

Science and Technology Select Committee inquiry on Research Integrity

A response from the Royal Society of Biology

14 March 2017

The Royal Society of Biology (RSB) is a single unified voice, representing a diverse membership of individuals, learned societies and other organisations. We are committed to ensuring that we provide Government and other policy makers, including funders of biological education and research, with a distinct point of access to authoritative, independent, and evidence-based opinion, representative of the widest range of bioscience disciplines.

The Royal Society of Biology is pleased to offer these high level points in relation to the Committee's inquiry on this important topic.

1. The extent of the research integrity problem

- 1.1. It is essential that the scientific literature and its communication, interpretation and use is based on the best and most consistent information that can be established. The work of scientists is essential to this and therefore they must act with integrity. The overwhelming majority of scientists, and scientific organisations strive for high quality and the generation of sound knowledge.
- 1.2. The research community and others have focused keenly on the issue of whether there are systemic or isolated integrity problems in science. Initiatives and studies have sought to find and resolve incidents, as well as to assess the scale of the problem overall. We agree with the conclusion of many assessments that flawed, irreproducible or incorrect publications found are rarely the result of deliberate misconduct or fraud. However, flawed practice, errors and lack of rigour are important problems to be addressed both at the individual and organisational level and whenever they arise. Science, through publication and dissemination of information, is an iterative and inherently self-correcting process. Inability to repeat or confirm published observations can reveal outstanding or new questions as well as problems, and often lead to new insights and knowledge. These should be published and disseminated also. This may not necessarily indicate deliberate or careless errors in the originating study, and indeed showing that a study could have been done better would not necessarily mean that it should be discounted or that the researchers lacked integrity.
- 1.3. The scientific community is global and highly connected, it is also growing and there has been a steady increase in the annual output of published papers internationally (long-term estimates are of around a 3% per annum rise but it may be as much as twice that in recent years)¹. Figures from 2014 indicated that 28 thousand peer-reviewed English-language journals collectively carried almost 2.5 million articles (p.a.); 95% of journals carry original research. Approximately 30% of journals cover biomedical research, making it the single largest subject area. It is important to scrutinise all fields. Because published science is communal knowledge, problems with the literature anywhere in the world have the potential to impact everywhere. In the UK, where there is science community and public concern about the literature, incidents are highly reported and receive attention. Systemic, research culture or individual failures in any country are therefore considered relevant to the UK, regardless of whether they are the direct product of UK research.

¹ Ware (2015) http://www.stm-assoc.org/2015_02_20_STM_Report_2015.pdf

- 1.4. UK researchers are highly connected and approximately 48% of research papers of UK authors include an international collaborator. Research practice and culture in the UK therefore has global reach and influence, as well as potentially experiencing the impact of international trends and incidents. The UK has a strong stable of journals which receive papers for review from authors internationally. Approximately 24% of journal articles are published through UK journals, again highlighting the influence (and the export strength) of UK publications. The publication policies and peer review practice of the UK's journals therefore have influence well beyond our 4% share of the global researcher community. Many journals are led by learned societies, or communities with specific charitable or chartered purpose to support excellence in their discipline, and established commercial journals often have long-standing relationships with their academic communities, this leads to a focus on governance processes to support only publication of quality content. Many bioscience journals, published by our members, devote particular attention to these matters in guidelines and editorials.²
- 1.5. The report by the Nuffield Council for Bioethics³ sought views and information from across the sciences, receiving input from a high proportion of researchers active in biology (bioscience 56%, medicine 27%, environmental 4%, veterinary 2%, neuroscience 1%; selections not exclusive) and producing recommendations for action which we encourage. The report showed that 'rigorous' was the word most associated with high quality activity, along with 'accurate', 'original', 'honest' and 'transparent' indicating high awareness of the demands of good research, as you would expect. The report also details not only the systemic pressures affecting researchers and research activity but the unintended negative and damaging influences. These warrant particular corrective attention, including through awareness-raising in the researcher community as well as among leaders, funders and organisations. Community norms are powerful in both setting and resetting behaviours.
- 1.6. Groups and information platforms such as Retraction Watch,⁴ PubPeer⁵ and others actively communicate and raise awareness of incidents of retraction of publications. This serious action may be as a result of deliberate wrong-doing or a failure of good practice, with the retraction triggered by external scrutiny by a reader, or indeed by one or all of the authors realising a mistake. The vigilance of the community is essential to all of this.
- 1.7. Systematic reviews and meta-analyses are increasingly powerful and effective approaches to distilling information from multiple sources, they can also act to highlight problems within the corpus of available data.⁶ Irreproducible results arising from poorly designed or analysed experiments are increasingly highlighted and in the biomedical sciences in particular there are ongoing programmes to examine and redress these problems. However, they are complex in origin and therefore difficult to resolve.⁷ Researchers should aim at all times for the highest standards, and failures in experimental design and execution must be minimised. There is an important role here for education and for institutional support.
- 1.8. Exercises such as the UK's Research Excellence Framework attest to the high quality research produced in volume by UK research institutions in receipt of Government research funding through the Higher Education Funding Council for England (HEFCE) administered mechanism. Research funded through

² For example, The British Journal of Pharmacology (2015) <http://onlinelibrary.wiley.com/doi/10.1111/bph.12856/full>

³ The Nuffield Council for Bioethics (2014) The Culture of Scientific Research in the UK

⁴ <http://retractionwatch.com/>

⁵ <https://pubpeer.com>

⁶ See for example the work of Prof Malcolm Macleod <http://www.ed.ac.uk/clinical-brain-sciences/people/principal-investigators/professor-malcolm-macleod>

⁷ See for example the ongoing work of the Academy of Medical Sciences and others <https://acmedsci.ac.uk/policy/policy-projects/reproducibility-and-reliability-of-biomedical-research>

other mechanisms, including by major charities also scores highly. Overall there is recognition of high quality in large quantities, as well as an awareness of problems within the literature and practice. There is a vast and expanding global publication base to review. Discoverability is an important and growing challenge and capacity to ensure that work is original rests on being able to find whether any relevant studies exist in the literature. In addition to issues of the sheer volume of current output, older published work is less easy to search with current digital technology and available meta-data. Multidisciplinary research presents great opportunities for the development of knowledge but real challenges for those involved to review colleagues' contribution to the work (and publication) and to peer reviewers to ensure that all relevant knowledge-bases are covered. Different methodological approaches and terminology differences can make it difficult for contributing authors to scrutinise each other's work but errors by one could affect the reputation and output of all. Discovery and discussion of these issues is ongoing within the community.

- 1.9. In all regards peer review is an essential element both pre and post publication. Better training in peer review has been highlighted as a need in the past and continues to be a significant need. The peer reviewing population turns over with time and therefore training and standard setting is a constant need. This is a significant challenge for the publishing, funding and research communities and we hear calls for enhanced provision of training from reviewers and authors. Institutions and learned communities have an important role to play as guardians of quality.

2. Causes and drivers of recent trends

- 2.1. The desires to contribute something novel to the body of knowledge, and to test theories and hypotheses, are powerful drivers in and of themselves. These motivations can act to drive excellence but can also open up the risk that errors of interpretation will be made when rigour fails. Publication now functions not only to communicate findings but to establish authors' reputation and therefore the associated potential for recognition and reward. The reward is often the recognition itself, and the prospect of conducting more research, but may also be the prospect of promotion in research institutions, and associated remuneration. These drivers therefore can act negatively to dim good judgement or in extreme cases to encourage misconduct or fraud. The increased numbers of researchers entering the community, with a high attrition rate and reduced capacity to develop a reputation by being well known to all relevant colleagues and research leaders, places more focus on the journal publication as the unit of currency. The Research Excellence Framework (REF) and assessments for league tables, among other things, adds to this. The Research Culture project explored this in detail and it is significant that although many responsible governing policies are set to reduce risks (e.g. that the journal impact factor should not be the metric of quality assessment in REF), the communication and implementation of these is insufficient to counter a community held view that they *are* determining factors, and so the influence remains.
- 2.2. Internationally there are reports of systems to reward numbers of publications and their associated journal impact factor resulting in a publication volume drive. It has been reported that a black market of ready results develops around this without regard for the data quality; if true this is anathema to science and progress. These forces are not mirrored in the UK but their effects are felt nonetheless.

3. The effectiveness of controls/regulation (formal and informal), and what further measures if any are needed

- 3.1. There are a range of relevant initiatives to support quality and combat irregularities in the science and research environment in the UK. The Concordat to support Research Integrity⁸ is widely recognised and adopted by institutions and provides a powerful framework. Individual researcher awareness of the concordat could improve but individuals will encounter its institutional implementation. The Concordat on Open Research Data⁹ also supports sharing and community opportunity for scrutiny and use of research data.
- 3.2. Many publishers make particular measures to support the integrity of publications as well as preparing to deal with any disputes or controversies, for example via the Committee on Publication Ethics (COPE)¹⁰. This provides advice as well as raising awareness of problems and their origins. Given that it is often the lack of awareness or preparedness that causes problems, this is vital work. For example, many questions arise regarding the manipulation of images in papers because researchers are unaware that digitally annotated images are not allowed, and complete originals must be available (although they are often not saved). In addition, some journals provide comprehensive training for editors and publish guides for authors and potential authors,^{11,12} and peer reviewers.¹³ Specific, stated readiness to publish so-called negative data also helps to enhance the integrity of the science record. Some newly established journals specifically encourage publication of negative data but there remains the challenge of encouraging writing of papers that are unlikely to be highly cited. Preference for writing up and publishing positive and novel results means that information on negative associations is too frequently lost to the literature, with associated risk that experiments will be repeated by others if knowledge gained is unavailable to them. This is a significant problem and complex to address.
- 3.3. The use of animals in research is a particular concern and rigorous standards must apply and focus on appropriate reduction, refinement and replacement (3Rs) of animals wherever possible. The National Centre for the 3Rs (NC3Rs) and others have developed reporting guidelines for journals called ARRIVE (Animal Research: Reporting In vivo Experiments)¹⁴. These are widely adopted by journals but full compliance is still a long way off; insisting on this aspect of implementation is a responsibility for the authors, publishers and funders (if involved).
- 3.4. The RSB acts to promote professional practice among its members and beyond. Elected members (MRSB and FRSB) must adhere to our Code of Conduct¹⁵ which provides a guide and framework for ethical practice. Properly embedded norms and understanding require education from the start and therefore the RSB Degree Accreditation Programme criteria include requirements to cover ethics, experimental design and other aspects tailored to the achievement of competence level required of graduates.¹⁶ This will act to inform the development for future researchers early. We encourage continuing professionalisation and believe it is important for the learned community to remain vigilant, vocal and active on matters relevant to the delivery of high quality science.
- 3.5. Research Councils and major funding and research organisations have well developed governance structures and practice, including whistle-blowing policies, to nurture high quality science. In the

⁸ <http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2012/the-concordat-to-support-research-integrity.pdf>

⁹ <http://www.rcuk.ac.uk/documents/documents/concordatonopenresearchdata-pdf/>

¹⁰ <http://publicationethics.org/>

¹¹ For example, The British Ecological Society <http://www.britishecologicalsociety.org/publications/journal-policies/>

¹² <http://www.britishecologicalsociety.org/wp-content/uploads/2016/04/Guide-to-Data-Management.pdf>

¹³ <http://www.britishecologicalsociety.org/wp-content/uploads/2016/04/Guide-to-Peer-Review.pdf>

¹⁴ <https://www.nc3rs.org.uk/arrive-guidelines>

¹⁵ <https://www.rsb.org.uk/images/Code%20of%20Professional%20and%20Ethical%20Conduct.pdf>

¹⁶ <https://www.rsb.org.uk/education/accreditation>

inevitable competition for resource clear communication of these norms and expectations are an important stabilising influence.

- 3.6. Openness and transparency are key to regulating this complex area. There are increasing opportunities for posting unreviewed material on pre-print servers and elsewhere. Care must be taken in the interpretation and use of this material by authors and others. Increased access to the peer reviewed literature through open access publication and the publication of supplementary material and data alongside papers is a trend that facilitates scrutiny, but requires time and effort from the community to do so. Pre-publication mechanisms to ensure that the published record is as good as possible from the outset is key to making best progress. Training is needed to establish and embed good practice in data generation, recording and labelling, management, communication and peer review. There is an important role for the science community, societies and publishers to support this, including in encouraging participation in peer review which is not rewarded, and training for this. In particular, a focus on training and continuous development of professionals is a key element.

4. What matters should be for the research/academic community to deal with, and which for Government

- 4.1. As outlined, the research community and research organisations within it have a primary role in guiding and guarding science norms. Issues and trends are often complex and the culture of research is influenced by these over time. Active engagement in this by the community at national and international levels is required in order to follow and guide changing practice.
- 4.2. Government is a major investor in science and a major customer for research. As such funding and procurement policies are influential and assessment, such as the REF, has a big influence. In addition, the developing role of UKRI in relation to distribution and direction of funding streams and policy will influence the environment for research. It remains important that competition should always favour high quality and that the Haldane Principle should apply; Government's recognition of this is very welcome and powerful. We see no appetite or argument for Government regulation of integrity in science in the UK. Dynamic and open lines of communication between Government and researcher organisations and an active and empowered research community can communicate and embed the absolute requirement for high quality research in the UK.

Appendix A: Member Organisations of the Royal Society of Biology

Full Organisational Members

Academy for Healthcare Science
Agriculture and Horticulture Development Board
Amateur Entomologists' Society
Anatomical Society
Association for the Study of Animal Behaviour
Association of Applied Biologists
Bat Conservation Trust
Biochemical Society
British Andrology Society
British Association for Lung Research
British Association for Psychopharmacology
British Biophysical Society
British Crop Production Council
British Ecological Society
British Lichen Society
British Microcirculation Society
British Mycological Society
British Neuroscience Association
British Pharmacological Society
British Phycological Society
British Society for Cell Biology
British Society for Developmental Biology
British Society for Gene and Cell Therapy
British Society for Immunology
British Society for Matrix Biology
British Society for Medical Mycology
British Society for Nanomedicine
British Society for Neuroendocrinology
British Society for Parasitology
British Society for Plant Pathology
British Society for Proteome Research
British Society for Research on Ageing
British Society of Animal Science
British Society of Plant Breeders
British Society of Soil Science
British Toxicology Society
Daphne Jackson Trust
Drug Metabolism Discussion Group
Fondazione Guido Bernardini
GARNet
Genetics Society
Heads of University Centres of Biomedical Science
Institute of Animal Technology
Laboratory Animal Science Association
Linnean Society of London
Marine Biological Association
Microbiology Society
MONOGRAM – Cereal and Grasses Research Community
Network of Researchers on Horizontal Gene Transfer & Last Universal Cellular Ancestor
Nutrition Society
Quekett Microscopical Club

Royal Microscopical Society
SCI Horticulture Group
Science and Plants for Schools
Society for Applied Microbiology
Society for Experimental Biology
Society for Reproduction and Fertility
Society for the Study of Human Biology
Systematics Association
The British Library
The Field Studies Council
The Physiological Society
The Rosaceae Network
Tropical Agriculture Association
UK Environmental Mutagen Society
UK-BRC – Brassica Research Community
UK-SOL – Solanacea Research Community
University Bioscience Managers' Association
VEGIN – Vegetable Genetic Improvement Network
Zoological Society of London

Supporting Organisational Members

Affinity Water
Association of Medical Research Charities
Association of the British Pharmaceutical Industry (ABPI)
AstraZeneca
BASIS Registration Ltd.
Bayer
BioIndustry Association
Biotechnology and Biological Sciences Research Council (BBSRC)
British Science Association
Envigo
Fera
Forest Products Research Institute
Gatsby Charitable Foundation
Institute of Physics
Ipsen
Medical Research Council (MRC)
MedImmune
Pfizer UK
Plant Bioscience Limited (PBL)
Porton Biopharma
Procter & Gamble
Royal Botanic Gardens, Kew
Royal Society for Public Health
SynBiCITE
Syngenta
The Ethical Medicines Industry Group
Understanding Animal Research
Unilever UK Ltd
Wellcome Trust
Wessex Water
Wiley Blackwell