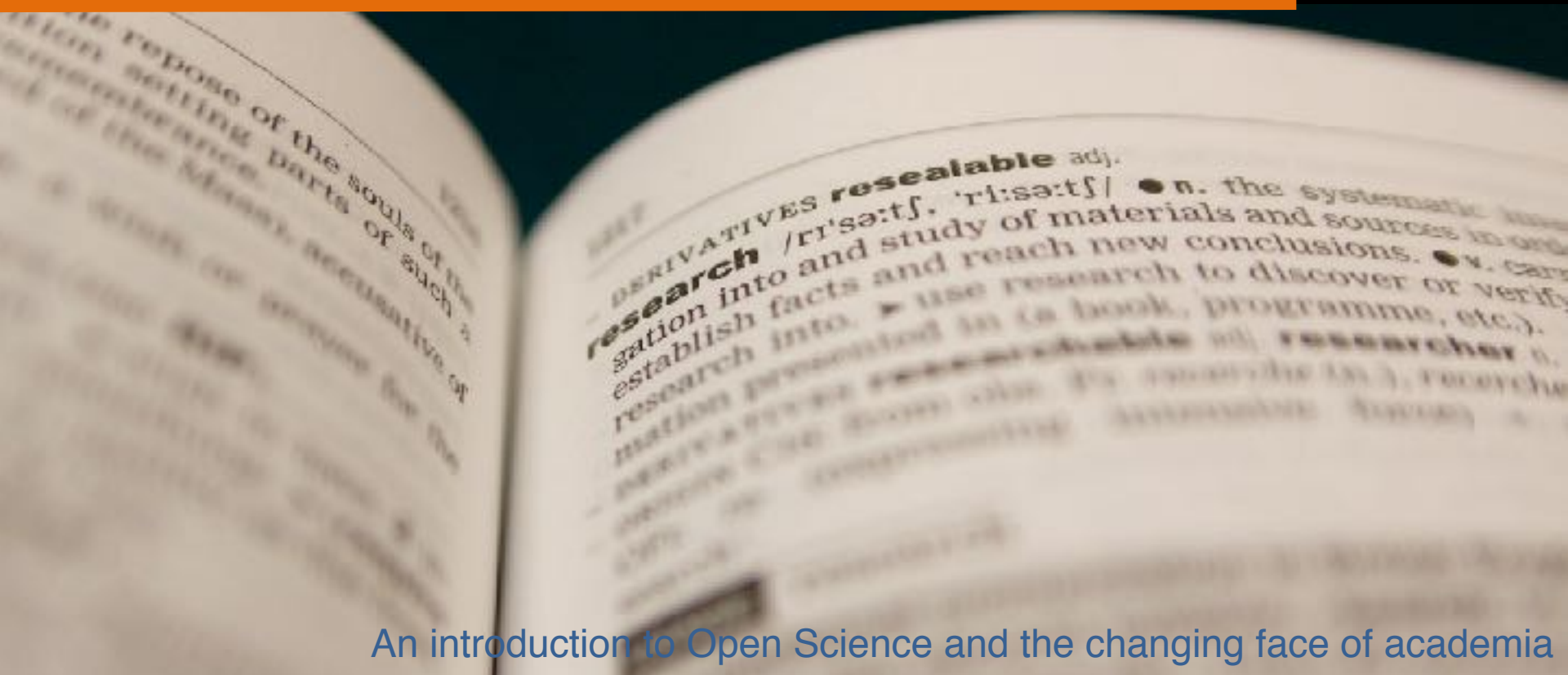


Reproducibility and Openness

Facilitating Scientific Progress and Research Impact



An introduction to Open Science and the changing face of academia

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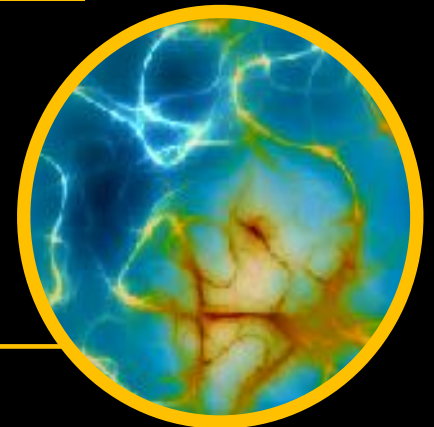
What items have you produced in your [subject name] course so far?

Reproducibility in research



The role of Open Science

Discussion of course assessment



A diagram illustrating the research process. At the bottom is a blue-outlined triangle labeled 'RESEARCH PROBLEM'. Four orange-outlined circles are arranged in a diamond shape above it, connected by orange lines. The circles are labeled 'CODE', 'FIGURES', 'RAW DATA', and 'WRITTE N REPORT' (with a typo). The background is a blurred image of an open book.

CODE

FIGURES

**RAW
DATA**

**WRITTE
N
REPORT**

**RESEARCH
PROBLEM**

Reproducibility

Reproducibility?

Begley & Ellis (2012)
Nature 483, 531-533

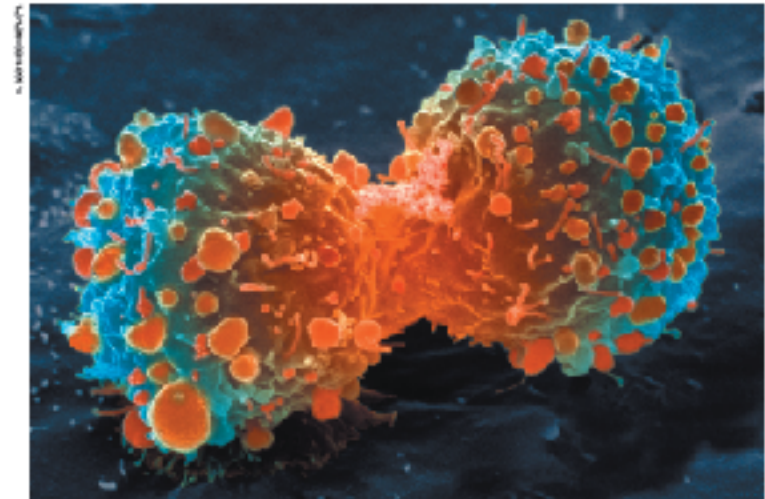
COMMENT

WIKI WILSON Shifts spotlight
to such studies when
they're negative

DAVE SPEER Fast climate
policy shifts could
worrying

HOWARD H. HUBB Consensus
too often reached using
Google

WILLIAM F. V. VALE
and colleagues
renew debate



Many cancer therapies in preclinical research are not reproducible, in part because of the degree of cell-to-cell and cell-to-cell

Raise standards for preclinical cancer research

C. Glenn Begley and Lee M. Ellis propose how methods, publications and incentives must change if patients are to benefit.

Efforts over the past decade to concentrate the genetic alterations in human cancer have led to a better understanding of the molecular basis of the complexity of disease. Although progress in the cancer field has led to the hope that this would lead to more effective drugs, the reality is that our ability to translate cancer research to clinical practice has been remarkably low. Sadly, clinical

trials are failing: have the highest failure rates compared with other biomedical areas. Given the high investment in oncology, it is not surprising that the success of most development may be lower than for other disease areas, and a larger number of drugs with unproven potential will enter the clinic. However, this does not mean that clinical research is hopeless and

investigation of new therapies is a waste of time and money. It is a waste of time and money if the clinical success is low.

Many factors are responsible for the high failure rate, notwithstanding the laboratory success of many of the drugs. Generally, the success of preclinical work such as in drugable cancer cell lines and animal models is not sufficient to ensure

“Some non-reproducible clinical papers have spawned an entire field, with hundreds of secondary publications that expanded on elements of the original observation, but did not actually seek to confirm or falsify its fundamental basis”.

Image shown is from front page of Begley & Ellis (2012), produced by the Nature Publishing Group

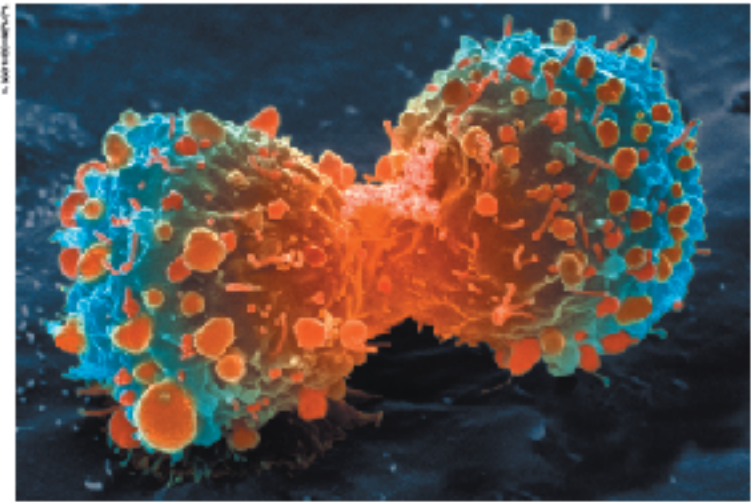
COMMENT

WIKI WILSON Shifts in portland cement production will affect the environment.

DAVID SPENCER Fast climate change will affect the environment.

ANDREW B. HARRIS Computers have better methods using Google Plus.

WILLIAM F. WILSON A new method for the environment.



Many cancer cells are produced by the same process as the one shown here, but the degree of their irregularity is much higher.

Raise standards for preclinical cancer research

C. Glenn Begley and Lee M. Ellis propose how methods, publications and incentives must change if patients are to benefit.

Efforts to cure the most deadly cancers have been the focus of intense research. In human cancer, there is a better understanding of the molecular mechanisms of the complex diseases. Although progress in the cancer field has been made, it has not led to more effective drugs, nor to the ability to translate cancer research to clinical practice and to the availability of new drugs.

In the meantime, the high cost of cancer research has led to a focus on the development of new drugs. Given the high cost of cancer research, it is not surprising that the number of new drugs developed in the cancer field is lower than in other disease areas, and a larger number of drugs with unproven potential will enter the clinical trial. However, this does not mean that the cancer field is not making progress.

Many factors are responsible for the high failure rate, notwithstanding the inherently difficult nature of this disease. Generally, the number of preclinical tests such as in the cancer cell line and animal models is not sufficient to ensure that a new drug will be effective in the clinical trial.

Scientific Publication or Advertisement?

Landrum & Stiefl (2012)
Future Med. Chem.
4(15), 1885-1887

“It lies in our hands – the community of editors and reviewers – to insist that publications are accompanied by the source code and data required to allow their results and conclusions to be reproduced...”

A diagram illustrating the components of a coherent research story. At the top, two black circles with white outlines contain the words 'CODE' and 'FIGURES'. Below these is a thick black horizontal bar with the text 'Coherent Research Story' in white. Underneath the bar are two more black circles with white outlines, containing 'RAW DATA' and 'WRITTE N REPORT'. At the bottom center is a blue-outlined triangle containing the words 'RESEARCH PROBLEM'. Thin white lines connect the top circles to the central bar, and the bottom circle to the triangle.

CODE

FIGURES


Coherent Research Story

**RAW
DATA**

**WRITTE
N
REPORT**

**RESEARCH
PROBLEM**

The Role of Open Science



“A piece of content or data is **open** if anyone is free to use, reuse, and redistribute it — subject only, at most, to the requirement to attribute and/or share-alike.”

What is openness?



In learning about open science, you'll learn how to effectively and safely share your research outputs, through licensing, code repositories and publication, and in doing so, to foster **reproducibility** in your work and enhance your **research impact**.

What is openness?

Users of these slides will need to embed the video from Science Commons here, available on YouTube at the following address: <http://www.youtube.com/watch?v=hZAcTNFzF-s>

Big Data, Networked Research

And all sorts of other approaches...

- Data Mining
- Crowdsourcing
- Understanding Negative Results
- Web-based Lab Books

Open Science facilitates discovery by supporting the **dissemination** and **availability** of information, and enabling its reuse through provision of **legal licensing**.

Examples of Data-Enabled Research



Søren Brunak, Denmark Technical University

- molecular level sys bio + healthcare sector data.
- Mining electronic health records: towards better research applications and clinical care' [http://](http://www.ncbi.nlm.nih.gov/pubmed/22549152)

www.ncbi.nlm.nih.gov/pubmed/22549152

Chas Bountra, Structural Genomics Consortium

- accelerate identification of candidate targets for drug discovery by generating freely available novel reagents
- They crystallize 5-10 structures per month!
- SGC is responsible for 25 - 50% of all structures deposited into the Protein Data Bank on human parasites + biomed proteins



UK Research Councils

“..BBSRC will require a copy of any resulting published journal article...to be deposited, at the earliest opportunity, in an appropriate e-print repository...”



“Free and open access to the outputs of publicly-funded research offers significant social and economic benefits...”

“All published research articles arising from EPSRC-sponsored research...must become available on an Open Access basis through any appropriate route”



Further Reading

Michael Nielsen's book
“Reinventing Discovery”

