Summary:

In this evidence, we put research integrity into its global and changing context. Research is now a 'global enterprise' with substantially increased funding and with a major increase in the number of researchers worldwide. While the incidence of research misconduct remains at a low level of around 2-3% of all researchers, the absolute number of incidences has grown with this increased research volume. The growth in researchers has also led to a significant increase in scientific publications, mostly multi-authored and reflecting increased international collaboration. We provide a short history of the rationale behind and the development of the World Conferences on Research Integrity and their output, including the influential and foundational Singapore and Montréal Statements and the current Amsterdam Agenda. We include some general comments regarding codes of conduct, including reference to the UK Concordat and the European Code of Conduct, the need for compliance in the provision of education and training and the need to promote research on research integrity itself. Finally, we have made some remarks on the need for changes to the overall global research system.

Global Growth of Research

Since the turn of the century, there has been a dramatic increase in the volume of research conducted worldwide with a concomitant major increase in the number of researchers involved in this endeavour.

This increase has been largely driven, although not exclusively, by the countries of Asia in which China, by virtue of its size predominates. For example, there were 7.8 million full-time equivalent researchers in 2013, representing growth of 21% since 2007. Global gross expenditure on research and development (GERD) totalled 1.48 trillion PPP (purchasing power parity) dollars in 2013. The proportion of expenditure as a percentage of GERD in the world grew faster (30.5%) than the global economy (20.1%) between 2007 and 2013. This global increase is shown in Figure 1 below.
Written evidence submitted by Tony Mayer, Professor Lex Bouter, and Professor Nick Steneck (RES0026)

The smaller countries in Asia have also increased their research investment. For example, Singapore, with its commitment to a knowledge-based economy, has increased its public investment in research, stepwise in its five-year plans, tenfold since 1991 and by nearly 50% over the level of investment in 2005 – see Figure 2. Of course, Singapore is somewhat of an exception in the magnitude of the increase.

Commensurate with this growth in research has been the growth of research outputs measured in terms of scientific papers and articles. Between 2008 and 2014, the number of scientific articles catalogued in the Science Citation Index of Thomson Reuters’ Web of Science grew by 23%, Growth
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was strongest among the upper middle-income economies (94%), primarily driven, again, by the growth in Chinese publications (151%). This growth in scientific publications is only to be expected with more research being undertaken and with more researchers involved world-wide. Together, with this increase in publications there has been a sharp increase in multi-authored papers based on international collaborations. As Nature reported in 2016,

“International collaborations are on the rise.....In 2013, just over one half of science and engineering articles form institutions in the UK listed an international co-author; for the USA the number was roughly one third and, China about 15.”

Figure 2: Growth of publications (compiled by Professor Michael Khor, NTU Singapore based on data from Elsevier Scopus)

Thus, with this growth in both the amount of research and its increasingly collaborative (especially international) nature, there has to be trust that everyone is working to common high standards of good research practice (often labelled as the responsible conduct of research - RCR).

There is no reason to believe that the incidence of research misconduct has changed over time, but the increased volume of research inevitably means that there are now more cases of misconduct than in the past.

More worryingly, surveys of researchers show that while there will be a relatively small number (2-3%) of serious misconduct cases, there remains a large penumbra of those who admit to less than the best research practice. This number refers to the number of scientists who self-report having committed fabrication or falsification at least once during the last 3 years. For example, this is not translatable to the number of ‘corrupted’ articles. Furthermore, it is, most likely, an underreported estimate due to the self-reported nature of the data.

Also, there is an increasing problem of non-reproducibility, with some estimates that as much of 35% of biomedical research reported is not reproducible. The estimates published, so far, range between 15 and 90% being not reproducible. This comes from an informal survey of the scientific literature conducted for the Netherlands Royal Academy of Arts and Sciences that will be published in January 2018.
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World Conferences on Research Integrity and their Output

With this increasing globalisation of research, the need for fostering responsible conduct of research has become even more necessary.

The recently published book (Reference 1) “Scientific Integrity and Ethics in the Geosciences” edited by Linda C. Gundersen, the chairs of the first four World Conferences have a chapter on “The Origin, Objectives and Evolution of the World Conferences on Research Integrity”

In it we say that “… The World Conferences on Research Integrity (WCRI) have grown over the past decade from a proposal to convene a joint U.S.–European conference on research integrity into a global effort to foster integrity in research through research, discussion, the harmonization of policies, and joint action. Over the course of the first four WCRIs, held in Lisbon, Portugal in 2007; Singapore in 2010; Montreal, Canada, in 2013; and Rio de Janeiro, Brazil, in 2015, participation has grown from 275 participants from 47 countries in 2007 to 474 participants from 48 countries in 2015. The WCRIs have produced two global statements on research integrity: the Singapore Statement in 2010 and the Montreal Statement in 2013. In addition, three sets of proceedings and numerous papers and working reports archived on the WCRI website (www.researchintegrity.org) are available…. In an ideal world, integrity should be a regular element of all aspects of research. In practice, it is too often a topic that gets attention when there is a crisis and then is put on the shelf until the next crisis arises. Thus, over the 40 or so years that research integrity has been a topic of public discussion, universities, professional societies, and governments have responded to crises, issued reports, and then, too often, moved on to other issues, hoping that no further crises would arise… The World Conferences on Research Integrity have evolved into an ongoing forum for the study and discussion of ways to promote responsible behaviour in research. This was not, however, the goal of the initial and somewhat audaciously titled “World Conference on Research Integrity” held in Portugal in 2007. The aim of the initial conference was more modest. “

The history of this endeavour, in more detail, starts in the early 2000s, when one of us (NS), on secondment to the US Office of Research Integrity (ORI), embarked on a mission to promote a USA/Europe dialogue about research integrity. This followed on from several high profile cases of research misconduct and the lack of common approaches to the whole area of integrity in research. This quickly evolved from just a trans-Atlantic meeting into the concept of a World conference. The challenge, from the European side, was picked up by the European Science Foundation (ESF), in Strasbourg, which led to the first World Conference on Research Integrity held in September 2007. This was organised under the auspices of the Portuguese EU Presidency of the time with financial support from the European Commission in addition to that from ESF and ORI plus financial aid from the NATO Science Programme addressing Europe’s near neighbours. It was co-organised and co-chaired by NS and TM. At the same time as the first conference was being planned, Japan, which had experienced research misconduct problems, stimulated workshops through the OECD Global Science Forum and this opportune coming together of both initiatives was an important aspect of the first Conference.

This initial conversation on research integrity demonstrated the need for such international gatherings enabling practitioners in the area the ability to exchange and learn from each other and attracted a gratifying 275 participants from 47 countries. It also illustrated the wide diversity of approaches being employed between countries not least in Europe as these ranged from the national quasi-judicial systems of Scandinavia to self-regulation by research institutions as practised by Ireland, the UK and many other countries.
The second conference, again co-organised and co-chaired by NS and TM, was held in Singapore in 2010, supported by the three major research institutions in Singapore together with its Ministry of Education. The size had expanded to nearly 350 participants from a similar number of countries.

The main themes of the conference focused on four key aspects of research integrity:

1. National and international structures for promoting integrity and responding to misconduct,
2. Global codes of conduct and best practices for research,
3. Common curricula for training students and researchers in best practices, and

Rather than just continuing to have important networking conversations and sharing experiences, it was important that such a meeting should have a lasting impact. Hence, the Singapore Statement on Research Integrity was endorsed, after considerable debate, as a consensus document of the participants. The Statement is now available in 27 languages, apart from English, and is a succinct summary of principles and responsibilities that apply to researchers and their institutions. It has found widespread acceptance and is now regarded as an important ‘foundingational document’. As a seminal document, it has been used to underpin national statements, the Statement of Principles produced by the Global Research Council and research integrity policies in many institutions, even though it may not necessarily be acknowledged. (References 2 and 3)

The third World Conference, co-chaired by Professor Melissa Anderson, University of Minnesota and Dr Sabine Kleinert, The Lancet magazine and COPE (the Committee on Publication Ethics), was held in Montréal in 2013. Again, it was considered important to continue the approach from Singapore in terms of creating a lasting output. The result was the Montréal Statement on Research Integrity in Cross-boundary Research Collaborations. This addressed the issues arising in different cross-boundary situations - between disciplines, between institutions, internationally and between sectors (academia and industry. (References 4 and 5)

The fourth conference, also co-chaired by Anderson and Kleinert, was held in Rio de Janeiro in 2015, attracting 474 participants, especially and unsurprisingly, with strong representation from South America, an area previously badly under-represented. The theme was “Research Rewards and Integrity: Improving Systems to Promote Responsible Research.” This was expressed not only in the plenary sessions but also in focus tracks that addressed the relationships between research integrity and systems represented by funders, countries, and research institutions.

The fifth conference took place in Amsterdam in May 2017, again co-chaired by NS and TM plus Professor Lex Bouter (LB) with the overall theme of ‘transparency and accountability’. This time the numbers participating were hugely increased to 836 from 52 countries —treble the numbers attending the first meeting. This demonstrates the increasing importance with which research integrity and the responsible conduct of research is now regarded globally.

After 10 years of world conferences it was agreed to give the system a legal ‘personality’ and a World Conferences on Research Integrity Foundation was formed and registered in the Netherlands. It was considered timely to develop an ‘Amsterdam Agenda’ to take stock of what has been happening worldwide, the measures that have been put in place to address and improve research integrity and their effectiveness. In other words, to put in place a system whereby we can measure what progress has and is being made.

The Amsterdam Agenda, in detail, will see the Foundation:
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Seeking to establish a “Registry for Research on the Responsible conduct of Research” (RRRCR). The RRRCR will seek to encourage researchers to plan, conduct, and report and share their research around six key elements:

a. Problem. The particular shortcomings they are addressing, such as selective reporting, poor mentoring or inadequate quality assurance.

b. Impact. An estimation of the relative impact of the shortcomings on the reliability of research, on trust in the research enterprise, on the responsible use of research funds and on other relevant measures of responsible research.

c. Intervention. The specific way(s) they plan to address the identified shortcoming(s), such as through training, outcomes assessment, quality checks, or reinforcements that encourage responsible behaviour.

d. Hypothesis or Anticipated Outcomes. The changes expected as a result of the intervention.

e. Assessment. How they plan to test their hypotheses and to assess whether the outcomes have been achieved.

f. Data sharing. How data (quantitative and qualitative) will be shared.

As part of the Agenda, the Foundation will:

Encourage funding institutions to support research on research integrity;

Raise awareness of the importance of research on research integrity and its use in developing evidence-based policy;

Report on the response to the RRRCR at the 6th World Conference on Research Integrity in 2019.

Details of the Amsterdam Agenda may be found at Reference 6.

The need to look at how research integrity is addressed in the universities remains and that is the core purpose of the Amsterdam Agenda. This challenge was the subject of a recent letter published in Science magazine by LB, TM and NS. (Reference 7)

With the establishment of the Foundation, and with a regular series of World Conferences in place, the Sixth World Conference will be held in Hong Kong in 2019 with co-organisers from Hong Kong University and the Royal Melbourne Institute of Technology together with LB. It will have the goal of organising and prioritising future research on research integrity as well as addressing the new challenges with which research integrity is faced especially from technologies, the demands for data, and the ongoing need to address research integrity in a global system of increasing competition and pressure.

This latter topic is, perhaps, the most important of all in that we are now living in a system of intense competition and pressure that extends from governments, through funders to individuals (see under General Comments below).

General Comments

Codes of Conduct are general statements of principle often elaborating what is contained in its basic form in the Singapore Statement. They may be national (enshrined in law or as a result of a national consensus or developed by funding agencies) or local, developed by the institution concerned. Codes can either cover all disciplinary fields or be discipline-specific. They set out general principles as well
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as having details about the handling of cases of misconduct. They may also impose the requirement for education and training in responsible conduct of research to be provided by the institution performing research. While of a general or universal nature, in practice, these apply only to publically funded institutions (universities and national research performing institutions) and may only have a limited influence on the private sector or in sensitive topic fields like military research. In Europe, after 10 years since the then Commissioner for Research, Janos Potočnik, in his keynote address to the First World Conference promised that the EU Framework Programme would adopt a code of conduct, this is now in place. The delay was caused by Member States (including the UK), arguing that research integrity was a matter for national rather than European action, even when there was largely an absence of national codes. The only European code of conduct was that developed by ALLEA (ALL European Academies - the European Federation of Academies of Sciences and Humanities) and the ESF. This was developed at the time of the Second World Conference in Singapore. More recently, there has been an assessment of research integrity policies in Europe under the auspices of Science Europe (the association of national funding agencies and national research performing institutions). Furthermore, the European Code has been updated and revised at the urging of the European Commission. (References 8 and 9).

In the UK, there is the Concordat, which took a long time in gestation, and which is now endorsed by all the relevant bodies in the UK and forms the basis for the Research Councils’ policy (References 10 and 11). Again, this is a general statement of principles to be adopted by research institutions. In many countries in the world, for example in Australia and Singapore, there is now a requirement imposed by funding agencies, that puts responsibility for the responsible conduct of research both on the individual grantee and on the employing institution. This latter condition is important as this is, perhaps, the more positive approach with the implication that the employing institution must provide adequate education, training and facilities for all its researchers. Indeed, this is also a condition for the receipt of research grants used by the US National Science Foundation.

It is important that there should be an audit for compliance with such conditions, not merely that such a policy exists but a demonstration of how education and training programmes and the essential facilities are being implemented.

This leads on to the need to understand the causes of poor research practices and misconduct and how the interventions being adopted are working. This is the purpose of the Amsterdam Agenda and especially the need for more research on the whole issue of research integrity. Our letter to Science magazine (reference 7) emphasises this point.

Overall, we consider that, in general, that it is best to continue the development of self-regulation as rarely do law, politics and research sit well together – accepting the need for accountability and transparency – which were the themes of the Fifth World Conference.

What we do need, as stated in our Science letter, is that universities themselves should take responsibility to promote research into research integrity. This will also require a commitment from funding agencies to provide adequate funding for meta-research in the topic. At the same time, the funding agencies should demand greater transparency (including preregistration).

Finally, the whole system of academic research is currently permeated by perverse incentives (from governments through funding agencies, to institutions and thence to individuals) through the academic reward system that need to be removed or at least diminished. Governments want their funding agencies to support top quality research and for their universities to be highly-ranked in World league tables; universities respond accordingly, passing on this pressure to their faculty and
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researchers; and the academic reward system is based on producing scientific papers and similar outputs which provides the basis for tenure and promotion. Ultimately, systemic changes have to be a fundamental part of any changes to promote the responsible conduct of research globally.

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For general reading and, currently, a comprehensive report, see the US National Academies of Science report “Fostering integrity in research” http://www.nap.edu/21896