Paved with good intentions, the road to Scientific Misconduct

S. Karataglidis, University of Johannesburg

Introduction

This is a report from the attendance of the "Combating Scientific Fraud and Research Irregularities Summit 2013," October 23-25, 2013, Sandton.
The presentation will cover the following aspects:

- Identifying misconduct
- Causes of misconduct
- Examples
- Possible strategies to combat

Most of the information/slides are from the first presentation: "Understanding the international trends on scientific misconduct and research irregularities… and some cases" by Rubin Pillay, Daniel White Jordan Professor, Spears School of Business and Center for Health Sciences, Oklahoma, USA.

Definitions

Scientific misconduct is:

- …the violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research
- …the intention or gross negligence leading to fabrication of the scientific message or a false credit or emphasis given to a scientist (DK)
- …the intention[al] distortion of the research process by fabrication of data, text, hypothesis, or methods from another researcher's manuscript form or publication; or distortion of the research process in other ways.“(SW)

Forms of misconduct

- Fabrication invention of data or cases
- Falsification willful distortion of data or results
- Plagiarism copying of ideas, data, or words without attribution (qualitatively different because it does not distort scientific knowledge)
- Misrepresentation inaccurate representation of contribution to research or originality of work
- Bias inability to separate personal, subjective views from experimentally-based factual information
- Inaccuracy errors, mistakes or omissions that may lead to incorrect conclusions
- Mining to find a statistically significant relationship that is then presented as the original target of the study
- Suppression the failure to publish significant findings; selectively publish only when it supports one's expectations
- Violation of ethical standards regarding human and animal experiments
- Image fraud manipulation of images to distort their meaning

Intention to deceive is a key element.

Typology of Research Behaviours (Steneck, 2006)

- Fabrication, falsification, and plagiarism (FFP)
- Questionable research practices (QRP)
  - misrepresentation, inaccuracy, bias
- Responsible conduct of research (RCR)

Ideal behaviour

worst behaviour

QRPs - questionable research practices

- “…actions that violate traditional values of the research enterprise and that may be detrimental to the research process.”
- Misrepresentation,
- Inaccuracy,
- Bias
- Duplication
- salami slicing

Common QRPs in health (some are applicable more generally)

- Not properly disclosing involvement in firms whose products are based on one's own research.
- Failing to present data that contradict one's previous research.
- Changing the design, methodology or results of a study in response to pressure from a funding source.
- ***Pressure from a funding source, research agency.***
- Withholding details of methodology or results in papers or proposals.
- Using inadequate or inappropriate research designs.
- The use of inappropriate controls and treatment periods.
- The improper choice of subjects.
- The improper administration of competing treatments.
- Selective publication of data to support desired conclusions.

Pressure from a funding source, research agency

“Publish or perish” mentality…

Quality or quantity?

Pressure

Misconduct

Mediocrity

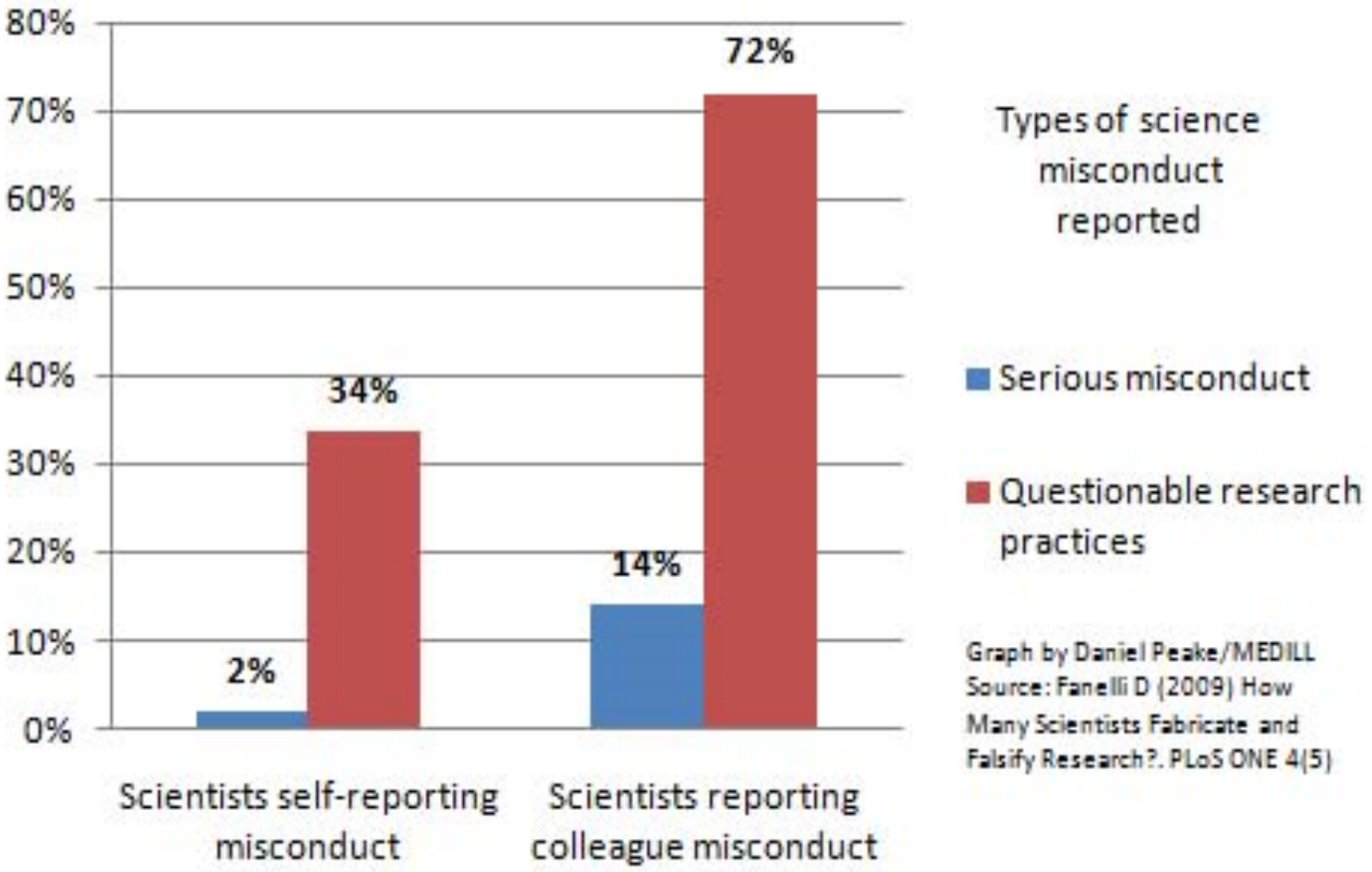
“Ocorrafoo Cobange” of the “Wassee Institute of Medicine” in ASMARA

- John Bohannon, of Science magazine
- Submitted scientific paper with grave errors – “Molecule X from lichen species Y inhibits the growth of cancer cell Z”
- Submitted to 304 open-access publishers
- 157 of the journals had accepted the paper and 98 had rejected it; 20 had stated that the paper was still under review
- Journals published by Elsevier, Wolters Kluwer, and Sage all accepted bogus paper

Levels of Occurrence

- Confirmed vs. actual cases.
- NSF/DHHS: report 20 – 30 cases per year:
  - 2.5M US researchers = 0.001% in total.
  - Underestimate? Confirmed cases not reliable estimators.
  - Reporting resistance – whistleblower hardship.
  - Overestimates came from duplicate reporting and not actually knowing what research misconduct was.
- So, early "Tip of ice berg" or "rare bad apples" estimates poor.
- ORI (USA) 1989 to 2006 -198 confirmed misconduct.
  Office of Research Integrity: www.ori.hhs.gov

Reports of scientific misconduct

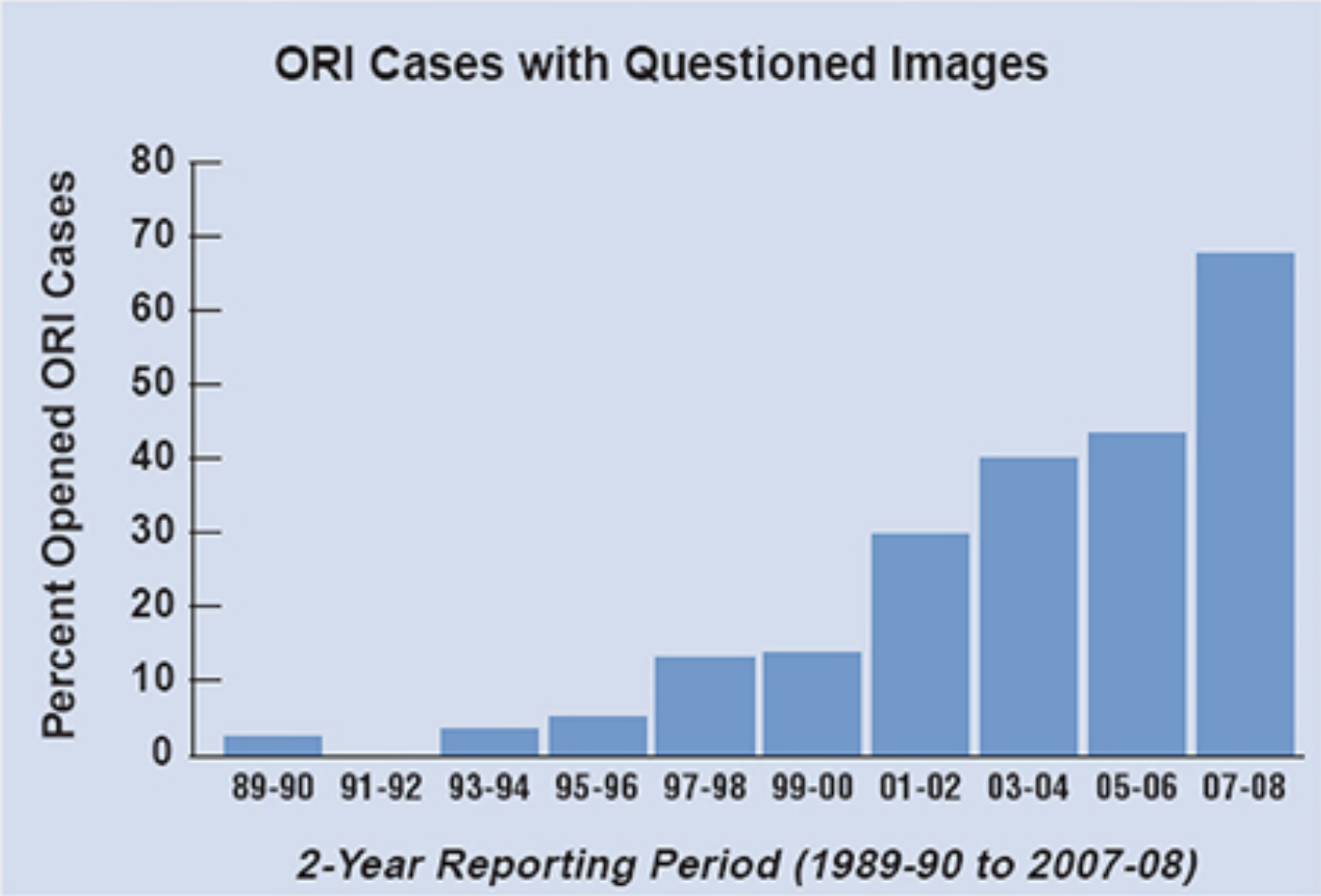


Graph by Daniel Peake/MEDILL
Source: Fanelli D (2009) How Many Scientists Fabricate and Falsify Research?. PLoS ONE 4(5)

Levels of occurence, Serious Misconduct

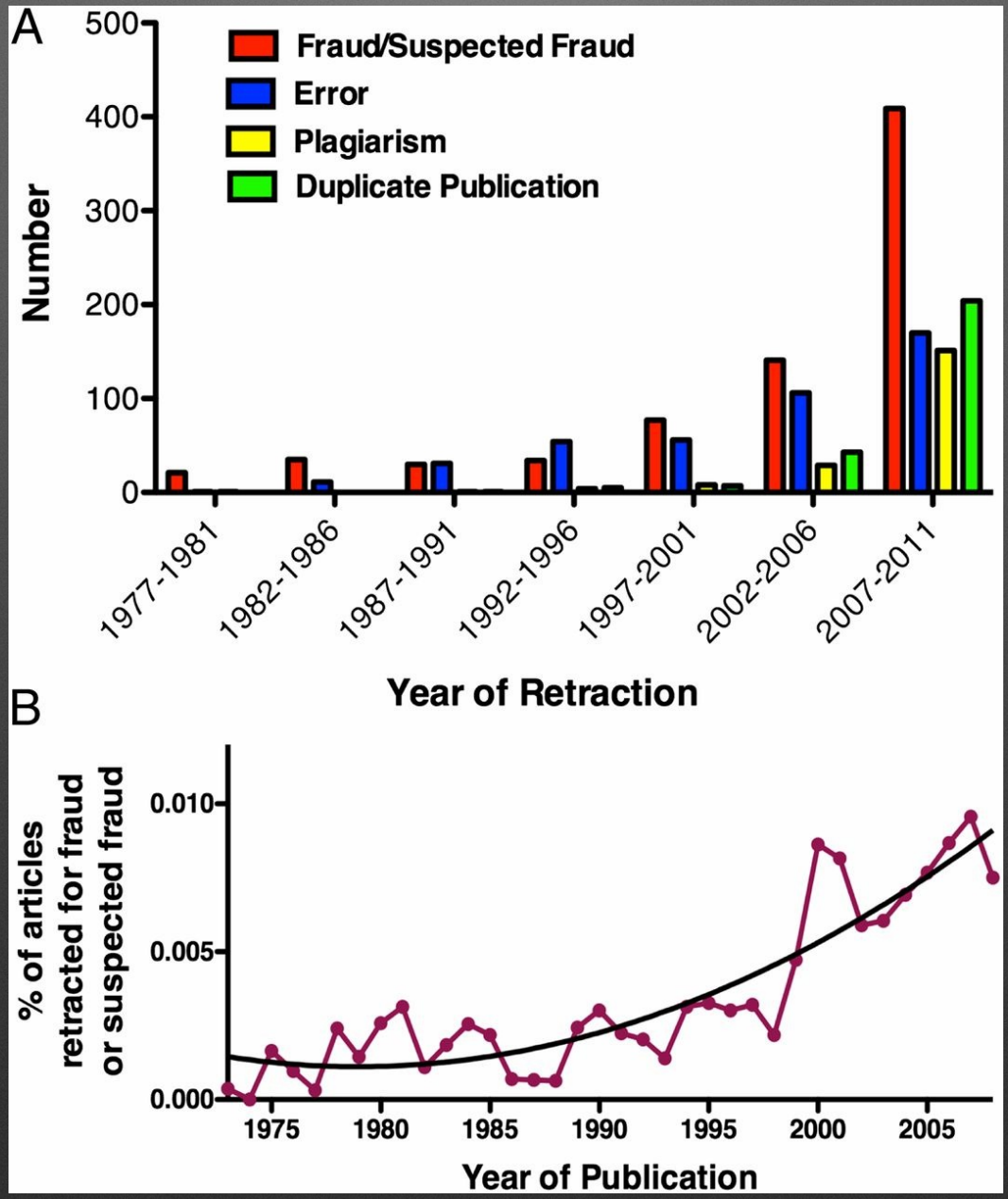
- (Martinson, Nature, 2005)
- Overall 1%
- 0.5% admitted to “falsifying or cooking research data”
- 1% using another’s ideas w/o permission or giving credit
- 5.3% failing to present data that contradicted their own previous research
- 12.8% overlooking use of flawed data
- ISCB survey (2000)-51% aware of at least 1 case; 31% in a project where fraud occurred;13% asked to support FFP
- Clinical trials – 2.7% FFP in study, 0.6% in article (Gardner et al, 2005)
- 1% of images to Journal of Cell Biology improperly manipulated (Rossner, 2004)

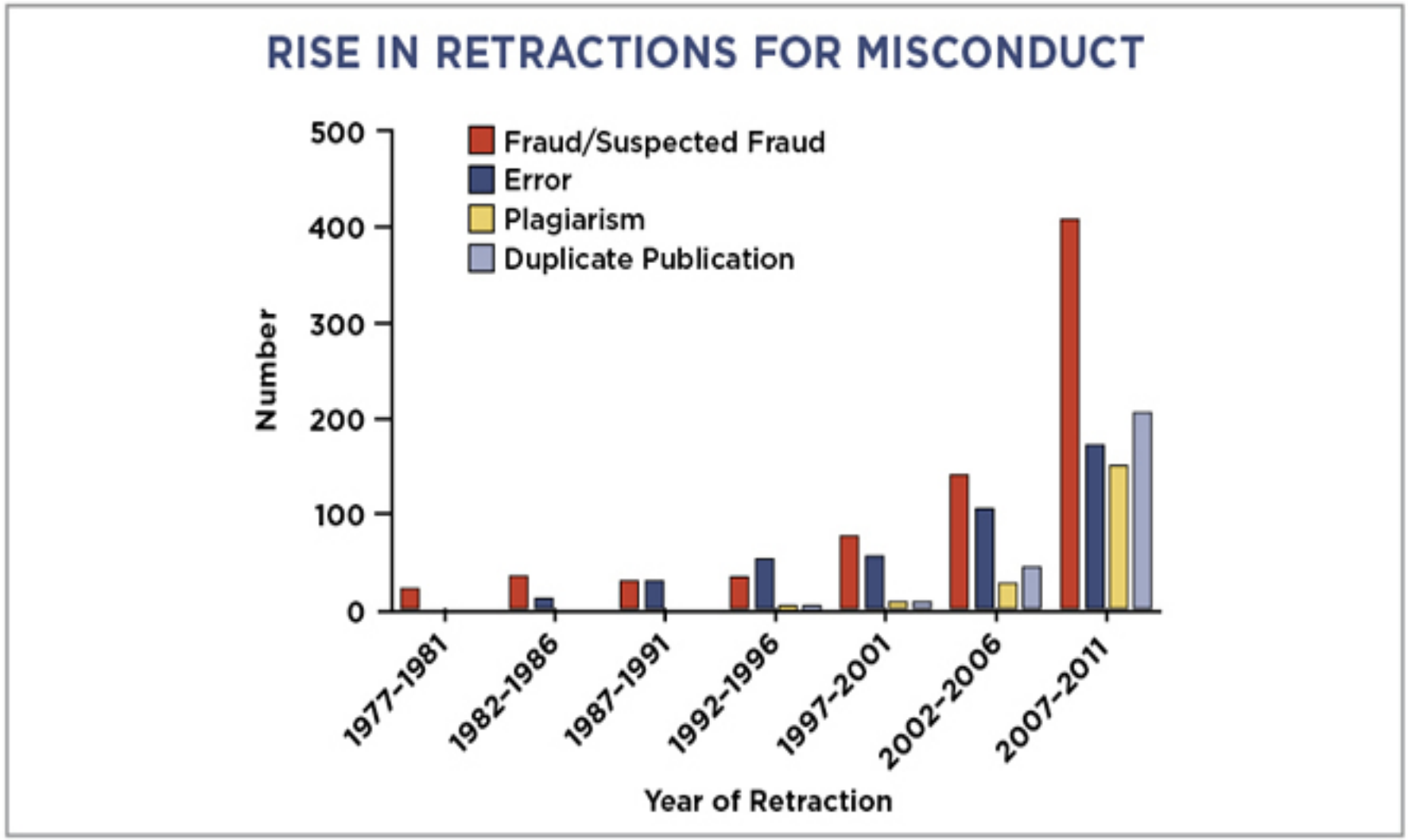
As of 2008, 80% of reported ORI (NIH Office of Research Integrity) cases involved images



Krueger, J., "Incidences of ORI cases involving falsified images," Office of Research Integrity Newsletter, September 2009, Vol. 17 Number 4.

Number of retracted articles for specific causes by year of retraction.





Number of retracted articles for specific causes by year of retraction.

Ferric C. Fang, R. Grant Steen, and Arturo Casadevall, "Misconduct Accounts for the Majority of Retracted Scientific Publications," *Proceedings of the National Academy of Sciences* 109.42 (16 October 2012): 17,028–33. Reprinted with permission from the authors.

Spurious Science

Rising retraction rates suggest that more published findings are unreliable, cannot be replicated or are simply wrong.

Retractions are rising across most fields...

FIELD	RETRACTIONS 2001-05	2006-10
Medicine	87	436
Biology	69	277
Chemistry	5	147
Pharmacology	10	59
Multidisciplinary	41	54
Neuroscience	6	53
Immunology	5	47
Engineering	2	43
Physics	17	35
Materials	4	31

...including at some of the most influential journals...

The top science journals ranked by total citations.

JOURNAL	RETRACTIONS 2001-05	2006-10
Journal of Biological Chemistry	6	20
Proceedings of the National Academy of Sciences of the USA	7	24
Nature	16	13
Science	18	15
Journal of the American Chemical Society	0	6
Physical Review Letters	1	0
New England Journal of Medicine	3	5
Physical Review B-Condensed Matter	7	2
Astrophysical Journal	0	0
Applied Physics Letters	4	5

...while lag time grows between publication and retraction.

Average time, in medicine and biology.*

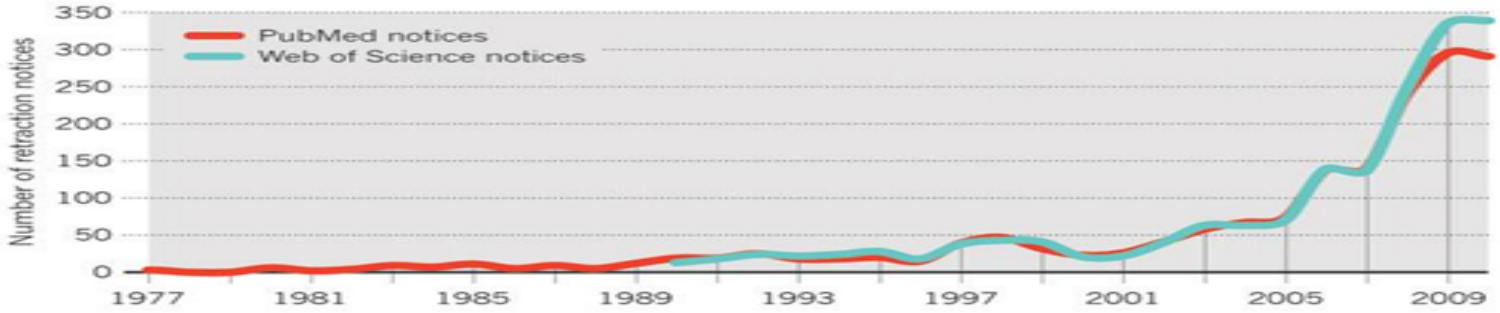
YEAR	RETRACTIONS	MONTHS UNTIL RETRACTION
2000	4	5.25
2001	11	11.27
2002	38	18.61
2003	40	19.38
2004	43	14.33
2005	50	18.44
2006	104	22.15
2007	111	22.39
2008	162	26.96
2009	179	31.62

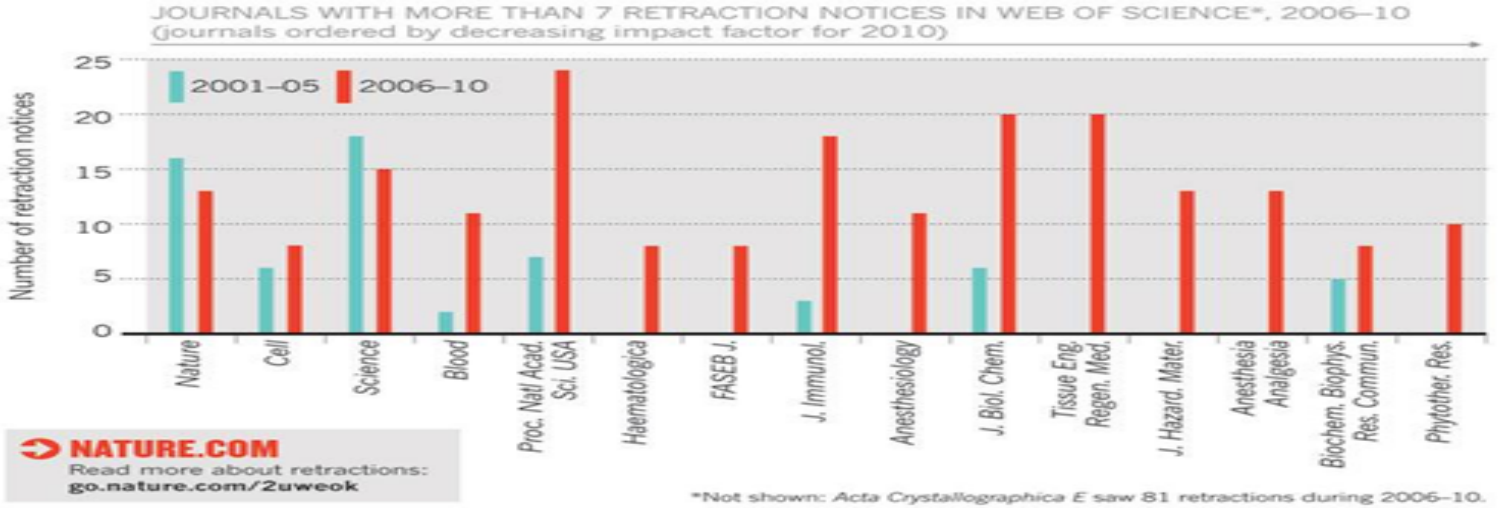
Sources: Thomson Reuters (retractions by field and journal); R. Grant Steen, Journal of Medical Ethics, Dec 2010 (retraction time)

*Based on an analysis of 742 medicine and biology papers retracted from the PubMed database

RISE OF THE RETRACTIONS

In the past decade, the number of retraction notices has shot up 10-fold (**top**), even as the literature has expanded by only 44%. It is likely that only about half of all retractions are for researcher misconduct (**middle**). Higher-impact journals have logged more retraction notices over the past decade, but much of the increase during 2006–10 came from lower-impact journals (**bottom**).



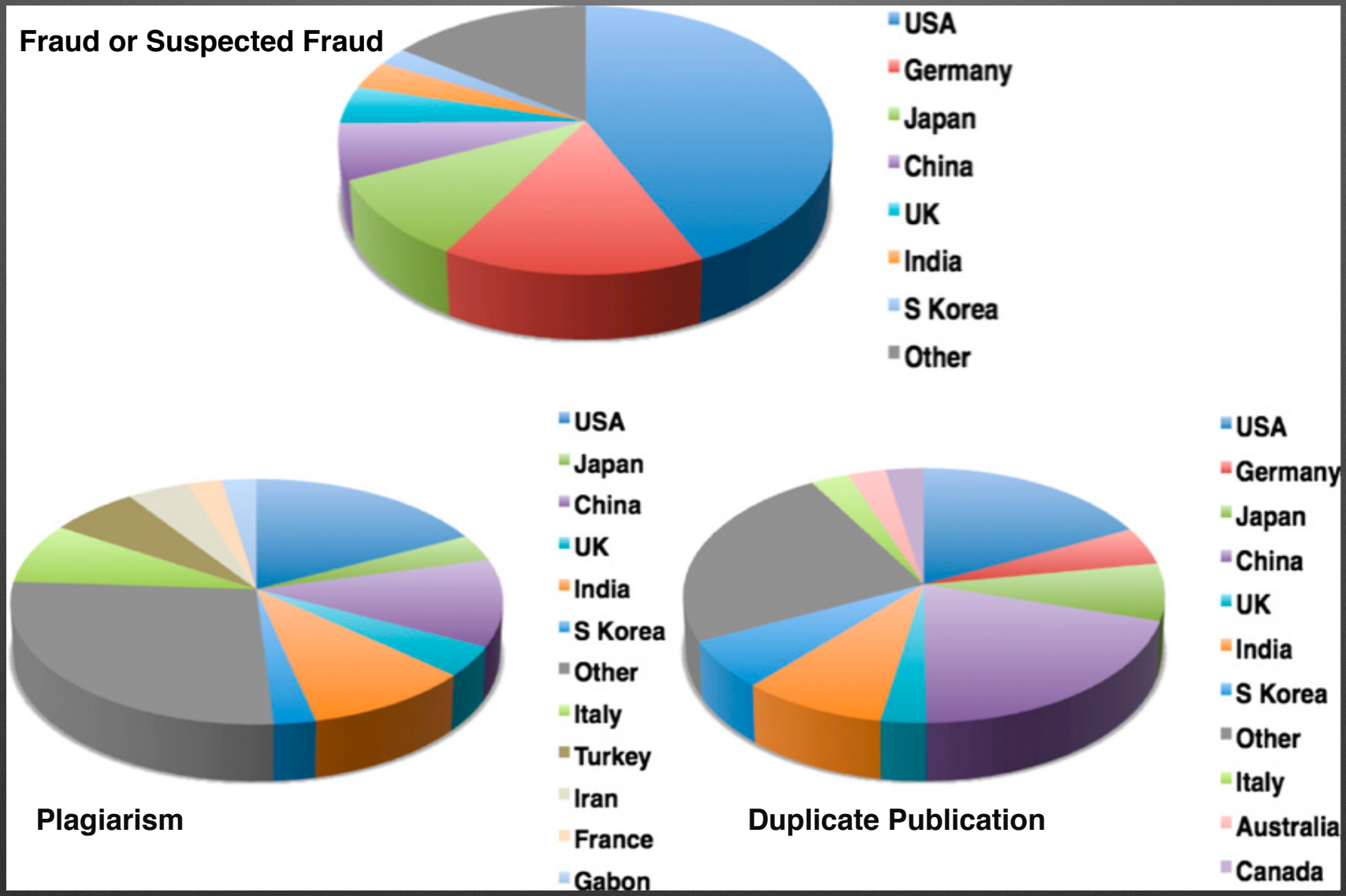


NATURE.COM
Read more about retractions:
go.nature.com/2uweok

*Not shown: *Acta Crystallographica E* saw 81 retractions during 2006–10.

Misconduct, world-wide

- Few data available on misconduct from the developing world.
- Retracted articles were authored in 56 countries (Fang, et al., 2012).
- China described as a “scientific Wild West” (Science, 2006).
- 542 allegations of misconduct and found positive evidence in 60 cases: data falsification (40%), plagiarism (34%) and data fabrication or theft (34%).
- FFP originated in countries with longstanding research traditions.
- Plagiarism and duplicate publication often arise from countries that lack a longstanding research tradition.


Fraud or Suspected Fraud
USA
Germany
Japan
China
UK
India
S Korea
Other
USA
Japan
China
UK
India
S Korea
Other
Italy
Turkey
Iran
France
Gabon
Plagiarism
USA
Germany
Japan
China
UK
India
S Korea
Other
Italy
Australia
Canada
Duplicate Publication

Consequences of Scientific Misconduct

- Vary based on the severity of the fraud, the level of notice it receives, and how long it goes undetected.
- Undermine the reliability of the research record and impacts research agendas.
- Weaken the trust colleagues have in one another and the trust the public has in researchers.
- Waste research funds and other resources; investigation costs; lawsuits and remediation.
- Leads to decisions that cause public and/or personal harm:
  - Wakefield's vaccine-autism link; incidence of measles and mumps increased. (To be discussed.)
  - Steinschneider's infant sleep apnoae-SIDS link.
  - False markets.
- Full impact on the course of research or society is difficult to asses.
- Many of the confirmed cases of FFP revolve around actions undertaken before the work is circulated outside the laboratory.

Questionable research practices…

- QRPs are much more prevalent. They could have a higher impact than actual cases of misconduct.
- This is most noticeable in the health sciences: new drugs, new devices, new protocols… Jessie Gelsinger (U. Pennsylvania, 1999), and Ellen Roche (Johns Hopkins, 2001) DIED; the latter as a result from poor literature reviews…

Case studies

I will discuss several cases from both the health sciences and physical sciences.

Time prevents from looking at all cases available.

Misconduct in Physical Sciences….

Cold Fusion, University of Utah, 1989

- Two electrochemists, Stanley Pons and Martin Fleischman claimed to have discovered the fusion of deuterium nuclei in a paladium cell.
- Results were published in an electrochemistry journal… Publication would have been rejected by the nuclear physics community for incredible sloppiness.
- Repeated attempts to replicate the experiment around the world by physicists (including yours truly) failed.
- Suspected tampering of unsupervised equipment by Pons' nephew.

Element-118

Lawrence Berkeley National Laboratory, USA, 2001

- Reported discovery of element-118 by LBNL in Physical Review Letters, August 2001, by group including Dr Victor Ninov (formerly of GSI, Germany).
- Attempts to replicate the discovery at GSI and RIKEN (Japan) failed.
- Results from programme “Goosy” of Ninov’s were not scrutinised.
- Ninov did not allow others to operate the programme. Reverse-engineering of executable code showed results were “hard-wired” into the programme.
- Examples of this fraud were subsequently noticed in previous analyses, also by Ninov, of GSI experiments.
- Paper was retracted. LBNL facility almost shut down as a result. Ninov was fired, others suspended pending investigation.

In the Healthe Sciences: Andrew Wakefield (1998)

- Author of paper in Lancet claiming link between vaccinations and autism.
- Investigation lasted more than 2 years, ending May 2010, concluding he was guilty of conflict of interest, both as recipient of money from lawyer looking for that link, and regarding the company he set up to conduct tests.
- Highly selective reporting of data.
- Unethical dealings with children.
- Result: Now seeing re-emergence and epidemics of previously controlled diseases. (Measles, mumps, polio…)

Werner Bezwoda: high-dose chemotherapy

The only South African case of note: Bezwoda in the 1980's and 1990's claimed that high-dose chemotherapy could be used for treatment of breast cancer. This proved to be false. The problems:

- Records of only 62 of the 154 patients quoted in the study were kept.
- Many records were handwritten and unsigned.
- Of those, only 27 met any standard of the trial.
- No permission for the study was granted by the Wits Ethics Committee.
- No patients were on the standard chemotherapy treatment for comparison.

James Wilson (1999)

This is the case involving Jesse Gelsinger…

- Conducted clinical trial using gene therapy to combat OTC deficiency at University of Pennsylvania.
- Wilson was President and major shareholder (30%) of Genova, the company developing the product undergoing the trial.
- Failed to report adverse reaction to therapy in animal tests, including fatalities.

Jon Sudbo (1993-2005)

- Research into prevention of oral cancer at Norwegian Radium Hospital Oslo, Norway.
- 2005 paper in Lancet drew immediate criticism for including 900 patients from a database that did **not** exist at time of citation.
- Also finding that second figure in a 2001 paper was an enlargement of the first.
- 15 papers plus the PhD were retracted.

Hwang Wu-Sook (2004)

- Two papers in Science reporting production of human embryonic stem cells via Somatic Cell Nuclear Transfer.
- Data were fabricated and falsified.
- Also obtained human cells by unethical means.
- Suspended prison term for embezzlement.

Possible solutions

- **National, Professional, Organizational and Individual** systems to provide leadership on preventing, recognizing, investigating, correcting, and punishing wrongdoing in science.
- More emphasis on the quality of publications rather than quantity.
- *Less (?)* emphasis on impact measures when rating journals. Not all high-impact journals guarantee quality, but instead may be an indication of reach.
- Fostering a cooperative and collaborative culture in the research community developing more stable and sustainable sources of research funding.
- Possible new indices: Retraction (number per 1000 articles) and Transparency (how well a journal controls its refereeing processes).

Conclusions

- Scientific misconduct, while not endemic, is widespread.
- Pressures to perform and publish in quantity lead to misconduct.
- Such pressures also lead to mediocrity.
- Consequences of misconduct are difficult to assess:
  - Retractions of publications;
  - Firing of staff/loss of qualifications;
  - Epidemics;
  - Fatalities.

The South African context.

There has only been one major case of misconduct in South Africa. But, we must be careful…

- The issue of quality versus quantity results from different metrics used by the DoHET (subsidies) and DST (NRF grants, Ratings).
- DoHET: subsidy based on number of units - weighted number of publications, inversely to number of authors. Strong incentive for (many) single-author papers. Submissions likely to very-low impact journals.
- DST: NRF grants, and especially Ratings, are awarded by recognising collaborative research, and (improving) international profile. Strong incentive for large, collaborative, projects.
- There may be a need for an office in the NRF to review Integrity in Research (ORI?).
- This conflict must be resolved. Other countries count each paper as one paper, regardless of number of authors.