

# Research Integrity



## **The Research Framework:**

Legislation, policies, guidance, ethics, oversight, enforcement/punishment, training and competency...

## **Openness & Transparency:**

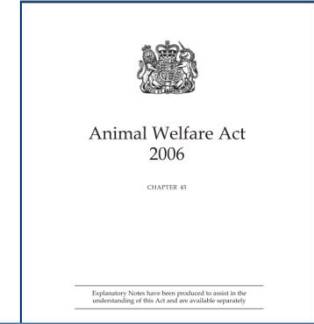
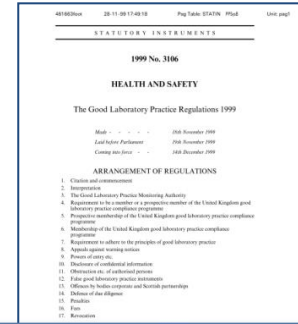
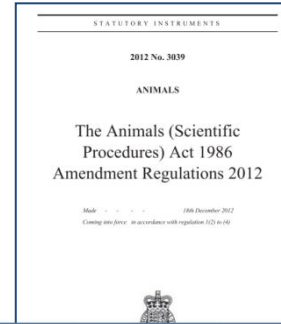
How organisations and individuals interact with and communicate the conduct of research within the scientific community and to the broader 'public'.

## **Research Outputs:**

Papers published in print and online, the sharing of data, biological materials, samples, animals, reagents, refinements and good practice....

# Research Framework

## Legislation

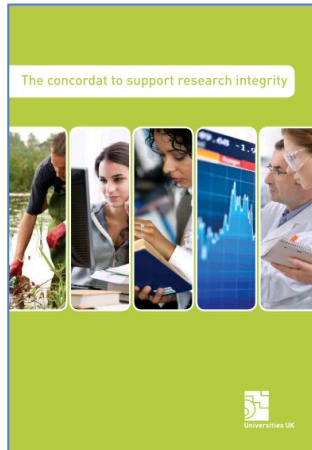


We acknowledge that the UK has the most detailed legislative framework concerning research on animals in the world. But proper attention to the welfare of animals involved in research and the accountability of scientists who conduct research on animals cannot be achieved merely by having detailed regulations. Regulation can act as an emotional screen between the researcher and an animal, possibly encouraging researchers to believe that simply to conform to regulations is to act in a moral way. It is therefore crucial to promote best practice more actively and to improve the culture of care in establishments licensed to conduct experiments on animals.

Quote from Nuffield Council on Bioethics 2005 Ethics of research involving animals report.

# Research Framework

## Policies



### Concordat on Openness on Animal Research in the UK



ARRIVE

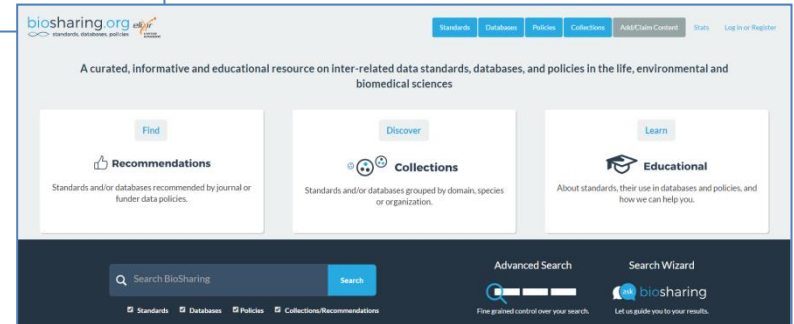
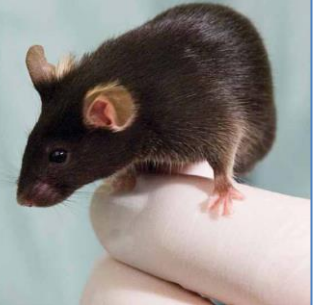
### Concordat on Open Research Data

The Concordat on Open Research Data has been developed by a UK multi-stakeholder group. This concordat will help to ensure that the research data gathered and generated by members of the UK research community is made openly available for use by others wherever possible in a manner consistent with relevant legal, ethical, disciplinary and regulatory frameworks and norms, and with due regard to the costs involved.

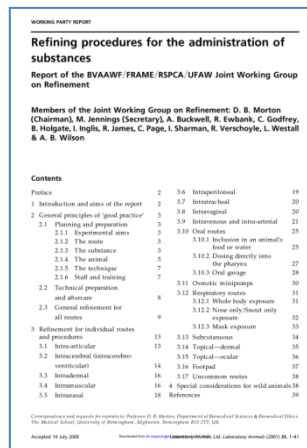
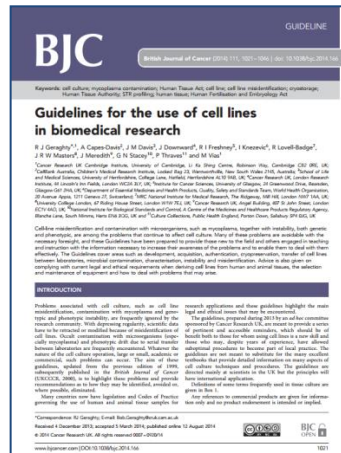
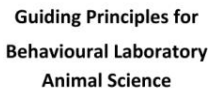


July 2016

Responsibility in the use of animals in bioscience research: Expectations of the major research council and charitable funding bodies



# Guidance



## Others



### An institutional framework for the 3Rs

### 1. Improving access to information and other resources

Providing easy access to online resources and information on events and training courses is essential for equipping all staff involved in animal research with contemporary and comprehensive information on the 3Rs.

Most institutions will have an intranet for project and personal licence holders and animal care staff, setting out internal policies and standard operating procedures. Internal online resources could be strengthened by providing a direct and visible link to the NC3Rs, including its Procedure with Care website, newsletters, free events and

## 2. Championing the 3Rs

There is a need to move the SRs 'out of the animal facility'. Responsibility for the SRs should not just be considered to be the domain of the vets and animal care staff. While these staff have a significant role to play on refinement and improving animal welfare, wide scientific engagement is required for the full adoption

of the 3Rs. This is particularly the case for replacement and reduction where detailed knowledge of the scientific objectives and experimental design are required.

Divisions (Departments or Schools as appropriate) should be encouraged to have scientific 3Rs champions who can help identify relevant 3Rs opportunities from the NC3Rs website, the scientific literature and conferences to share with colleagues. A programme of regular seminars or journal clubs focusing on the 3Rs should be instigated. The 3Rs should be a regular item on lab meeting agendas.

### 3. Involving the wider institutional community

Advances in the 3Rs are dependent on challenging existing models and procedures, and scientific and technological innovation. A multi-disciplinary approach is often required, including those not normally involved with animal research.

Many institutions have expertise in a wide range of disciplines from mathematics to material sciences. Providing a framework where biologists and those not directly involved in animal research come together to focus on 3Rs issues can be difficult. Nevertheless, providing opportunities for networking and knowledge exchange can accelerate the development of the 3Rs. Ideas to facilitate this include workshops focusing on a particular theme, for example, "can bioreactors be used for X?". Setting ambitious 'blue sky' challenges relevant to Departmental research priorities such as "how could we replace

Pioneering Better Science

## Responsible Research In Practice



## EDITORIAL

### Ten Simple Rules for Effective Statistical Practice

Robert E. Kosa<sup>7</sup>, Brian S. Caffo<sup>2</sup>, Marie Davidson<sup>3</sup>, Xiao-Li Meng<sup>4</sup>, Bin Yu<sup>2</sup>, Nancy Reid<sup>6,\*</sup>

<sup>1</sup> Department of Statistics, Machine Learning Department, and Center for the Neural Basis of Cognition, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States of America; <sup>2</sup> Department of Biostatistics, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland, United States of America; <sup>3</sup> Department of Statistics, North Carolina State University, Raleigh, North Carolina, United States of America; <sup>4</sup> Department of Statistics, Harvard University, Cambridge, Massachusetts, United States of America; <sup>5</sup> Department of Statistics and Department of Electrical Engineering and Computer Science, University of California Berkeley, Berkeley, California, United States of America; <sup>6</sup> Department of Statistical Sciences, University of Toronto, Toronto, Ontario, Canada

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 OPEN ACCESS

**Citation:** Kass RE, Cohn SE, Doornik M, Wang H, Yajima M (2014) Ten Simple Rules to Effective Writing. *PLoS ONE* 9(12): e111683. doi:10.1371/journal.pone.0111683

Editor: Peter Leach, Waltham Institute, UNITED KINGDOM  
 Email: p.leach@walthaminst.ac.uk  
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There are some outstanding resources available that explain many of these concepts clearly and in much more detail than we have been able to do here; among our favorites are Con and

Donnelly [1], Leek [3], Peng [4], Kass et al. [5], Takyi [6], and Yu [7].

**Rule 1: Statistical Methods Should Enable Data to Answer Scientific Questions**

A big difference between inexperienced users of statistics and expert statisticians appears as soon as they contemplate the uses of some data. While it is obvious that experiments generate data to answer scientific questions, inexperienced users of statistics tend to take for granted the link between data and scientific issues and, as a result, may jump directly to a technique based on data structure rather than scientific goal. For example, if the data were

PLoS Comput Biol. 2016; 12(6): e1004961. doi:10.1371/journal.pcbi.1004961 June 9, 2016

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**BJP** British Journal of  
Pharmacology

## EDITORIAL

Do as you would be done  
by: write as you would wish  
to read

Gordon B Drummond<sup>1</sup> and Sarah L Vowler<sup>2</sup>

<sup>1</sup>Department of Anaesthesia and Pain Medicine, University of Edinburgh, Royal Infirmary, Edinburgh, UK, and <sup>2</sup>Cancer Research UK, Cambridge Research Institute, Li Ka Shing Centre, Cambridge, UK

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This article is being published  
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*Advances in Physiology Education*,  
*Microcirculation and Clinical and  
Experimental Pharmacology and  
Physiology*.

Gordon Drummond is Senior Statistics Editor for *The Journal of Physiology*.

Sarah Vowler is Senior Statistician in the Bioinformatics Core at Cancer Research UK's Cambridge Research Institute.

This article is the last in a series on best practice in statistical reporting. All the articles can be found at [http://onlinelibrary.wiley.com/journal/10.1111/ISSN1476-5381/homepage/statistical\\_reporting.htm](http://onlinelibrary.wiley.com/journal/10.1111/ISSN1476-5381/homepage/statistical_reporting.htm).

# Openness & Transparency



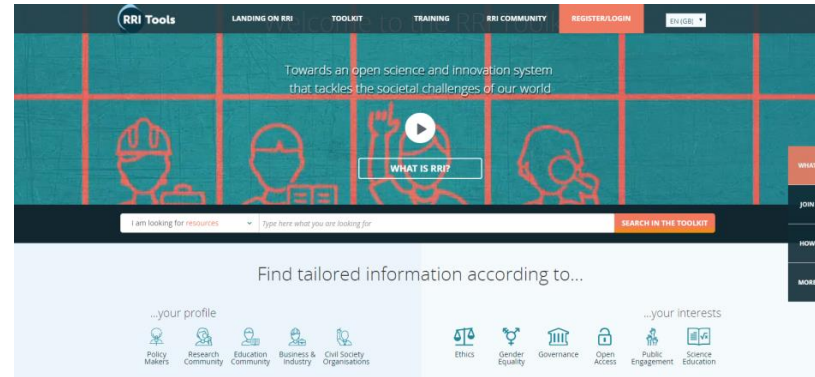
“..the project suggests that public engagement is more firmly embedded in the context of arts, humanities and social sciences than it is among researchers in science, technology, engineering and mathematics.”



# Openness & Transparency



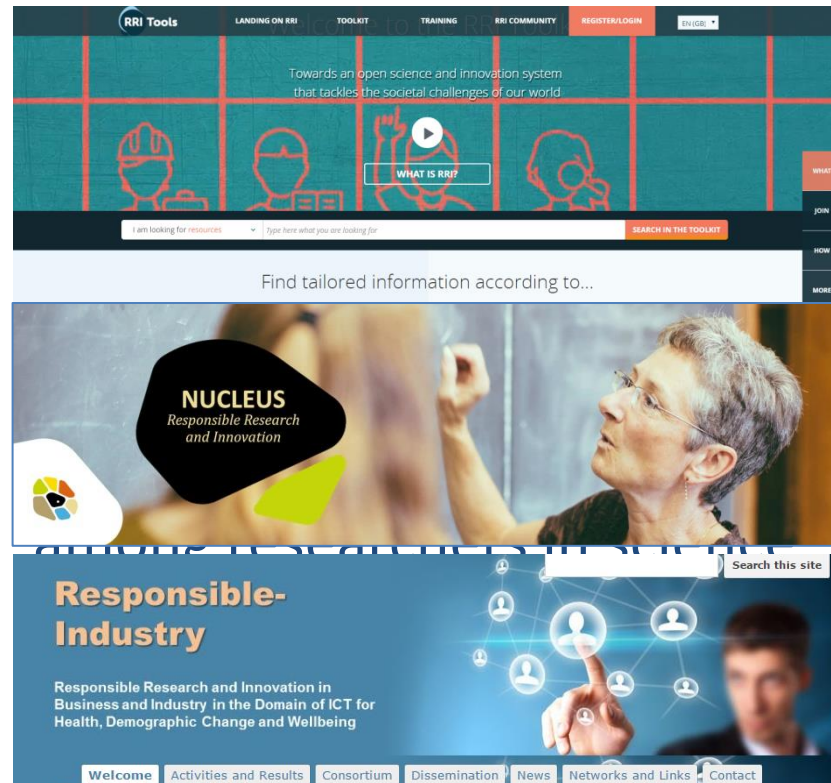
Responsible Research  
In Practice



# Openness & Transparency



Responsible Research  
In Practice





## Introduction to Responsible Research and Innovation in the ICT Industry Related to Health and Ageing

How to apply Responsible Research and Innovation (RRI) in i... ➔



# Research Outputs

Reproducibility and reliability of biomedical research: improving research practice

Symposium report, October 2015

The Academy of Medical Sciences | BBSRC | MRC | Wellcome Trust

## Reproducibility and the conduct of research

**Data dredging**  
Also known as p-hacking, this involves repeatedly searching a dataset or trying alternative analyses until a 'significant' result is found.

**Omitting null results**  
When scientists or journals decide not to publish studies unless results are statistically significant.

**Underpowered study**  
Statistical power is the ability of an analysis to detect an effect, if the effect exists – an underpowered study is too small to reliably indicate whether or not an effect exists.

**Errors**  
Technical errors may exist within a study, such as misidentified reagents or computational errors.

**Underspecified methods**  
A study may be very robust, but its methods not shared with other scientists in enough detail, so others cannot precisely replicate it.

**Weak experimental design**  
A study may have one or more methodological flaws that mean it is unlikely to produce reliable or valid results.

### Issues

## Possible strategies

**Open data**  
Openly sharing results and the underlying data with other scientists.

**Pre-registration**  
Publicly registering the protocol before a study is conducted.

**Collaboration**  
Working with other research groups, both formally and informally.

**Automation**  
Finding technological ways of standardising practices, thereby reducing the opportunity for human error.

**Open methods**  
Publicly publishing the detail of a study protocol.

**Post-publication review**  
Continuing discussion of a study in a public forum after it has been published (most are reviewed before publication).

**Reporting guidelines**  
Guidelines and checklists that help researchers meet certain criteria when publishing studies.

Responsible Research  
In Practice

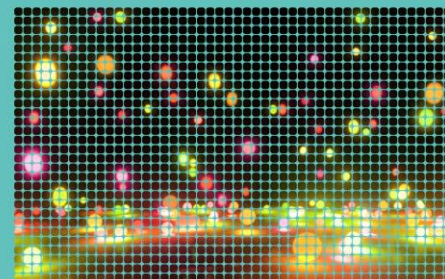
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Published 28<sup>th</sup> July 2016



### Digital Science Report

### The State of Open Data

A selection of analyses and articles about open data, curated by Figshare

Foreword by Professor Sir Nigel Shadbolt

OCTOBER 2016



Responsible Research  
In Practice

Markowitz *Genome Biology* (2015) 16:274  
DOI 10.1186/s13059-015-0820-7



### COMMENT

### Open Access



## Five selfish reasons to work reproducibly

Florian Markowitz

### Abstract

And so, my fellow scientists: ask not what you can do for reproducibility, ask what reproducibility can do for you! Here, I present five reasons why working reproducibly pays off in the long run and is in the self-interest of every ambitious, career-oriented scientist.

**Keywords:** Reproducibility, Scientific career

how science actually is. And, whether you like it or not, science is all about more publications, more impact factors, more money and more career. More, more, more... so how does working reproducibly help me achieve more as a scientist.

### Reproducibility: what's in it for me?

In this article, I present five reasons why working reproducibly pays off in the long run and is in the self-interest of every ambitious, career-oriented scientist.

A complex equation on the left half of a black board, an even more complex equation on the right half. A short sentence links the two equations: "Here a miracle occurs". Two mathematicians in deep thought. "I think you should be more explicit in this step", says one to the other.

This is exactly how it seems when you try to figure out how authors got from a large and complex data set to a dense paper with lots of busy figures. Without access to the data and the analysis code, a miracle occurred. And there should be no miracles in science.

Working transparently and reproducibly has a lot to do with empathy: put yourself into the shoes of one of your collaboration partners and ask yourself, would that person be able to access my data and make sense of my analyses. Learning the tools of the trade (Box 1) will require commitment and a massive investment of your time and energy. A priori it is not clear why the benefits of working reproducibly outweigh its costs.

Here are some reasons because reproducibility is the right thing to do! Because it is the foundation of science! Because the world would be a better place if everyone worked transparently and reproducibly! You know how that reasoning sounds to me? Just like yaddah, yaddah, yaddah...

It's not that I think these reasons are wrong. It's just that I am not much of an idealist; I don't care how science should be, I am a realist; I try to do my best given

**Reason number 1: reproducibility helps to avoid disaster**  
"How bright promise in cancer testing fell apart" titled a *The New York Times* article published in summer 2011 [1] highlighting the work of Keith Raggerty and Kevin Combes, two biostatisticians at M.D. Anderson Cancer Center. Raggerty and Combes had exposed lethal data analysis problems in a series of high-impact papers by breast cancer researchers from Duke University [2].

The issues discovered by Raggerty and Combes could have easily been spotted by any co-author before submitting the paper. The data sets are not huge and can easily be spot-checked on a standard laptop. You do not have to be a statistics wizard to realize that patient numbers differ, labels got swapped or samples appear multiple times with conflicting annotations in the same data set. Why did no one notice these issues before it was too late? Because the data and analysis were not transparent and required forensic bioinformatics to untangle [2].

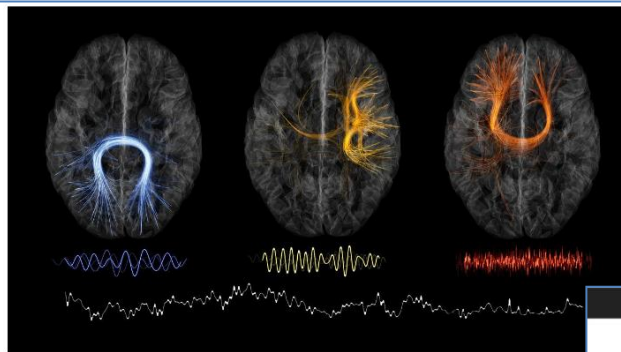
For me, this example provides a powerful motivation to be more transparent and reproducible in my own work. Even smaller disasters can be embarrassing. Here is an example from my own research. Our experimental collaboration partners were validating a pathway model that we had generated computationally. When writing the paper, however, we hit a crucial roadblock: no matter how hard we tried, we could not reproduce our initial pathway model. Maybe the data had changed, maybe the code was different, or maybe we just couldn't remember the parameter settings of our method correctly. Had we published this result, we would not have been able to

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# Research Outputs



The Montreal Neurological Institute plans to free up its findings, including data that point to connections between brain regions communicating at different neural rhythms.

SEBASTIEN DERY, MCGILL  
BRAIN IMAGING  
MONTREAL NEUROLOGICAL INSTITUTE

## Montreal institute going 'open' to accelerate science

By Brian Owens | Jan. 21, 2016, 2:00 PM

Guy Rouleau, the director of McGill University's Montreal Neurological Institute (MNI) and Hospital in Canada, is frustrated with how slowly neuroscience research translates into treatments. "We're doing a really shitty job," he says. "It's not because we're not trying; it



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# Research Outputs

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Reviewing Data Management Plans  
London, 30 November 2016


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27 October, 2016 | in DCC News



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# ANY QUESTIONS ?

[nikki@responsibleresearchinpractice.co.uk](mailto:nikki@responsibleresearchinpractice.co.uk)

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Responsible Research  
In Practice



**RESPONSIBLE**  
**Ethical**  
**Science that is**  
**Evidence based**  
**AND above all**  
**Reproducible**  
**Challenging and**  
**Honest**



# "Research that is worth doing, is worth doing properly"

Responsible Research in Practice provides bespoke support, training and advice to enhance the responsible conduct of research in everyday practice. We use practical experience to provide an international service to individuals and organisations working in Bioscience and Laboratory Animal Science sectors.

## Contact Us

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