

Toolbox research integrity

2022 | www.nwo-i.nl/wi-toolbox



↓ [About this toolbox](#)

! warning – beware of printing – this toolbox consists of more than 140 pages !

Dilemma Game

Dilemmas for scientists for critical dialogue. What would you do?
Developed by EUR, for individual use, in groups and during lectures and presentations, free, in English

- Game
- To exchange
- Knowledge and behaviour
- Inspire
- Confront

→ [Factsheet](#)

'On being a scientist' (the book)

'On being a scientist' (the book)
The handbook on WI, from the National Academy of Sciences

- A must read
- Knowledge
- To inform

→ [Factsheet](#)

WI@NWO-I

Every year, we pay attention to the current state of affairs with attractive speakers and a lot of discussion

- Meeting
- Knowledge
- To exchange
- Inspire

→ [Factsheet](#)

Science theatre

Challenging theatre performances that touch the heart of science.
About truth, values and truthfulness

- Theater performance
- Confront
- Inspire

→ [Factsheet](#)

SYLLABUS All you wanted to know about WI

Lots of information and articles in a row in this syllabus

- Reference book
- Knowledge
- To inform

→ [Factsheet](#)

Guest experts

These experts are happy to contribute substantively to your workshop or event

- Lecture/presentation
- Knowledge
- To exchange
- Inspire/Confront

→ [Factsheet](#)

'On being a scientist' (the movie)

Many dilemmas are discussed in this film, made in the Netherlands, food for discussion

- Movie (56")
- Inspire
- Confront
- Free

→ [Factsheet](#)

Knowledge building blocks

Don't invent the wheel yourself: TU/e and UT share their course material

- Course material
- Knowledge and behaviour
- To inform

→ [Factsheet](#)

Energizers & starters

Meetings sometimes need some energy (again). These publications (in Dutch) provide you with some inspiration:

- Dirkse-Hulscher S. en Talen A.
Het groot werkvormenboek 1+2
ISBN 978 90 5261 613 1
ISBN 978 90 2440 483 4
- Karreman, M. *Warming-ups & energizers voor groepen, teams en bijeenkomsten*,
ISBN 978 90 5871 123 6

About this toolbox

How and why this toolbox?

With this toolbox we reach out to researchers, support staff, PhD students, management teams, boards and everyone else within NWO-I to talk about, learn from and practice the five principles of scientific research with integrity: honesty, carefulness, transparency, independence, responsibility. The basis is the Dutch Code of Conduct for Research Integrity (2018), which was co-signed by NWO. Within NWO-I, we strive to conduct our research as scientifically as possible and to behave accordingly, even when things get complicated. Integrity is often most difficult in the 'grey areas'. Knowing the code of conduct is then not enough. With the guidelines in this toolbox we can work together to explore and discuss each other's dilemmas and questions.

Prevent damage to the quality and reliability of science

The renewed Dutch code of conduct for research integrity was signed in 2018 by the KNAW, NFWO, TO2, VH, VSNU (including 2022 VNU) and NWO. From this code: Scientific research [...] is a regulated process [...] part methodological and part ethical in nature [...] articulated in a number of guiding principles: fairness, due diligence, transparency, independence, responsibility. If these principles are not leading, this threatens both the quality and the reliability of science. This can lead to direct damage, for example to the environment or patients, and can affect public trust in science and trust between scientists. It is therefore of great importance that the principles of good and honest research practice and the resulting standards for good research practices are clearly formulated and are widely taught, known and applied.

Being able to discuss safely

In addition to knowledge, sufficient motivation and ample opportunity to practice are required in order to acquire skills and behaviour. Each person goes through these steps differently (want > know > can > do¹). Going through this learning circle is only successful when it is safe to do so (for example, practicing without taunting or condemning a superior as a 'reward') and obstacles have been removed as much as possible in terms of motivation, capacity and opportunity². This is the responsibility of both the organisation and the individual scientist.

Questions and information

This toolbox is regularly updated and expanded. Always check the current version online at www.nwo-i.nl/wi-toolbox. Ask your questions to the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl. This toolbox was created with special thanks to Ralph Wijers (UvA) en bureau Van Stel voor teksten.

¹ Learning circle by Kolb

² Michie, S., van Stralen, M.M. & West, R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implementation Sci 6, 42 (2011). <https://doi.org/10.1186/1748-5908-6-42>

Factsheet

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The Dilemma game

As a scientist you are often confronted with dilemmas: can I exactly use the same dataset for multiple articles? Do I have to do it agree that a colleague is the co-author of an article to which he does not made a significant contribution? Erasmus University Rotterdam developed the English-language app The Dilemma game, in order to create an open and to stimulate critical discussion about integrity and professionalism in research. More about this app: <https://www.eur.nl/over-de-eur/beleid-en-reglementen/integriteit/wetenschappelijke-integriteit/dilemma-game>.

- Game
- To exchange
- Knowledge and behaviour
- Inspire
- Confront

What does this mean?

The game consists of dilemmas with four possible ways of acting from which the players can choose. The aim is to discuss and defend these choices. The app can thus support researchers in further developing their moral compass.

How much time does it take?

The Dilemma game has three variants: individual, a group or use during a lecture or meeting. In app form, the game can be played anywhere, alone or together with peers and colleagues, and only requires a few minutes of reading time per presented dilemma. After choosing the answer, the player gains insight into what percentage of the respondents made the same choice. Then the player can read an expert review. Every month a new 'dilemma of the month' is uploaded.

How much is this?

The app can be downloaded for free from an app store. What preparation is needed? No special preparation is needed.

How do you deploy this?

You can organize a discussion about the dilemmas and the four possible choices. The group mode (in rooms) invites you to choose solutions in a group, with a presentation in a plenary session. Do you want to work with scientific integrity in a small group, such as a department or research group? The app is useful for that. Suggestions for using the app: [Dilemma Game App Instructions and Suggestions.pdf](#).

Other comments

Wouter Steenbeek and Wim Bernasco, WI ambassador at NSCR, have experience with using the Dilemma game app in a larger group. They are willing to answer questions about it.

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.

Factsheet

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On being a scientist (the book)

'On Being a Scientist', A Guide to Responsible Conduct in Research, has been the handbook on scientific integrity for many years. The book describes the ethical foundations of scientific practices and some personal and professional issues that researchers face in their work. It applies to all scientific disciplines and to scientists at all stages of their scientific career.

- A must read
- Knowledge
- To inform

What does this mean?

The book includes a number of hypothetical scenarios that serve as a guideline for discussion.

How much time does it take?

The book, in English only, consists of 62 pages.

How much is this?

As a PDF, 'On being a scientist' can be downloaded for free:
<http://nap.edu/12192>

What preparation is needed?

No special preparation is needed.

How do you deploy this?

The book contains a lot of knowledge and practical examples and is a must have for all involved. In addition, it is suitable as a 'framework' for discussing dilemmas in the field of scientific integrity. For example, ask scientists to read the book, or certain parts of it, before a discussion meeting.

Other comments

'On being a scientist' is a 2009 publication of the American The National Academies Press, publisher of books in the field of Sciences, Engineering and Medicine.

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.

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WI@NWO-I

Scientific integrity is a way of life that needs maintenance. That is why NWO-I organizes an attractive webinar once a year on (one of) the five principles of scientific research with integrity: honesty, care, transparency, independence and responsibility. The form of the webinar can vary, but in any case offers room for discussion.

What does this mean?

This webinar is intended to put scientific integrity in the spotlight once a year. It should inspire institutes to keep talking and learning about how scientific integrity is embedded in the hectic scientific practice, in which PhD students and postdocs come and go.

How much time does it take?

A first webinar will be organized in 2022. Announcement will follow in other ways. It takes a maximum of two hours.

How much is this?

There are no costs for participants.

What preparation is needed?

This can differ per webinar. It is possible that participants study a case beforehand.

How do you deploy this?

The webinar can be a refresher, after which an institute can give it its own follow-up.

Other comments

The Communications Team of the NWO-I office also offers support for organizing a webinar within your own institute.

Who do I ask my other questions?

Please note: the first edition of this event has yet to be organised. Do you want to think along or organise it? Please send an email to info-nwoi@nwo.nl.

- Meeting
- Knowledge
- To exchange
- Inspire

Factsheet

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Science theatre

Challenging theatre performances that touch the heart of science. About truth, values and truthfulness within the institution 'the university'. Theatre makers Radio Kootwijk developed an exciting performance Mindlab (www.utwente.nl/mindlab/) at the request of the University of Twente. Later, it was performed for Utrecht University and Eindhoven University of Technology. Het Acteursgenootschap also focuses on science theatre. Besides existing (international) performances, such as [#MeTooAcademia: The Learning Curve](#), they create customised theatre. Sometimes they adapt an existing performance or develop a performance entirely focused on a specific theme.

- Theatre performance (1"15")
- Confront
- Inspire

What does this mean?

Both performances inspire you to think about and discuss with the audience what is important in your daily work, your career and your life - inside and outside the university.

How much time does it take?

Mindlab is a performance of 1.15 hours for a maximum of 150 spectators. You can make your own arrangements about the length with The Actors' society.

How much is this?

A Mindlab performance costs 9,000 euros, with two performances in one day at the same location, the price is 11,500 euros. A customised performance by The Actors Society varies, but take into account approx. 3,900 euro's.

What preparation is needed?

Contact them well in advance: Theatre makers Radio Kootwijk: Daphne Goudsmit, 06 46277587, tmrk.nl, detheaterloods.nl.
Or: Suzanne Spliethoff, managing director, 06 45336816
info@hetacteursgenootschap.nl

How do you deploy this?

As an introduction to a discussion about ethical behaviour in science.

To whom do I address my other questions?

To Léon Ouwerkerk of CWI (CWI had a performance on 13-9-2022), or to the Communication team of the NWO-I office via e-mail to info-nwoi@nwo.nl.

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SYLLABUS

All you wanted to know

In deze syllabus is veel informatie gebundeld rondom het streven naar wetenschappelijke integriteit. Naast de complete inhoud van het boek *On being a scientist* (Engels) bevat deze bundel (pdf) de weergave van het beleid van NWO, de [Dutch code of conduct for scientific integrity](#) (2018), the [Complaints Procedure for Scientific Integrity NWO-I Institutes](#) applicable to NWO-I and information about the [Scientific Integrity Hotline](#) and the [Scientific Integrity Confidential Advisers](#).

What does this mean?

The syllabus contains a lot of relevant information in one PDF. Complete the PDF with information that is specific to your institute. View the table of contents here, including xxxxxxxx

How much time does it take?

The syllabus serves as a reference.

How much is this?

NWO-I provides regular updates.

What preparation is needed?

No special preparation is needed.

How do you deploy this?

Institutes can, for example, issue these to new colleagues, in order to inform them of the code of conduct and the Complaints Procedure for NWO-I institutes. Other comments NWO-I emphasizes that the syllabus is not the solution for everything: scientific integrity is a way of life, about which the discussion must take place regularly, within an institute or groups of researchers. All suggestions for improvement and addition are welcome!

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.

- Reference book
- Knowledge
- To inform

SYLLABUS

All you wanted to know

Contents syllabus:

- Netherlands **Code of Conduct** for Research Integrity 2018
- **Confidential advisors** scientific integrity
- **Complaints procedure** research integrity NWO Institutes
- Online **training** research integrity

- **Book *On Being A Scientist* - 83 pages**
- Published **articles** in the staff newsletter *Inside NWO-I*:
 - “The code of conduct is in place, now we need awareness about scientific integrity” - interview with NSCR director a.i. Peter van der Laan about scientific integrity (june 2021)
 - Various reports of workshops at the NWO institutes (Nov 2021)
 - Introducing the confidential advisers scientific integrity Thom Palstra and Tanja Kulkens (Dec 2021)



Netherlands Code of Conduct for Research Integrity

2018

Netherlands Code of Conduct for Research Integrity

2018



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Netherlands Code of Conduct for Research Integrity (2018).



This is a translated version of the “Nederlandse Gedragscodewetenschappelijke Integriteit (2018)”. Every effort has been made to ensure its conformity with the original Dutch document. In case of disputes, the authoritative version is the original Dutch document.

The following link ensures that this Code will remain discoverable via the Internet in the long term: <https://doi.org/10.17026/dans-2cj-nvwu>
The Dutch version of this code can be found via this link.

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Abbreviations used in this Code of Conduct

- **ALLEA:** All European Academies
<http://www.allea.org/>
- **KNAW:** Royal Netherlands Academy of Arts and Sciences
<https://www.knaw.nl/en>
- **NFU:** Netherlands Federation of University Medical Centres
<http://www.nfu.nl/english>
- **NWO:** Netherlands Organisation for Scientific Research
<https://www.nwo.nl/en>
- **OECD:** Organisation for Economic Co-operation and Development
<http://www.oecd.org/>
- **TO2 federation:** Associated Applied Research Institutes (*Deltares, MARIN, NLR, TNO, WR*)
<https://www.to2-federatie.nl>
- **VSNU:** Association of Universities in the Netherlands
http://www.vsnu.nl/en_GB

Preamble

In the words of the *European Code of Conduct for Research Integrity* (revised version, 2017, hereafter referred to as ‘the ALLEA Code’), research is ‘the quest for knowledge obtained through systematic study and thinking, observation and experimentation’. Although disciplines may differ in approach and method, they share a motivation to increase and to spread our understanding of ourselves and the world in which we live. In our modern knowledge society, scientific and scholarly research has thereby acquired an indispensable role. In providing knowledge and understanding of all aspects of reality, science and scholarship also provide the building blocks for political decision-making and the stimulus for societal development and economic growth. Increasingly, the sciences and the humanities are subject to more, and better articulated, demands on the part of politics and society.

If scientific and scholarly research is to perform this role properly, research integrity is essential. This holds true for all disciplines. Research in the sciences and the humanities derives its status from the fact that it is a process governed by standards. That normativity is partly methodological and partly ethical in nature, and can be expressed in terms of a number of guiding principles: *honesty, scrupulousness, transparency, independence and responsibility*. Researchers who are not guided by these principles risk harming both the quality and the trustworthiness of research. This can take the form of direct damage, for example to the environment or to patients, and can undermine public trust in scientific and scholarly research as well as mutual trust between individual researchers. It is therefore vital that the principles of research integrity and the ensuing guidelines for good research practices be defined with the greatest possible clarity and be acknowledged and applied as widely as possible. That is the aim of this Code of Conduct, which plays a threefold role.

- I For researchers, trainee researchers and students, it provides an educational and normative framework (chapters 2 and 3) that they are expected to internalize and be guided by in their research activities.

- II For the executive boards of research institutions and for research integrity committees, it provides a frame of reference when assessing alleged research misconduct (chapters 3 and 5).
- III For institutions, it sets out a number of duties of care (chapter 4).

Particularly with regard to the first of these roles, the Code provides both (a) methodological standards (as to what a good researcher does) and (b) ethical standards (as to what a researcher with integrity does). These are also important for the assessment of alleged research misconduct; after all, the boundary between (a) and (b) is not always easy to define. Cases of substantial, systematic and deliberate non-compliance with the methodological standards, in particular, are also objectionable from an ethical perspective. When it amounts to gross negligence, a questionable research practice or ‘sloppy science’ is more than a matter of mere error or carelessness but rather something that can undermine the very integrity of research. The assessment framework in 5.2 takes this into account.

Since 2004, when the first version of the Netherlands Code of Conduct for Academic Practice was published, there has been a great deal of attention devoted, both in the Netherlands and internationally, to the importance of research integrity and to the potential contribution of codes of conduct. Recently, this has been the occasion for minor changes. However, the situation has now evolved to the point where a new text is needed, one that has clearer standards and greater internal coherence, that accords with international developments and that covers applied, fundamental and practice-oriented research alike.¹ The decision was therefore made to conduct a full review.

Research in the sciences and the humanities will continue to develop in the way it is conducted and organized, as well as in the way it is embedded in society. This, in turn, will lead to evolving views on good research practices. From time to time, the standards for good research practices and the related duties of care must be reviewed and the Code updated. Some areas of research practices are subject to change; for

1. See the Report submitted by the committee reviewing the Code of Conduct for Academic Practice in 2016 to the Association of Universities in the Netherlands (VSNU), the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO) and the Netherlands Federation of University Medical Centres (NFU): [http://www.vsnul.nl/files/documenten/Domeinen/Onderzoek/Adviesrapport Commissie Verkenning Herziening Gedragscode Wetenschapsbeoefening 2016.pdf](http://www.vsnul.nl/files/documenten/Domeinen/Onderzoek/Adviesrapport%20Commissie%20Verkenning%20Herziening%20Gedragscode%20Wetenschapsbeoefening%202016.pdf)

example, the growing importance of the way data is used and managed and the developments in the area of open science. It is to be expected that these and other advances will require additions and adjustments to the Code in future.

This document is a Code of Conduct for researchers and institutions in the Netherlands, but also respects the scope of international framework documents² such as the *Singapore Statement on Research Integrity* (2010),³ the OECD's *Best Practices for Ensuring Scientific Integrity and Preventing Misconduct* (2007)⁴ and ALLEA's recently revised *European Code of Conduct for Research Integrity* (2017).⁵ On certain points, the Code presented here offers more specifics and details than the ALLEA code.

Chapter 1 of this Code addresses its scope: to what activities does it apply and who is bound by it? Then, in line with the ALLEA code and comparable documents from many other countries, it covers the following areas:

- Chapter 2 defines five principles of integrity that underlie good research practices.
- Chapter 3 distils these principles into 61 standards for good practices in the respective phases of the research process. Good research requires adherence to these standards throughout that process.
- Chapter 4 formulates institutions' duties of care: they must ensure a working environment that promotes and guarantees good research practices.
- Chapter 5 delineates those cases in which non-compliance with the standards in chapter 3 may constitute research misconduct and a sanction can be imposed: only in serious cases. But even in less serious ones it may be necessary for the institution to take corrective, and possibly also preventive, measures.

The parties primarily responsible for good research are the researchers themselves, their supervisors and the institutions where they work. That said, they also have to deal with the way in which scientific and scholarly research is organized and financed in the Netherlands,

within the context of the European Union. Other parties within this system – such as the funders of research (including the government), publishers, journal editors and societal partners – can either facilitate or hinder good research that meets standards of research integrity. Although, as a rule, these parties will not commit to this Code, and in some cases have their own codes or regulations,⁶ they should nevertheless – at the very least – be guided by the principles of this Code.

2. An even broader framework is provided by the recently revised UNESCO Recommendation on Science and Scientific Researchers, available at: http://portal.unesco.org/en/ev.php-URL_ID=49455&URL_DO=DO_TOPIC&URL_SECTION=201.html

3. Available at: <http://wcrif.org/guidance/singapore-statement>.

4. Available at: <https://www.oecd.org/sti/sci-tech/40188303.pdf>

5. Available at: <http://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf>

6. Many journals and publishers have committed to the guidelines of the Committee on Publication Ethics (COPE), available at: <https://publicationethics.org/resources/guidelines>.

1. Scope and transitional provisions

1. Scope and transitional provisions

1.1 To which activities does this Code apply?

1. This Code covers scientific and scholarly research in the broadest sense, as conducted at institutions that adopt it. This encompasses both publicly and privately funded research, be that fundamental, applied or practice-oriented.
2. ‘Research’ refers to all activities connected to the practice of research – applying for funding, designing and conducting research, engaging in assessment and peer review, serving as an expert and documenting, reporting and publicizing research.
3. The principles and standards of this Code also apply to popular scientific publications, teaching materials and advice provided by researchers, insofar as this can reasonably be required.
4. There are other forms of integrity besides research integrity. The researcher must treat subordinates, students and colleagues with respect, for example, and must refrain from committing fraud with expense statements. Insofar as these forms of integrity are not directly related to the research practice, they fall outside the scope of this Code.⁷ The boundary is not always clearly defined, however, so this Code also includes some ‘borderline’ cases.⁸

1.2 Which institutions are bound by this Code?

5. This Code is binding by virtue of self-regulation, and hence binding on those institutions that adopt it.
6. This Code has been adopted by the Royal Netherlands Academy of Arts and Sciences (KNAW), the Netherlands Federation of University Medical

Centres (NFU), the Netherlands Organisation for Scientific Research (NWO), Associated Applied Research Institutes (TO2 federation), the Netherlands Association of Universities of Applied Sciences and the Association of Universities in the Netherlands (VSNU). These organizations ensure that the institutes, university medical centres, universities of applied sciences and research universities they represent or oversee also adopt this Code.

7. Other institutions, including private enterprises, can also adopt this Code.
8. Joint research with other institutions (including private ones) that have not adopted this or a comparable Code should only take place if there is sufficient confidence that your own part of the research can be conducted in compliance with this Code and the joint research results meet generally accepted principles of integrity in research.

1.3 To whom does this Code apply?

9. Within the institutions that have adopted this Code, chapters 2 and 3 apply first and foremost to:
 - individual researchers, including PhD students (whether or not they are employed as such by their university) and visiting researchers, part-time researchers or external professionals insofar as they participate in research by or at the institution or disclose their research in its name;
 - supervisors, principal investigators, research directors and managers insofar as they help determine the design and conduct of research.

7. But they do possibly fall under other integrity codes and/or under statutory regulations.

8. For example, and in line with the ALLEA code, standard 61 in chapter 3 and duty of care 5 in chapter 4.

10. Chapters 2 and 3 also apply to work of other parties involved in research, such as support staff, students or participating citizens, although only the researchers, principal investigators or research directors on whose instructions or under whose responsibility they work are personally accountable for non-compliance with the standards in this Code.
11. Within an educational setting, this Code is meaningful as an object of study and in training courses. Scientific and scholarly research by students therefore falls within its normative framework (chapters 2 and 3). As long as that research is conducted only in an educational context and does not result in publications other than a published thesis, however, non-compliance with the standards of this Code cannot result in a complaints procedure as described in section 5.4 or in imposing sanctions as described in section 5.3.⁹
12. Chapter 4 focuses mainly upon the institutions themselves and the officers employed there in a managerial or executive capacity. One of the duties of those institutions and officers is ensuring that researchers comply with the standards in chapter 3.

1.4 Relationship with other regulations

13. This Code contains general standards for all disciplines in the sciences and humanities and for the institutions adopting it. These standards may be specified or supplemented in writing for each discipline or institution, but never weakened.
14. In some areas that overlap with or are related to research integrity, statutory regulations and codes of conduct are in effect that set requirements for researchers. See the Appendix for a brief overview of these. Failure to comply with such a regulation or code of conduct will in some cases mean that the researcher has also failed to comply with a standard from chapter 3 of this Code. If that is the case, it could result not only in a sanction under that statutory regulations or code of conduct but also in a measure or sanction as referred to in section 5.3.
15. Where application of this Code conflicts with a statutory regulation, the latter prevails.

9. Work by students falls under other regulations, such as the Education and Examination Regulations of their degree programme.

1.5 Date of entry into force and transitional provisions

16. At those institutions adopting it on or before 1 September 2018, this Code enters into force on 1 October 2018.
17. At institutions adopting it after 1 September 2018, this Code enters into force at a time to be determined by the individual institution.
18. Chapters 2, 3 and 5 of this Code apply to:
 - a. research started after this Code has entered into force; and,
 - b. research activities started after this Code has entered into force, as part of previously initiated research.
19. The Netherlands Code of Conduct for Academic Practice (2014 revision) is revoked, except in respect of:
 - a. research completed before this Code entered into force; and,
 - b. research activities initiated before this Code entered into force and not yet completed when it did so.
20. An institution may, in a plan of action established prior to this Code taking effect, determine that one or more of its duties of care as set out in chapter 4 will enter into force at a later date. The plan of action shall mention this date, which may differ per duty.

2. Principles

2. Principles

Principles are the basis of integrity in research. They should guide individual researchers as well as other parties involved in research, such as the institutions where it is conducted, publishers, scientific editors, funding bodies and scientific and scholarly societies – all of which, given their role and interest in responsible research practices, may be expected to foster integrity.

This Code is based on the following five, widely supported principles.¹⁰ In each case an explanation, with examples, is provided in italics detailing their impact on the practice of research. As such, these explanations link the principles with the standards presented in chapter 3.

1. Honesty

Honesty means, among other things, reporting the research process accurately, taking alternative opinions and counterarguments seriously, being open about margins of uncertainty, refraining from making unfounded claims, refraining from fabricating or falsifying data or sources and refraining from presenting results more favourably or unfavourably than they actually are.

2. Scrupulousness

Scrupulousness means, among other things, using methods that are scientific or scholarly and exercising the best possible care in designing, undertaking, reporting and disseminating research.

3. Transparency

Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external

stakeholders. If parts of the research or data are not to be made public, the researcher must provide a good account of why this is not possible. It must be evident, at least to peers, how the research was conducted and what the various phases of the research process were. At the very least, this means that the line of reasoning must be clear and that the steps in the research process must be verifiable.

4. Independence

Independence means, among other things, not allowing the choice of method, the assessment of data, the weight attributed to alternative statements or the assessment of others' research or research proposals to be guided by non-scientific or non-scholarly considerations (e.g., those of a commercial or political nature). In this sense, independence also includes impartiality. Independence is required at all times in the design, conduct and reporting of research, although not necessarily in the choice of research topic and research question.

5. Responsibility

Responsibility means, among other things, acknowledging the fact that a researcher does not operate in isolation and hence taking into consideration – within reasonable limits – the legitimate interests of human and animal test subjects, as well as those of commissioning parties, funding bodies and the environment. Responsibility also means conducting research that is scientifically and/or societally relevant.

Principles can be regarded as 'virtues' of a good researcher, guiding them towards the right choices in all kinds of circumstances. The most important of these are specified in chapter 3, in the form of standards. By their very nature, however, principles are less subject to change than the standards they give rise to, which

10. For a justification of the choice for these particular five principles, in part against the background of common international practice, see the report submitted by the committee reviewing the Code of Conduct for Academic Practice in 2016 to the Association of Universities in the Netherlands (VSNU), the Royal Netherlands Academy of Arts and Sciences (KNAW) the Netherlands Organisation for Scientific Research (NWO) and the Netherlands Federation of University Medical Centres (NFU): [http://www.vsnul.nl/files/documenten/Domeinen/Onderzoek/Adviesrapport Commissie Verkenning Herziening Gedragscode Wetenschapsbeoefening 2016.pdf](http://www.vsnul.nl/files/documenten/Domeinen/Onderzoek/Adviesrapport%20Commissie%20Verkenning%20Herziening%20Gedragscode%20Wetenschapsbeoefening%202016.pdf)

sometimes need to be adapted or extended as research practices change. All such revisions must remain true to the principles underlying them.

Principles are also guiding factors in cases not covered by the standards described in chapter 3. In such cases, even if an action is in conflict with a principle, as long as it violates none of the standards itemized in chapter 3 nor any additional standard established by a discipline or institution, then sanctions as mentioned in chapter 5 will not be imposed.

Principles may sometimes clash. On occasion, for example, responsibility towards a commissioning party or the need to safeguard public security restricts the extent to which a researcher can be transparent. In such cases, it will be necessary to determine which principles should be given priority. Where possible and necessary, these considerations have already been taken into account in drafting the standards listed in chapter 3.

3. Standards for good research practices

3. Standards for good research practices

3.1 Introduction

In this chapter, the principles described above are further elaborated into more specific standards for good research practices. These set out what researchers must take into consideration in their work, individually and as a team. They are for the most part presented separately for each individual phase of the research process: design, conduct, reporting, assessment and peer review and communication. The chapter concludes, in 3.7, with a number of standards applicable to all phases. In their elaboration and application, the differences between fundamental, applied and practice-oriented research may be relevant.

The standards included in this chapter are *general* ones. They may be specified or supplemented in writing, depending upon the discipline or institution, but not weakened.

3.2 Design

1. Consider the interests of science and scholarship and/or society when determining the subject and structure of your research.
2. Conduct research that can be of scientific, scholarly and/or societal relevance.
3. Do not make unsubstantiated claims about potential results.
4. Take into account the latest scientific and scholarly insights.
5. Make sure that your research design can answer the research question.
6. Ensure that the methods you employ are well justified.
7. If the research is conducted on commission and/or funded by third parties, always specify who the commissioning party and/or funding body is.
8. Be open about the role of external stakeholders and possible conflicts of interest.¹¹
9. In research with external partners, make clear written agreements about research integrity and related matters such as intellectual property rights.
10. As necessary, describe how the collected research data are organized and classified so that they can be verified and reused.
11. As far as possible, make research findings and research data public subsequent to completion of the research. If this is not possible, establish valid reasons¹² for their non-disclosure
12.
 - a. In the event of an investigation into alleged research misconduct, make all relevant research and data available for verification subject to the confidentiality safeguards established by the board of the institution.
 - b. In highly exceptional cases, there may be compelling reasons for components of the research, including data, not to be disclosed to an investigation into alleged research misconduct. Such cases must be recorded and the consent of the board of the institution must be obtained prior to using the components and/or data in question in the scientific or scholarly research. They must also be mentioned in any results published.
13. Ensure that the required permissions are obtained and that, where necessary, an ethical review is conducted.
14. Accept only research assignments that can be undertaken in accordance with the standards in this Code.
15. Enter into joint research with a partner not affiliated with an institution which has adopted this or a comparable Code only if there is sufficient confidence that your own part of the research can be conducted in compliance with this Code and the joint research results meet generally accepted principles of integrity in research.

11. By, for instance, adopting a Declaration of Scientific Independence as recommended in the KNAW report *Wetenschap op bestelling* ("Science to Order", 2005), p. 46.

12. Valid reasons, including confidentiality, can be found in: Council of the European Union, Outcome of Proceedings: The transition towards an Open Science system, paragraph 14 (Brussels, 27/05/2016, 9526/16, via: data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf).

3.3 Conduct

16. Conduct your research accurately and with precision.
17. Employ research methods that are scientific and/or scholarly.
18. Make sure that the choice of research methods, data analysis, assessment of results and consideration of possible explanations is not determined by non-scientific or non-scholarly (e.g. commercial or political) interests, arguments or preferences.
19. Do not fabricate data or research results and do not report fabricated material as if it were fact.
20. Do justice to all research results obtained.
21. Do not remove or change results without explicit and proper justification. Do not add fabricated data during the data analysis.
22. Ensure that sources are verifiable.
23. Describe the data collected for and/or used in your research honestly, scrupulously and as transparently as possible.
24. Manage the collected data carefully and store both the raw and processed versions for a period appropriate for the discipline and methodology at issue.
25. Contribute, where appropriate, towards making data findable, accessible, interoperable and reusable in accordance with the FAIR principles.¹³
26. Take into consideration the interests of any humans and animals involved, including test subjects, as well as any risks to the researchers and the environment, while always observing the relevant statutory regulations and codes of conduct.¹⁴
27. Keep your own level of expertise up to date.
28. Take on only those tasks that fall within your area of expertise.
29. Do justice to everyone who contributed to the research and to obtaining and/or processing the data.
30. Ensure a fair allocation and ordering of authorship, in line with the standards applicable within the discipline(s) concerned.
31. All authors must have made a genuine intellectual contribution to at least one of the following elements: the design of the research, the acquisition of data, its analysis or the interpretation of findings.
32. All authors must have approved the final version of the research product.
33. All authors are fully responsible for the content of the research product, unless otherwise stated.
34. Present sources, data and arguments in a scrupulous way.
35. Be transparent about the method and working procedure followed and record them where relevant in research protocols, logs, lab journals or reports. The line of reasoning must be clear and the steps in the research process must be verifiable. This usually means that the research must be described in sufficient detail for it to be possible to replicate the data collection and its analysis.
36. Be explicit about any relevant unreported data that has been collected in accordance with the research design and could support conclusions different from those reported.
37. Be clear about results and conclusions, as well as their scope.
38. Be explicit about uncertainties and contraindications, and do not draw unsubstantiated conclusions.
39. Be explicit about serious alternative insights that could be relevant to the interpretation of the data and the research results.
40. When making use of other people's ideas, procedures, results and text, do justice to the research involved and cite the source accurately.
41. Avoid unnecessary reuse of previously published texts of which you were the author or co-author.
 - a. Be transparent about reuse by citing the original publication.
 - b. Such self-citation is not necessary for reuse on a small scale or of introductory passages and descriptions of the method applied.¹⁵

3.4 Reporting results

13. See the GoFair website: <https://www.go-fair.org/fair-principles/>

14. See the Appendix for an overview of the most relevant statutory regulations in this context.

15. See KNAW, *Correct Citeren* ("Correct citation practice", 2014): <https://www.knaw.nl/en/news/publications/correct-citation-practice>.

42. Always provide references when reusing research material that can be used for meta-analysis or the analysis of pooled data.
43. Avoid unnecessary references and do not make the bibliography unnecessarily long.
44. Be open and complete about the role of external stakeholders, commissioning parties, funding bodies, possible conflicts of interest and relevant ancillary activities.
45. As far as possible, make research findings and research data public subsequent to completion of the research. If this is not possible, establish the valid reasons¹⁶ for this.

3.5 Assessment and peer review

46. Be honest and scrupulous as an assessor or peer reviewer, and explain your assessment.
47. Do not use information acquired in the context of an assessment without explicit consent.
48. Do not use the system of peer review to generate additional citations for no apparent reason, with the aim of increasing your own or other people's citation scores ('citation pushing').
49. Refrain from making an assessment if any doubts could arise regarding your independence (for example, because of possible commercial or financial interests).
50. Refrain from making an assessment outside your area of expertise, or do so only in general terms.
51. Be generous in cooperating with internal and external reviews of your own research.
52. Do not establish a journal that does not apply the required standards of quality to its publications, and do not cooperate with any such journal.

3.6 Communication

53. Be honest in public communication and clear about the limitations of the research and your own expertise. Only communicate to the general public about the research results if there is sufficient certainty about them.
54. Be open and honest about your role in the public debate and about the nature and status of your participation in it.
55. Be open and honest about potential conflicts of interest.

3.7 Standards that are applicable to all phases of research

56. As a supervisor, principal investigator, research director or manager, provide for an open and inclusive culture in all phases of research.
57. As a supervisor, principal investigator, research director or manager, refrain from any action which might encourage a researcher to disregard any of the standards in this chapter.
58. Do not delay or hinder the work of other researchers in an inappropriate manner.
59. Call attention to other researchers' non-compliance with the standards as well as inadequate institutional responses to non-compliance, if there is sufficient reason for doing so.
60. In addressing research misconduct, make no accusation that you know or should have known to be incorrect.
61. Do not make improper use of research funds.

16. Valid reasons, including confidentiality, can be found in: Council of the European Union, Outcome of Proceedings: The transition towards an Open Science system, paragraph 14 (Brussels, 27/05/2016, 9526/16, via: data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf).

4. Institutions' duties of care

4. Institutions' duties of care

4.1 Introduction

Institutions provide a working environment that promotes and safeguards good research practices. They ensure that researchers can work in a safe, inclusive and open environment where they feel responsible and accountable, can share concerns about dilemmas and can discuss errors made without fearing the consequences ('blame-free reporting').

These obligations on the part of institutions are duties of care. Institutions must fulfil these duties so that researchers can and, in fact, do observe the standards for good research practices. Many of these duties of care apply to distinct levels within an institution, engendering further obligations for personnel working at various levels, particularly supervisors, principal investigators, research directors, managers and executive board members.

The regulated right to raise complaints described in chapter 5 does not apply to the institutional duties of care. Naturally, internal regulatory organs such as the Supervisory Board or representative bodies may concern themselves with ensuring compliance.

4.2 Training and supervision

1. Raise awareness about research integrity within the organization and, where necessary, provide or facilitate training courses for researchers, support staff, research leaders and research managers.
2. Embed a focus on research integrity firmly in educational activities of higher education institutions.
3. Provide a working environment in which responsible research practices are facilitated.
4. Ensure that new researchers and PhD students are supervised by suitably qualified persons.
5. Ensure transparent and fair procedures for appointments, promotions and remuneration.

4.3 Research culture

6. Ensure compliance with all relevant statutory regulations, codes of conduct, instructions and protocols.
7. Encourage a research culture in which the standards in chapter 3 are embedded and take measures if there are signs that they are not being complied with or there is a risk that this will occur.
8. Provide clear instructions, protocols and other means to support researchers and to help them understand what constitutes good research practice within their discipline(s) and institution.
9. Take appropriate measures to prevent non-compliance with the standards. For example, monitor the quality and intensity of the supervision of starting researchers such as PhD students as well as the composition of PhD committees.
10. Provide an open, safe and inclusive research culture in which researchers:
 - a. discuss the standards for good research practices,
 - b. hold each other accountable for compliance with the standards, and
 - c. are prepared to report any reasonable suspicion of non-compliance to the committee or officer referred to in 21 below or a confidential counsellor as referred to in 20 below.

4.4 Data management

11. Provide a research infrastructure in which good data management is the rule and is facilitated.
12. Ensure that, as far as possible, data, software codes, protocols, research material and corresponding metadata can be stored permanently.
13. Ensure that all data, software codes and research materials, published or unpublished, are managed and securely stored for the period appropriate to the discipline(s) and methodology concerned.

14. Ensure that, in accordance with the FAIR principles¹⁷, data is open and accessible to the extent possible and remains confidential to the extent necessary.
15. Ensure that it is clear how data, software codes and research material can be accessed.

4.5 Publication and dissemination

16. Ensure that contracts with commissioning parties and funding bodies include fair agreements about access to and the publication of data and research material.
17. Ensure that the public communication of research results is performed scrupulously.

4.6 Ethical norms and procedures

18. Undertake ethical reviews where necessary; for example, by setting up one or more ethical committees and providing them with adequate support. These committees can provide researchers with binding or non-binding advice on issues such as the use and treatment of patients, human and animal test subjects, the possible risks of publishing data, the use of human tissue, risks to the environment or cultural heritage and potential conflicts of interest.
19. On the institution's website, publish information about its policy with regard to the registration and disclosure of relevant ancillary activities, positions and interests, including the measures in place to implement that policy.
20. Appoint and support easily accessible confidential counsellors for research integrity.
21. Appoint a committee or officer to consider complaints as referred to in section 5.4

17. See the GoFair website: <https://www.go-fair.org/fair-principles/>.

5. Non-compliance with standards: measures and sanctions

5. Non-compliance with standards: measures and sanctions

5.1 Introduction

In this chapter, 'standard' refers to the standards for good research practices listed in chapter 3, including the additional standards for a discipline or institution referred to in section 3.1. 'Assessment criteria' refers to the factors described in section 5.2C.

Researchers, supervisors, principal investigators, research directors, managers and the executive board members of the institution must always strive to ensure that the standards are fulfilled scrupulously. Non-compliance with them undermines professional responsibility, which harms the research process and the relationship between individual researchers, and possibly also trust in and the credibility of the research. Section 5.2 provides guidelines for institutional boards and for the committees and officers referred to in section 5.4, under 1, in judging the severity of specific cases of non-compliance with standards, including the assessment criteria to be applied. Section 5.3 deals with measures and sanctions to be imposed, if necessary, and section 5.4 addresses the submission and consideration of complaints about alleged instances of research misconduct.

5.2 Research misconduct, questionable research practices and minor shortcomings

A. Research misconduct

In serious cases, non-compliance with one or more standards constitutes 'research misconduct' on the part of the researcher involved as well as, where applicable, the supervisor, principal investigator, research director or manager who incited that non-compliance.

1. The clearest examples of research misconduct are fabrication, falsification and plagiarism.
 - Fabrication means the invention of data or research results and reporting them as if they are fact (chapter 3, standard 19).
 - Falsification means the manipulation of data or research material, equipment or processes to change, withhold or remove data or research results without justification (standard 21).
 - Plagiarism means the use of another person's ideas, work methods, results or texts without appropriate acknowledgement (standards 34, 40). In some cases, however, plagiarism is of such limited extent and significance that its labelling as 'research misconduct' would be excessive.
2. In the event that the following standards are not met, the determination of whether the case in question constitutes 'research misconduct' or a less serious violation will depend on the outcome of an assessment using the criteria as mentioned in section 5.2C:
 - Design: standards 7, 8 and 14.
 - Conduct: standards 18, 22 and 23.
 - Reporting: standards 30, 36, 38, 42, 44 and 45.
 - Assessment and peer review: standards 47 and 49.
 - Communication: standards 53 and 55.
 - General standards: standards 57, 58 and 60.
3. Only in exceptional cases is non-compliance with any of the other standards to be characterized, in the light of the assessment criteria, as 'research misconduct'.

B. Questionable research practices and minor shortcomings

In cases where non-compliance with the standards does not constitute ‘research misconduct’, it may instead be categorized as ‘questionable research practice’ or, in the least serious situations, as a ‘minor shortcoming’. Which of these descriptions is appropriate in any specific case depends upon the outcome of the assessment using the criteria in section 5.2C. In the event of a ‘minor shortcoming’, in general there will be no reason to impose measures or sanctions as referred to in section 5.3.

C. Assessment criteria

When the executive board of the institution and the committee or officer referred to in section 5.4, under 1 are considering the case, the following criteria are particularly important:

- a. the extent of the non-compliance;
- b. the level to which non-compliance was intentional and whether it was a form of gross negligence or was the result of carelessness or ignorance;
- c. the possible consequences for the validity of the research in question and for the prevailing scientific knowledge and scholarship;
- d. the potential effects on the trust in scientific and scholarly research and between researchers;
- e. the potential impact on individuals, society and the environment;
- f. the potential benefits for the researcher or other interested parties;
- g. whether the matter concerns a scientific or scholarly publication, as opposed to a popularizing article, teaching materials or an advisory report;
- h. opinions within the discipline(s) concerning the severity of the non-compliance;
- i. the researcher’s position and experience;
- j. the extent of any prior violations committed by the researcher;
- k. whether the institution itself has failed in its duties of care;
- l. how much time elapsed before action was taken against the non-compliance within or outside the institution.

5.3 Sanctions and other measures

If the executive board of the institution suspects non-compliance with one or more standards, it ensures that the case is examined honestly and fairly. If such non-compliance is indeed established after proper investigation, it may be deemed appropriate to impose sanctions or other measures. The nature and extent of

these will depend, among other things, upon whether the non-compliance is found to constitute ‘research misconduct’, a ‘questionable research practice’ or a ‘minor shortcoming’. If the suspicion of non-compliance proves unfounded, appropriate remedial measures are taken.

Sanctions

Whenever ‘research misconduct’ is established, the board of the institution must consider whether it is possible and desirable to impose sanctions. Naturally, any sanction must always be appropriate and proportionate. In serious cases, the institution has the powers to impose penalties within its legal powers, such as a formal reprimand, transfer, demotion or dismissal. A person’s authorization to supervise degrees may also be suspended. Furthermore, the institution may deem it necessary to report the matter to the relevant regulatory bodies or to authorities empowered to impose other administrative, disciplinary or criminal sanctions.

Other measures

Regardless of whether a sanction ought to be imposed, it is always important to consider whether other appropriate measures are necessary. This is especially so in the event of repeated non-compliance or more-than-occasional breaches of the standards.

Even when there is no reason to impose sanctions, failure to comply with the standards cannot remain undiscussed. Researchers must always hold each other, their subordinates, their supervisors, principal investigators, research directors and managers accountable, to ensure that quality assurance is improved, that recurrence is prevented and that adverse effects are remedied or mitigated (e.g. by rectifying or retracting publications). The institution’s board should take measures itself or ensure that others do so. In this respect, it may make a difference whether the matter is a case of research misconduct, a questionable research practice or a minor shortcoming. It may also prove necessary for the institution to take preventive individual or general measures to ensure that research practices are improved, compliance with all standards is maintained and timely detection will take place (see also the duties of care described in chapter 4).

5.4 Complaints and investigations

If research misconduct is suspected, a complaint can be submitted to a relevant committee or officer appointed by the institution. The institution ensures that a scrupulous and fair procedure is in place to deal with any such complaint, including any judgement resulting from it. This procedure is also followed if the executive board of the institution itself considers it necessary to investigate possible research misconduct, even without receiving a complaint.

The following basic principles apply to the consideration and investigation of complaints.

1. Following a complaint or a request by the institution's board, the matter is investigated by the committee or officer appointed to that end.
2. In this section, 'the respondent' means the person whose conduct is under investigation. This may also be a person who no longer works at or for the institution.
3. A complaint may only be submitted about a suspected case of research misconduct (see section 5.2A).
4. The complaint or request must adequately substantiate why the complainant or petitioner believes that research misconduct has been committed.
5. Complaints related to methodological discussions and standard academic debates are inadmissible.
6. An anonymous complaint of alleged research misconduct will be considered only if the executive board of the institution sees good reason to do so because it believes that:
 - a. compelling public or institutional interests are at stake, or interests of the respondent so require; and,
 - b. the factual basis for the complaint can be investigated without input from the complainant.
7. The investigating committee or officer can refrain from initiating or continuing an investigation as soon as it becomes clear that the complaint or request:
 - a. concerns a purely professional difference of opinion;
 - b. is attributable solely to a labour dispute; or,
 - c. cannot result in a judgement that the respondent's actions constitute research misconduct.
8. The complainant and the respondent may consult a confidential counsellor.
9. The investigatory procedure regarding the research, as well as any second opinion:
 - shall provide for fair treatment, including hearing both sides and making all relevant information available to both the complainant and the respondent;
 - shall be confidential;
 - shall be organized in such a way that neither the complainant nor the respondent is unnecessarily disadvantaged;
 - shall be completed within a reasonable period of time;
 - shall be conducted by experts with no personal interest in the case; or
 - shall be set down by the institution in a clear, easily accessible regulation.
10. a. The procedure described in point 9 shall, if relevant to the institution, include provisions as to when, and under what conditions, the undisclosed components of scientific research or data shall be made available for verification as part of the investigation. Such provisions shall at least state which persons or officers are authorised to carry out verification checks, how they should be carried out and how the findings are to be reported.
b. Pursuant to section 3.2, point 12b, the procedure may include provisions stating that, in highly exceptional cases, there may be compelling reasons for components of the research, including data, not to be disclosed to an investigation into alleged research misconduct. Such cases must be recorded and the consent of the board of the institution must be obtained prior to using the components and/or data in question in the scientific research. They must also be mentioned in any results that are made public.
11. The investigating committee or officer may decide, by way of derogation from point 9, first bullet, to withhold certain information from the complainant and/or the respondent if there are compelling reasons to do so.
12. The respondent is presumed innocent until proven otherwise.
13. The investigating committee or official judges whether research misconduct has taken place.
14. After the committee or official has issued its judgement, the executive board of the institution gives its initial judgement on the matter and notifies the complainant and the respondent thereof, in writing and without delay.

15. The complainant and the respondent may request a second opinion within six weeks, for instance from the Netherlands Board on Research Integrity (LOWI).
16. If a second opinion is not requested within six weeks, the executive board of the institution settles on its final judgement. If a second opinion has been requested, the board takes that into consideration in its final judgement.
17. At the same time as issuing its final judgement, the executive board of the institution determines any sanctions or measures as referred to in section 5.3.
18. At least in all cases where research misconduct is established, the executive board of the institution ensures that the findings of the investigation and its final judgement are made public in anonymized form.
19. The board of the institution ensures that the rights of both the complainant and the respondent are protected, and that neither is unnecessarily disadvantaged in their career prospects or otherwise.
20. The board of the institution is not obliged to arrange legal assistance but may decide to do so.

Appendix

Appendix

Examples of statutory regulations and codes of conduct that overlap with or are related to the standards for responsible research practices

1. General Data Protection Regulation (GDPR)
(<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016R0679>)
2. Public Records Act (Archiefwet)
(<http://wetten.overheid.nl/BWBR0007376/2015-07-18>)
3. Genetically Modified Organisms Decree (Besluit genetisch gemodificeerde organismen)
(<http://wetten.overheid.nl/BWBR0035090>)
4. Radiation Protection Decree (Besluit stralingsbescherming)
(<http://wetten.overheid.nl/BWBR0012702>)
5. Code of Ethics for research in the Social and Behavioural Sciences involving human subjects
(<http://www.nethics.nl/Gedragcode-Ethical-Code/>)
6. Research Databases Act (Onderzoeksgegevensbankenwet)
(<http://wetten.overheid.nl/BWBR0010591/2017-09-01>)
7. Embryos Act (Embryowet)
(<http://wetten.overheid.nl/BWBR0013797>)
8. Code of Conduct for health research
(<https://www.federa.org/codes-conduct>)
9. Human tissue and Medical Research: Code of Conduct for Responsible Use
(<https://www.federa.org/codes-conduct>)
10. Genetically Modified Organisms Regulations
(<http://wetten.overheid.nl/BWBR0035072>)
11. Standard for the protection of animals used for scientific purposes
(<https://eur-lex.europa.eu/legal-content/NL/TXT/?uri=CELEX%3A32010L0063>)
12. Association of Universities in the Netherlands (VSNU) Sectorial regulation regarding ancillary activities
(<http://www.vsnu.nl/files/VSNUnu%202017/Sector%20regeling%20evenwerkzaamheden%202017.pdf>)
13. General Data Protection Regulation (Implementation) Act (Uitvoeringswet Algemene verordening gegevensbescherming)
(<http://wetten.overheid.nl/BWBR0040940/2018-05-25>)
14. UNESCO Recommendation on Science and Scientific Researchers
(http://portal.unesco.org/en/ev.php-URL_ID=49455&URL_DO=DO_TOPIC&URL_SECTION=201.html)
15. Foetal Tissue Act (Wet foetaal weefsel)
(<http://wetten.overheid.nl/BWBR0012983>)

16. House for Whistleblowers Act (Wet Huis voor de klokkenluiders)
(<http://wetten.overheid.nl/BWBR0037852/2016-07-01>)
17. Medical Research (Human Subjects) Act (Wet medisch wetenschappelijk onderzoek met mensen)
(<http://wetten.overheid.nl/BWBR0009408>)
18. Environmental Management Act (Wet milieubeheer)
(<http://wetten.overheid.nl/BWBR0003245>)
19. Experiments on Animals Act (Wet op de dierproeven)
(<http://wetten.overheid.nl/BWBR0003081>)
20. Medical Treatment Contracts Act (Wet op de geneeskundige behandelingsovereenkomst)
(http://wetten.overheid.nl/BWBR0005290/#Boek7_Titeldeel7_Afdeling5)
21. Medical Devices Act (Wet op de medische hulpmiddelen)
(<http://wetten.overheid.nl/BWBR0002697>)
22. Population Screening Act (Wet op het bevolkingsonderzoek)
(<http://wetten.overheid.nl/BWBR0005699>)
23. International, European and national legislation regarding intellectual property, including:
 - a. Copyright Act (Auteurswet)
(<http://wetten.overheid.nl/BWBR0001886/2017-09-01>)
 - b. Patents Act 1995 (Rijksoctrooiwet 1995)
(<http://wetten.overheid.nl/BWBR0007118/2017-03-01>)
 - c. Neighbouring Rights Act (Wet op de naburige rechten)
(<http://wetten.overheid.nl/BWBR0005921/2017-09-01>)
 - d. Seeds and Plant Materials Act 2005 (Zaaizaad- en plantgoedwet 2005)
(<http://wetten.overheid.nl/BWBR0018040/2017-09-01>)
24. Legislation and regulations related to public and state security and state secrets, including:
 - a. General Security Requirements for Ministry of Defence Assignments (ABDO 2006 for ongoing assignments, ABDO 2017 for new assignments) (Algemene beveiligingseisen voor defensieopdrachten 2006 en 2017)
(<https://www.defensie.nl/downloads/beleidsnota-s/2006/08/13/abdo-2006>)
(<https://www.defensie.nl/downloads/beleidsnota-s/2017/06/13/abdo-2017>)
 - b. Civil Service Information Security (Classified Information) Decree 2013 (Besluit Voorschrift Informatiebeveiliging Rijksdienst Bijzondere Informatie 2013)
(<http://wetten.overheid.nl/BWBR0033507/2013-06-01>)
 - c. Judicial Data and Criminal Records Act (Wet justitiële en strafvorderlijke gegevens)
(<http://wetten.overheid.nl/BWBR0014194/2016-01-01>)
 - d. Police Data Act (Wet politiegegevens)
(<http://wetten.overheid.nl/BWBR0022463/2018-05-01>)
 - e. Intelligence and Security Services Act 2017 (Wet op de Inlichtingen- en veiligheidsdiensten 2017)
(<http://wetten.overheid.nl/BWBR0039896/2018-05-01>)
 - f. Security Screening Act (Wet veiligheidsonderzoeken)
(<http://wetten.overheid.nl/BWBR0008277/2015-09-01>)

Colophon

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Bas van der Horst (BUREAUBAS)



Confidential advisors scientific integrity

NWO-I has two confidants for Scientific Integrity: Dr Tanja Kulkens, also Head of Chemistry and Physics at NWO, and Professor Thom Palstra, Professor of Solid State Chemistry and Rector Emeritus of the University of Twente. Both can be reached via vertrouwenspersoonWI@nwo.nl.

The Scientific Integrity (WI) fiduciaries want to be accessible to NWO-I staff with questions or dilemmas about WI, which they cannot discuss with their direct colleagues. The counsellors can listen, advise and, if necessary, provide guidance. In 2022, both will visit NWO institutes to talk to both management and staff. In this way, their new role will become better known and staff will find it easier to approach them if necessary. With nearly 1,900 employees NWO-I is a large organisation in which difficult dilemmas will always occur.

Who are Kulkens and Palstra?

Kulkens has been a confidential advisor for NWO-I for some time and now also holds the position of confidential advisor WI. Although she has no experience with violations of WI, integrity plays an important role in the peer review process and the other activities she carries out and supports at NWO domain Exact Sciences and Natural Sciences (ENW). She knows the science and the researchers and knows which dilemmas they face. Kulkens hopes to make them negotiable at an early stage.

As rector of the University of Twente, Palstra was responsible for setting up and organising the House of Integrity. This includes not only scientific integrity but also ethics committees, a safe (social) working environment and business integrity. Palstra learned the importance of scientific integrity at a previous employer, Bell Laboratories: the entire research system was built on it. WI plays an important role in the way Palstra practices science and supervises students and PhD candidates.

When to go to the confidential advisor?

The confidential advisors can be approached in case of concerns about or violations of scientific integrity via vertrouwenspersoonWI@nwo.nl. They can give advice on content and procedure, for example if it is unclear whether there has been a violation of scientific integrity in a particular case and what can be done about it. In addition, they can, if necessary, provide guidance in formulating a complaint. Going to the confidential advisor(s) guarantees complete confidentiality. Follow-up actions will only take place if the employee who takes the initiative gives permission to the confidential advisor(s).

Thom Palstra and Tanja Kulkens: "Take it as your own responsibility to actively deal with WI, but know how to find us if you can't work it out!"



Complaints Procedure for Research Integrity – NWO Institutes



Preamble

It is essential that scientific research is carried out in accordance with the guiding principles of research integrity: honesty, diligence, transparency, independence and responsibility. Research that does not follow these principles may cause direct harm (for example, to the environment or patients) and may undermine public confidence in science and trust between researchers. NWO therefore considers it its duty to monitor both the quality of scientific research funded by NWO and the quality of scientific research carried out by the NWO Institutes.

Since NWO endorsed the updated Netherlands Code of Conduct for Research Integrity 2018 and adopted a fair and scrupulous procedure for handling suspected complaints related to scientific integrity and the subsequent decision-making, the said Code of Conduct is applicable to NWO-I. Anyone may submit a complaint of alleged scientific misconduct to the Confidential Counsellor for scientific integrity. If no solution is reached, the complaint is referred to the *Research Integrity Committee*, which investigates the complaint and issues an opinion. Based on the opinion of the *Research Integrity Committee*, the NWO-I *Board* adopts an initial judgement. The *Complainant* and/or *Respondent* may submit this initial judgement to the Netherlands Board on Research Integrity (LOWI).

The Complaints Procedure for Research Integrity – NWO institutes applies to complaints of alleged “Research Misconduct” (as defined herein) by an NWO-I employee.

I. GENERAL

Article 1 Definitions

1. The following definitions apply for the purposes of this Procedure:

- a) *Board*: Board of the Netherlands Foundation of Scientific Research Institutes (NWO-I).
- b) *Complainant*: the person who addresses a *Complaint* to the *NWO-I Research Integrity Desk*, whether or not via the *Board* or the *Confidential Counsellor*.
- c) *Complaint*: a written report (which term includes emails) concerning a (suspected) instance of *Research Misconduct* on the part of an *Employee*.
- d) *Complaints Procedure*: the present *Complaints Procedure for Research Integrity*.
- e) *Confidential Counsellor*: a person appointed by the *Board* as a confidential counsellor for research integrity.



- f) *Director NWO-I*: the director Netherlands Scientific Research Institutes.

- g) *Employee*: a person who has or has had an employment contract with *NWO-I* or one of its Institutes under the WVOI collective labour agreement, or who is or has been otherwise employed under the responsibility of *NWO-I* or one of its Institutes.

- h) *Institute*: as defined in the Statutes of NWO-I.

- i) *Institute Director*: as defined in the Statutes of NWO-I.

- j) *LOWI*: Netherlands Board on Research Integrity.

- k) *Netherlands Code of Conduct for Research Integrity*: the Netherlands Code of Conduct for Research Integrity as endorsed by *NWO*, which took effect on 1 October 2018.

- l) *NWO*: Dutch Research Council.

- m) *NWO-I*: Netherlands Foundation of Scientific Research Institutes.

- n) *NWO Supervisory Board*: the supervisory board of the Dutch Research Council.

- o) *Research Integrity Committee*: a committee set up by the *Board* to assess the content of the complaint and to inform and advise the *Board* concerning its findings. The *Board* may set up an ad hoc or a permanent committee.

- p) *Research Integrity Desk*: digital mailbox for submitting a *Complaint*; has an *Research Integrity Desk Secretariat*.

- q) *Research Integrity Desk Secretariat*: the Legal Affairs department of *NWO-I* that acts as the Secretariat of the *Research Integrity Desk*.

- r) *Research Misconduct*: the infringing of nationally and internationally accepted standards of research conduct, as set out in the applicable *Netherlands Code of Conduct for Research Integrity*.

- s) *Respondent*: an Employee whose conduct is the subject of a complaint or an investigation carried out by the Research Integrity Committee at the Board's request.



Where the terms "he", "him" or "his" are used in this Complaints Procedure for Research Integrity, they may also be read as "she" or "her".

Article 2 General

1. Anyone may consult the *Confidential Counsellor* if they have a question or a *Complaint* concerning the conduct of scientific research.
2. Anyone may submit a *Complaint*. For the procedure, please see Sections II and III of this *NWO-I Complaints Procedure for Research Integrity*.
3. All parties involved in the *Complaint* must provide the *Confidential Counsellor* or the *Research Integrity Committee* with all cooperation that the latter may reasonably request in the exercise of their powers. If such cooperation is not forthcoming, the *Board* may draw the conclusions it deems appropriate.
4. All persons involved in handling a *Complaint* must maintain confidentiality regarding everything that comes to their knowledge in connection with the *Complaint*. This duty of confidentiality continues after the end of the Procedure, except in the case of anonymised reporting, e.g. in annual reports. If the duty of confidentiality is breached, the *Board* may impose appropriate measures.

II. CONFIDENTIAL COUNSELLOR

Article 3 Appointment of a *Confidential Counsellor*

1. The *Board* appoints a *Confidential Counsellor* (or multiple *Confidential Counsellors*) for a term of five years. A one-off reappointment for a consecutive term not exceeding five years is possible. Members of the *NWO Supervisory Board*, members of the *Research Integrity Committee* and persons who hold administrative positions at *NWO-I* or *NWO* are excluded from appointment;
2. At least one Confidential Counsellor is no Employee of *NWO-I* or *NWO*.
3. A *Confidential Counsellor* should at least have the following qualifications:
 - a) has experience of conflict management;
 - b) has an impeccable scientific reputation;
 - c) carries out no other activities that could interfere with the independency role of confidential counsellor.
4. The *Board* may terminate the appointment of a *Confidential Counsellor* prematurely:
 - a) at the *Confidential Counsellor's* own request;
 - b) if the *Confidential Counsellor* no longer meets the requirements for appointment set out in paragraph 2;
 - c) due to improper performance as a confidential counsellor.
5. The activities of the *Confidential Counsellor* are governed by the *NWO Code for Dealing with Personal Interests*.
6. Mediation by the Confidential Counsellor is only possible upon approval of Complainant and Respondent.



Article 4 Duties of Confidential Counsellor

The Confidential Counsellor:

- 1) Acts as a point of contact for questions and complaints concerning the conduct of scientific research, including the publication of research results.
- 2) Attempts – if there are opportunities for doing so – to resolve complaints amicably by mediation between the parties or by other means.
- 3) Refers the *Complainant* to the *Research Integrity Committee* via the *Research Integrity Desk* and the *Research Integrity Complaints Procedure* by asking the *Research Integrity Committee* to investigate the complaint if a solution under 2) is not possible.
- 4) Reports on the activities to the *Board* by means of a retrospective annual report worded in general terms without identifying any individuals.
- 5) May not assist both the *Respondent* and the *Complainant*.
- 6) Must maintain confidentiality regarding everything that becomes known to them in their capacity.

III. COMPLAINTS PROCEDURE

Article 5 Research Integrity Committee; appointment and composition

1. The *Board* sets up a *Research Integrity Committee* to assess the content of a *Complaint*. This may be an ad hoc or a permanent committee.
2. The NWO-I *Research Integrity Committee* consists of a chairperson and at least two other members. At least one of the members is a lawyer.
The members of the NWO-I *Research Integrity Committee* are appointed by the *Board*, in the case of a permanent committee, for a term of five years. The *Board* may determine whether the *Research Integrity Committee* can be temporarily expanded to include experts or ad hoc members who may or may not be associated with the organisation.
3. Members of the NWO Supervisory Board, the *Confidential Counsellor* and the relevant *Institute Director* are not eligible for appointment to the NWO-I *Research Integrity Committee*.
4. A member of the NWO-I *Research Integrity Committee* should at least have the following qualifications:
 - a) deals well with conflicts and differences of opinion;
 - b) has an impeccable scientific reputation;
 - c) is not an employee of NWO-I and holds no managerial position at NWO-I or otherwise that could hinder the proper functioning.
5. The *Board* may terminate the appointment prematurely:
 - a) at the own request of the chairperson or member of the *Research Integrity Committee*;
 - b) if the chairperson or member of the *Research Integrity Committee* no longer meets the requirements for appointment set out in paragraph 3;



- c) due to improper performance as a chairperson or member of the *Research Integrity Committee*.
- 6. A Confidential Counsellor of the Research Integrity Desk is not eligible for appointment as a chairperson or member of the Research Integrity Committee.
- 7. The activities of the Research Integrity Committee are governed by the NWO Code for Dealing with Personal Interests.

Article 6 Research Integrity Committee; duties

The duties of the *Research Integrity Committee* are to investigate the *Complaint* or request (based on Article 11) and to advise the *Board* accordingly.

Article 7 Research Integrity Committee; powers

The *Research Integrity Committee* has the power to:

- 1) Obtain information from *NWO-I* employees and bodies.
- 2) Demand access to all documentation and correspondence that it deems relevant to its investigations, and to seize or order the seizure of such documentation and correspondence if it deems necessary.
The term “documentation” includes the research data to which the *Complaint* relates. If the *Research Integrity Committee* deems it necessary, non-publicly available parts of the scientific research and related data will be made available for inspection to persons specifically designated by the *Research Integrity Committee*. These persons carry out the inspection under a strict duty of confidentiality and share their findings only with the *Research Integrity Committee*. The relevant findings will be presented in the opinion of the *Research Integrity Committee* in such a way that the confidentiality of the research or the research data is not infringed.
- 3) Consult experts or other third parties who may or may not be associated with the organisation.

Article 8 Research Integrity Committee; working methods

The working methods of the *Research Integrity Committee* are determined by the chairperson, provided no further regulations on working methods have been laid down.

Article 9 Research Integrity Desk Secretariat

- 1. The Legal Affairs department of *NWO-I* acts as the Secretariat of the *Research Integrity Desk*.
- 2. The *Research Integrity Desk Secretariat*:
 - a) advises the *Board* on whether the *Complaint* can be handled by *NWO-I*, and reports on this to the *Board*;
 - b) supports the *Confidential Counsellor* in the performance of its duties;
 - c) supports the *NWO-I Research Integrity Committee*
 - d) in the performance of its duties.

Article 10 Submitting a Complaint

- 1. Anyone may submit a *Complaint* to the *Research Integrity Desk*.



2. The *Complaint* should be in Dutch or English, and should include at least:
 - a) the name and address of the *Complainant*;
 - b) the date;
 - c) the signature of the *Complainant*;
 - d) a description of the alleged *Research Misconduct*;
 - e) the name or description of the person(s) against whom the *Complaint* is addressed, indicating the relationship between the *Respondent* and the *Complainant*;
 - f) a clear description of the alleged *Research Misconduct*.
3. The *Complainant* should submit the *Complaint* together with any supporting evidence in the *Complainant's* possession.
4. If the *Complaint* is a repeat of a complaint previously handled by *NWO-I*, the *Board* may dismiss the *Complaint* with reference to its previous decision, unless the *Complainant* demonstrates newly emerged facts or changed circumstances.

Article 11

The *Board* may also ask the *Research Integrity Committee* to investigate alleged *Research Misconduct* without a *Complaint* having been submitted.

Article 12

The *Research Integrity Committee* will consider an anonymous complaint only if the *Research Integrity Committee* sees good reason to do so on the basis of:

- 1) compelling public interests or compelling interests of the organisation or the respondent, and
- 2) the factual basis for the *Complaint* can be investigated without input from the *Complainant*.

Article 13

If the *Complaint* concerns a member of the *Board*, the *NWO* Supervisory Board will assume the role and powers assigned to the *Board* under this Procedure.

Article 14

If a *Complaint* concerns an *Employee* who has been employed by one or more other institutions that have endorsed the *Netherlands Code of Conduct for Research Integrity* and the *Complaint* can therefore be investigated at multiple institutions, the *Complaint* may be handled jointly, or the institutions may make other arrangements for its handling. In this case, the handling of the *Complaint* will be decided by the *Board*.

Article 15 Receipt of the *Complaint*

1. The *Research Integrity Desk Secretariat* confirms receipt of the *Complaint* in writing within one week.



2. The *NWO-I Research Integrity Desk Secretariat* informs the *Respondent*, the *Complainant* and the relevant *Institute Director* of the receipt of the *Complaint* and the further procedure within three weeks.
3. The *Board* may decide not to consider a *Complaint* if:
 - a) the *Complaint* does not meet the requirements set out in Article 10, second paragraph, of this Procedure, provided the *Complainant* has been given the opportunity to rectify the omission within a reasonable time limit;
 - b) the *Complaint* may be subjected to the judgement of a research integrity committee of another institution;
 - c) the *Complaint* has already or has previously been subjected to the judgement of a research integrity committee of another institution or judicial authority;
 - d) too long a period has elapsed since the alleged *Research Misconduct*, or the *Complainant* has waited an unreasonably long period before submitting a *Complaint*;
4. If the *Board* considers the *Complaint* admissible, the *Board* sets up a temporary or permanent *NWO-I Research Integrity Committee* in accordance with Article 5, if this has not already been done, and asks the *NWO-I Research Integrity Committee* to assess the content of the *Complaint*.

Article 16 Handling by the Research Integrity Committee

1. If the *Research Integrity Committee* considers the *Complaint* to be manifestly unfounded on first evidence, the *Research Integrity Committee* may rule that the *Complaint* is manifestly unfounded because:
 - a) the *Complaint* concerns a purely professional difference of opinion;
 - b) the *Complaint* is attributable solely to a labour dispute;
 - c) the *Complaint* is manifestly unfounded;
 - d) the *Complaint* is manifestly trivial.

In this case, the *Research Integrity Committee* will immediately issue an opinion to the *Board* within four weeks if they are of the opinion that the substance of the *Complaint* cannot be dealt with. The *Board* takes the decision subsequently and sends its decision to the *Complainant* and the *Respondent* as soon as possible. The decision of not dealing with substance of the *Complaint* is a decision with the meaning of article 17 section 1.

2. If the substance of the *Complaint* is handled by the *Research Integrity Committee*, the following procedure applies:
 - a) The *Research Integrity Committee* informs the *Complainant*, the *Respondent* and the relevant *Institute Director* of the *Complaint*.
 - b) The *Research Integrity Committee* gives the *Respondent* the opportunity to submit a written defence and sets a reasonable time limit for doing so.
 - c) The *Research Integrity Committee* hears the parties it considers to be involved in the *Complaint*, including the *Complainant* and the *Respondent*.
 - d) The parties may be assisted at the hearing by an authorised representative or a lawyer.
 - e) Hearings are not conducted in public.



- f) The *Research Integrity Committee* may hear witnesses and experts or ask experts to submit a written report.
- g) Hearings are minuted or recorded.
- h) The *Complainant* and the *Respondent* are heard in each other's presence unless there are compelling reasons for not doing so. In such a case, any parties not present at the hearing will be informed of the matters discussed in their absence.
- 3. In accordance with Article 7, the *Research Integrity Committee* may request access to all documentation and correspondence that it deems relevant to the assessment of the *Complaint*.
- 4. Within ten weeks after assessing the content of the *Complaint*, the *Research Integrity Committee* issues a written opinion to the *Board* on whether or not the *Complaint* is well-founded. The *Research Integrity Committee* may extend this term once by no more than four weeks.
- 5. The opinion of the *Research Integrity Committee* should include at least:
 - a) a description of the procedure followed;
 - b) a description of the positions of the parties involved, and the views of any witnesses and/or experts who have been consulted;
 - c) whether the *Research Integrity Committee* considers the *Complaint* to be founded or unfounded and, if it considers it to be founded, which of the qualifications referred to in Section 5.2 of the Netherlands *Code of Conduct for Research Integrity* should in its opinion be attributed to the *Complaint*;
 - d) the grounds of the opinion of the *Research Integrity Committee*.
- 6. The opinion of the *Research Integrity Committee* is submitted to the *Confidential Counsellor* for information.
- 7. The *Research Integrity Committee* reports on its activities to the *Board* by means of a retrospective annual report for the purpose of the annual report of NWO-I. In the report contains report on the cases handled and the activities carried out in general terms without information relating to identifiable persons.

Article 17 Decision-making and follow-up procedure

- 1. The *Board* adopts its initial judgement on the *Complaint* in its next meeting after receiving the opinion of the *Research Integrity Committee*.
- 2. The *Board* immediately issues a written notification of the initial judgement to the parties involved in the *Complaint*, including the *Complainant* and the *Respondent*, together with the opinion of the *Research Integrity Committee*. If the *Board* deviates in its initial judgement from the opinion of the *Research Integrity Committee*, the reason for the deviation will be stated in the initial judgement.
- 3. The *Complainant* and the *Respondent* may ask the *LOWI* to issue an opinion on the *Board's* initial judgement within six weeks after the date of the initial judgement. The current *LOWI* regulations apply to the procedure.
- 4. If the *Complainant* has not asked the *LOWI* for an opinion within the term referred to in the third paragraph, the initial judgement will be converted into a final judgement. The parties involved will be notified of this in writing.



5. If the *Complainant* has asked the *LOWI* for an opinion, the *Board* will adopt its final judgement after receiving that opinion. If the *Board* deviates in its final judgement from the opinion of the *LOWI*, the reason for the deviation will be stated in the judgement.
6. The *Board* immediately notifies the final judgement in writing to the parties involved in the *Complaint*, including the *Complainant*, the *Respondent* and, if applicable, the institution involved.
7. The final judgement of the *Board* will be published upon finalisation of the procedure in the annual report of *NWO-I*, including the report of findings and the opinion of the *Research Integrity Committee*.

Article 18 Protection of parties involved

1. Submission of a *Complaint* under this Procedure cannot lead to any direct or indirect disadvantage for the *Complainant*. The principle of good faith applies.
In particular, a *Complainant* did not act in good faith if a *Complaint* was submitted deliberately in order to harm a person's reputation. The same applies to witnesses, experts, the *Confidential Counsellor* or members of the *Research Integrity Committee*.
2. The members of the *Research Integrity Committee* and the eventual consulted experts keep confidential all information gathered and is known or informed to them in that capacity unless *Complainant* and *Respondent* explicitly have given their approval to otherwise.
3. *NWO-I* will make every effort to ensure that neither the *Complainant* nor the *Respondent* suffers any undue harm to their career prospects or otherwise as a result of the submission of a *Complaint*.

Article 19 Unforeseen cases

The *Board* will decide in all cases not covered by this procedure.

Article 20 Entry into force and publication

1. This procedure enters into force on 8 April 2020 and replaces all previous complaints procedures in relation to research integrity within *NWO-I*.
2. This procedure may be cited as the "*NWO-I Complaints Procedure for Research Integrity*" and will be published on the *NWO-I* website and the website of the individual *NWO-I* institute, if applicable.

Adopted by the *NWO-I* Board,

Date: December 2020



Science Integrity

NWO-I wants their trainee researchers to keep aware of research integrity in daily practice. Discussing integrity is essential as it contributes to an open, safe and inclusive research culture in which good scientific practices are ensured. NWO-I therefore offers four online modules to combine with the Dilemma Game app.

Intended for

This training is intended for all NWO-I PhD students and researchers in the first year of their appointment. It is part of the NWO-I training programme for PhD students.

Objective

During the course, participants will learn about:

- The main principles of research integrity and how you to apply to your own context.
- The principle required and the relevance of these principles for research integrity.
- Reflection on the current research culture and the conditions, inherent in science practice, that can undermine principles and make it more likely that researchers will abandon certain principles.
- The relevance of supervision, mentoring, and role modeling in the research environment and definitions of roles and their corresponding responsibilities.

Participants are invited to self-assess newly gained knowledge, relate and apply the concepts in reflection exercises. In addition, you will be asked to think about the relevance of these concepts for your daily research practice by drawing upon prior experience.

Content/method of working

In line with the [Dutch code](#), NWO-I offers four online modules that reflect on the European Code of Conduct for Research Integrity (ECOC). In the modules and Dutch code, this is referred to as ALLEA code.

These four online modules are accessible at any moment after you register:

- Introduction to Research Integrity (one hour).
- Introduction of Virtue Ethics to Research Integrity (one hour).
- Virtue Ethics under Current Research Conditions (one hour).
- Introduction to responsible supervision, mentoring and role modeling (one hour).

Registration

You can register here <https://www.nwo-i.nl/en/registration-training-science-integrity/>

At no point during the use of the modules is any personal information collected or saved. At some places in the modules, the user is invited to type input in open fields. Information entered into these fields is not sent back to any server. None of the entered information can be traced back to the user. It is not obligatory to use these fields.

Dilemma Game App

We recommend you to download the [Dilemma Game App](#) to participate in workshops at institute level or on an individual level. The Dilemma Game app is developed by Erasmus University Rotterdam (EUR) to stimulate awareness of integrity and professionalism in research and provide an opportunity for discussion and advice on realistic dilemmas in science.

Costs

Participating in the online module and the Dilemma Game App are free of costs.

This PDF is available at <http://nap.edu/12192>

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On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition (2009)

DETAILS

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ON BEING A SCIENTIST

A GUIDE TO RESPONSIBLE CONDUCT IN RESEARCH

T H I R D E D I T I O N

Committee on Science, Engineering, and Public Policy

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NATIONAL ACADEMY OF ENGINEERING, *AND*
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THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Charles M. Vest is president of the National Academy of Engineering.

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www.national-academies.org

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Preface

The scientific enterprise is built on a foundation of trust. Society trusts that scientific research results are an honest and accurate reflection of a researcher's work. Researchers equally trust that their colleagues have gathered data carefully, have used appropriate analytic and statistical techniques, have reported their results accurately, and have treated the work of other researchers with respect. When this trust is misplaced and the professional standards of science are violated, researchers are not just personally affronted—they feel that the base of their profession has been undermined. This would impact the relationship between science and society.

On Being a Scientist: A Guide to Responsible Conduct in Research presents an overview of the professional standards of science and explains why adherence to those standards is essential for continued scientific progress. In accordance with the previous editions published in 1989 and 1995, this guide provides an overview of professional standards in research. It further aims to highlight particular challenges the science community faces in the early 21st century. While directed primarily

toward graduate students, postdocs, and junior faculty in an academic setting, this guide is useful for scientists at all stages in their education and careers, including those working for industry and government. Thus, the term “scientist” in the title and the text applies very broadly and includes all researchers engaged in the pursuit of new knowledge through investigations that apply scientific methods.

In the past, beginning researchers learned the standards of science largely by participating in research and by observing other researchers make decisions about the interpretation of data and the presentation of results and interactions with their colleagues. They discussed professional practices with their peers, with support staff, and with more experienced researchers. They learned how the broad ethical values we honor in everyday life apply in the context of science. During that learning process, research advisers and mentors in particular can have a profound effect on the professional and personal development of beginning researchers, as is discussed in this guide. This assimilation of professional standards through experience remains vitally important.

However, many beginning researchers are not learning enough about the standards of science through research experiences. Science nowadays is so fast-paced and complex that experienced researchers often do not have the time or opportunity to explain why a decision was made or an action taken. Institutional, local, state, and federal guidelines can be overwhelming, confusing, and ambiguous. And beginning researchers do not always get the best advice from others or witness exemplary behavior. Anonymous surveys show that many researchers admit to engaging in irresponsible practices or have witnessed others doing so.¹

Furthermore, changes within science have complicated efforts

¹Martinson, B.C., Anderson, M.S., and de Vries, R. “Scientists Behaving Badly.” *Nature* 435(2005):737-738. Kirby, K., and Houle, F. A. Ethics and the Welfare of the Physics Profession. *Physics Today* 57 (11):42-49.

to ensure that every researcher has a solid grounding in the professional codes of science. Though support for research has grown substantially in recent years, exciting opportunities have continued to multiply faster than resources, and the resulting disparity between opportunities and resources has further reduced the time available to researchers to discuss professional standards. As research has become more interdisciplinary and multinational, it has become more difficult to ensure that communication among the members of a research project is sufficient. Increased ties among academic, industrial, and governmental researchers have strengthened research but have also increased the potential for conflicts. And the rapid advance of technology—including digital communications technologies—has created a wealth of new capabilities and new challenges.

In this changing environment of the early 21st century, a short guide like *On Being a Scientist* can provide only an introduction to the responsible conduct of research. Readers are thus encouraged to use the "Additional Resources" section of this guide, which lists many valuable publications, Web sites, and other materials on scientific ethics and professional standards, to find further material that explores this discourse. The challenges posed particularly by the increasing number of global and multinational ties within the science community will be further addressed in a subsequent publication of the National Research Council.

Established researchers have a special responsibility in upholding and promulgating high standards in science. They should serve as role models for their students and for fellow researchers, and they should exemplify responsible practices in their teaching and their conversations with others. They have a professional obligation to create positive research environments and to respond to concerns about irresponsible behaviors. Established researchers can themselves gain a new appreciation for the importance of professional standards by

thinking about the topics presented in this guide and by discussing those topics with their research groups and students. In this way, they help to maintain the foundations of the scientific enterprise and its reputation with society.

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The third edition also was prepared under the auspices of COSEPUP by the committee listed on the previous pages. Debbie Stine and Richard Bissell were study directors for the revision, Neeraj Gorkhaly provided administrative support, and Steve Olson served as consultant writer.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance

with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by David Challoner, University of Florida. Appointed by the National Academies, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

A Note on Using *On Being a Scientist*

For many graduate students, a seminar, class, or instructional module is their first formal exposure to responsible conduct in research. The guide *On Being A Scientist* explores the reasons for specific actions rather than stating definite conclusions about what should or should not be done in particular situations, and it can be used in formal sessions as well as for individual readings.

Scientific knowledge is achieved collectively through discussion and debate. Collective deliberation is an equally good way to explore how professional standards influence research. Group discussion can reveal the issues involved in a decision, connect those issues to more general standards, explore the interests and perspectives of different stakeholders, and identify possible strategies for resolving problems.

The guide *On Being a Scientist* hopes to stimulate group discussions, whether in orientations, seminars, research settings, or informal meetings. These discussions should include active researchers who bring their practical experience to the discussion and demonstrate by their presence that they recognize the critical importance of responsible conduct. The case studies included in this guide can be valuable to

the group discussions by introducing different scenarios and thus fostering a debate. Yet, the material presented in *On Being a Scientist* is not exhaustive. Thus, the publications, Web sites, and other materials listed in the "Additional Resources" section provide many opportunities to further explore issues of professional standards raised in this guide.

The Appendix contains brief discussions that relate the case studies to the professional standards discussed in the guide. The existence of professional standards implies that there are better and worse ways of approaching particular problems. At the same time, individuals interpret the cases in different ways, depending on their own experience and convictions. These different interpretations may be revealed particularly during panel discussions, which could include researchers who are at different stages of their careers—for example, a graduate student, a postdoctoral fellow, a junior faculty member, and a senior faculty member. Panels also can include individuals who have direct experience with administering programs or teaching classes on the responsible conduct of research. These individuals can relate the wide range of issues and perspectives involved in a particular case to professional standards.

Finally, training in the responsible conduct of research is too important to be relegated to a single seminar or Web-based tutorial. Responsible conduct is an essential part of good research and should not be separated from the rest of the curriculum. Since all researchers need to be able to analyze complex issues of professional practice and act accordingly, every course in science and related topics and every research experience should include discussions of ethical issues. Ideally, these discussions will continue during mentoring and advising sessions. It is hoped that this guide lays a foundation for those discussions, raising awareness and promoting debates among all researchers on matters of scientific ethics.

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INTRODUCTION TO THE RESPONSIBLE CONDUCT OF RESEARCH

Climatologist Inez Fung's appreciation for the beauty of science brought her to the Massachusetts Institute of Technology where she received her doctoral degree in meteorology. "I used to think that clouds were just clouds," she says. "I never dreamed you could write equations to explain them—and I loved it."¹

The rich satisfaction of understanding nature is one of the forces that keeps researchers rooted to their laboratory benches, climbing through the undergrowth of a sweltering jungle, or following the threads of a difficult theoretical problem. Observing or explaining something that no one has ever observed or explained before is a personal triumph that earns and deserves individual recognition. It also is a collective achievement, for in learning something new the discoverer both draws on and contributes to the body of knowledge held in common by all researchers.

Scientific research offers many satisfactions besides the exhilaration of discovery. Researchers seek to answer some of the most fundamental questions that humans can ask about nature. Their work can have a direct and immediate impact on the lives of people throughout the world. They are members of a community characterized by curiosity, cooperation, and intellectual rigor.

However, the rewards of science are not easily achieved. At the frontiers of research, new knowledge is elusive and hard won. Researchers often are subject to great personal and professional pressures. They must make difficult decisions about how to design investigations, how to present their results, and how to interact with colleagues. Failure to make the right decisions can waste time and resources, slow the advancement of knowledge, and even undermine professional and personal trust.

¹Skelton, R. *Forecast Earth: The Story of Climate Scientist Inez Fung*. Washington, DC: Joseph Henry Press, 2005.

Over many centuries, researchers have developed professional standards designed to enhance the progress of science and to avoid or minimize the difficulties of research. Though these standards are rarely expressed in formal codes, they nevertheless establish widely accepted ways of doing research and interacting with others. Researchers expect that their colleagues will adhere to and promote these standards. Those who violate these standards will lose the respect of their peers and may even destroy their careers.

Researchers have three sets of obligations that motivate their adherence to professional standards. First, *researchers have an obligation to honor the trust that their colleagues place in them*. Science is a cumulative enterprise in which new research builds on previous results. If research results are inaccurate, other researchers will waste time and resources trying to replicate or extend those results. Irresponsible actions can impede an entire field of research or send it in a wrong direction, and progress in that field may slow. Imbedded in this trust is a responsibility of researchers to mentor the next generation who will build their work on the current research discoveries.

Second, *researchers have an obligation to themselves*. Irresponsible conduct in research can make it impossible to achieve a goal, whether that goal is earning a degree, renewing a grant, achieving tenure, or maintaining a reputation as a productive and honest researcher. Adhering to professional standards builds personal integrity in a research career.

Third, because scientific results greatly influence society, *researchers have an obligation to act in ways that serve the public*. Some scientific results directly affect the health and well-being of individuals, as in the case of clinical trials or toxicological studies. Science also is used by policy makers and voters to make informed decisions on such pressing issues as climate change, stem cell research, and the mitigation of natural hazards. Taxpayer dollars fund the grants that support much research. And even when scientific results have no immediate applications—as when research reveals new information about the universe or the

fundamental constituents of matter—new knowledge speaks to our sense of wonder and paves the way for future advances.

By considering all these obligations—toward other researchers, toward oneself, and toward the public—a researcher is more likely to make responsible choices. When beginning researchers are learning these obligations and standards of science, the advising and mentoring of more-experienced scientists is essential.

Terminology: Values, Standards, and Practices

Research is based on the same ethical values that apply in everyday life, including honesty, fairness, objectivity, openness, trustworthiness, and respect for others.

A “scientific standard” refers to the application of these values in the context of research. Examples are openness in sharing research materials, fairness in reviewing grant proposals, respect for one’s colleagues and students, and honesty in reporting research results.

The most serious violations of standards have come to be known as “scientific misconduct.” The U.S. government defines misconduct as “fabrication, falsification, or plagiarism (FFP) in proposing, performing, or reviewing research, or in reporting research results.” All research institutions that receive federal funds must have policies and procedures in place to investigate and report research misconduct, and anyone who is aware of a potential act of misconduct must follow these policies and procedures.

Scientists who violate standards other than FFP are said to engage in “questionable research practices.” Scientists and their institutions should act to discourage questionable research practices (QRPs) through a broad range of formal and informal methods in the research environment. They should also accept responsibility for determining which questionable research practices are serious enough to warrant institutional penalties.

Standards apply throughout the research enterprise, but “scientific practices” can vary among disciplines or laboratories. Understanding both the underlying standards and the differing practices in research is important to working successfully with others.

ADVISING AND MENTORING

All researchers have had advisers; many are fortunate to have acquired mentors as well. An adviser oversees the conduct of research, offering guidance and advice on matters connected to research. A mentor—who also may be an adviser—takes a personal as well as a professional interest in the development of a researcher. A mentor might suggest a productive research direction, offer encouragement during a difficult period, help a beginning researcher gain credit for work accomplished, arrange a meeting that leads to a job offer, and offer continuing advice throughout a researcher's career. Many successful researchers can point to mentors who helped them succeed.

Researchers in need of mentors have many options. Fellow researchers and research assistants, administrators, and support staff all can serve as mentors. Indeed, it is useful to build a diverse community of mentors, because no one mentor usually has the expertise, background, and time to satisfy all the needs of a mentee.

Mentors themselves can benefit greatly from the mentoring that they provide. Through mentoring others, researchers can be exposed to new ideas, build a strong research program and network of collaborators, and gain the friendship and respect of beginning researchers. Mentoring fosters a social cohesion in science that keeps the profession strong, and every researcher, at a variety of stages in his or her career, should act as a mentor to others.

Advisers and mentors often have considerable influence over the lives of beginning researchers, and they must be careful not to abuse their authority. The relationship between an adviser or mentor and an advisee or mentee can be complex, and conflicts can arise over the allocation of credit, publication practices, or the proper division of responsibilities. The main role of an adviser or mentor is to help a researcher move along a productive and successful career trajectory. By maintaining and modeling high standards of conduct, advisers and mentors gain the moral authority to demand the same of others.

A Change of Plans

Joseph came back from a brief summer vacation convinced that he would be able to finish up his Ph.D. in one more semester. Though he had not discussed the status of his thesis with his adviser or any other member of his thesis committee since the spring, he was sure they would agree that he could finish up quickly. In fact, he had already begun drawing up a list of companies to which he planned to apply for a research position.

However, when his research adviser heard about his plans, she immediately objected. She told him that the measurements he had made were not going to be enough to satisfy his dissertation committee. She said that he should plan to spend at least two more semesters on campus doing additional measurements and finishing his dissertation.

Joseph had always had a good working relationship with his adviser, and her advice had been very helpful in the past. Plus, he knew that he would need a good recommendation from her to get the jobs that he wanted. But he couldn't help but wonder if her advice this time might be self-serving, since her own research would benefit greatly from the additional set of measurements.

1. Should Joseph try to change his adviser's mind? For example, should he review what his measurements already show and compare that with what the new measurements would add and then ask his adviser to reconsider?
2. Should Joseph talk with other members of his thesis committee to get their opinions?
3. What actions could Joseph have taken earlier to avoid the problem?
4. What actions can Joseph take now to avoid future disappointment?

Beginning researchers also have responsibilities toward their advisers and mentors. They should develop clear expectations with advisers and mentors concerning availability and meeting times. Also, beginning researchers have a responsibility to seek out and work with mentors rather than expect that potential mentors will seek them out (though potential mentors often do take the initiative in establishing these relationships). Readily available guidelines that spell out the expectations of advisers, mentors, advisees, and mentees—whether provided through individual research groups or through research

Choosing a Research Group

When a graduate student or postdoctoral fellow is deciding whether to join a research group, gathering information about the group and its leaders is valuable in helping that individual arrive at a good decision. Sometimes this information can be acquired from written materials, from conversations with current or previous students or postdoctoral fellows in the group, or by asking the senior researcher directly. This may help to determine whether you are really interested in the research that the group is or will be pursuing. Among the useful questions that could be asked are the following:^a

- Who oversees the work of beginning researchers?
- Will a research adviser also serve as a mentor? If so, what is that person's mentoring style?
- What role does a trainee have in choosing and developing a project?
 - How long do graduate students or postdoctoral fellows typically take to finish their training?
 - What are the sources of funding for a project, and is the funding likely to be disrupted?
 - Do beginning researchers participate in writing journal articles, and how are they recognized as authors?
 - How much competition is there among group members and between the group and other groups?
 - Are there potential dangers from chemical, biological, or radioactive agents? If so, what training is offered in these areas?
 - What are the policies regarding ownership of intellectual property developed by the group?
 - Are graduate students and postdoctoral fellows discouraged from continuing their projects when they leave?
 - Are graduate students and postdoctoral fellows encouraged and funded to attend professional meetings and make presentations?
 - Are there opportunities for other kinds of professional development, such as giving lectures, supervising others, or applying for funds?

^aFor additional questions, please see: Committee on Science, Engineering, and Public Policy, Phillip A. Griffiths, Chair, *Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering*, National Academy Press, 1997. 84 pp.

institutions—can define the terms of these relationships. As with all relationships between humans, there can be no guarantee for compatibility, but both sides should act professionally, and institutions must promote good advising and mentoring by rewarding individuals who exhibit these skills and by offering training in how to become a better adviser or mentor.

THE TREATMENT OF DATA

In order to conduct research responsibly, graduate students need to understand how to treat data correctly. In 2002, the editors of the *Journal of Cell Biology* began to test the images in all accepted manuscripts to see if they had been altered in ways that violated the journal's guidelines. About a quarter of the papers had images that showed evidence of inappropriate manipulation. The editors requested the original data for these papers, compared the original data with the submitted images, and required that figures be remade to accord with the guidelines. In about 1 percent of the papers, the editors found evidence for what they termed "fraudulent manipulation" that affected conclusions drawn in the paper, resulting in the papers' rejection.

Researchers who manipulate their data in ways that deceive others, even if the manipulation seems insignificant at the time, are violating both the basic values and widely accepted professional standards of science. Researchers draw conclusions based on their observations of nature. If data are altered to present a case that is stronger than the data warrant, researchers fail to fulfill all three of the obligations described at the beginning of this guide. They mislead their colleagues and potentially impede progress in their field or research. They undermine their own authority and trustworthiness as researchers. And they introduce information into the scientific record that could cause harm to the broader society, as when the dangers of a medical treatment are understated.

This is particularly important in an age in which the Internet allows for an almost uncontrollably fast and extensive spread of information to an increasingly broad audience. Misleading or inaccurate data can thus have far-reaching and unpredictable consequences of a magnitude not known before the Internet and other modern communication technologies.

Misleading data can arise from poor experimental design or careless measurements as well as from improper manipulation. Over time,

researchers have developed and have continually improved methods and tools designed to maintain the integrity of research. Some of these methods and tools are used within specific fields of research, such as statistical tests of significance, double-blind trials, and proper phrasing of questions on surveys. Others apply across all research fields, such as describing to others what one has done so that research data and results can be verified and extended.

Because of the critical importance of methods, scientific papers must include a description of the procedures used to produce the data, sufficient to permit reviewers and readers of a scientific paper to evaluate not only the validity of the data but also the reliability of the methods used to derive those data. If this information is not available, other researchers may be less likely to accept the data and the conclusions drawn from them. They also may be unable to reproduce accurately the conditions under which the data were derived.

The best methods will count for little if data are recorded incorrectly or haphazardly. The requirements for data collection differ among disciplines and research groups, but researchers have a fundamental obligation to create and maintain an accurate, accessible, and permanent record of what they have done in sufficient detail for others to check and replicate their work. Depending on the field, this obligation may require entering data into bound notebooks with sequentially numbered pages using permanent ink, using a computer application with secure data entry fields, identifying when and where work was done, and retaining data for specified lengths of time. In much industrial research and in some academic research, data notebooks need to be signed and dated by a witness on a daily basis.

Unfortunately, beginning researchers often receive little or no formal training in recording, analyzing, storing, or sharing data. Regularly scheduled meetings to discuss data issues and policies maintained by research groups and institutions can establish clear expectations and responsibilities.

The Selection of Data

Deborah, a third-year graduate student, and Kamala, a postdoctoral fellow, have made a series of measurements on a new experimental semiconductor material using an expensive neutron test at a national laboratory. When they return to their own laboratory and examine the data, a newly proposed mathematical explanation of the semiconductor's behavior predicts results indicated by a curve.

During the measurements at the national laboratory, Deborah and Kamala observed electrical power fluctuations that they could not control or predict were affecting their detector. They suspect the fluctuations affected some of their measurements, but they don't know which ones.

When Deborah and Kamala begin to write up their results to present at a lab meeting, which they know will be the first step in preparing a publication, Kamala suggests dropping two anomalous data points near the horizontal axis from the graph they are preparing. She says that due to their deviation from the theoretical curve, the low data points were obviously caused by the power fluctuations. Furthermore, the deviations were outside the expected error bars calculated for the remaining data points.

Deborah is concerned that dropping the two points could be seen as manipulating the data. She and Kamala could not be sure that any of their data points, if any, were affected by the power fluctuations. They also did not know if the theoretical prediction was valid. She wants to do a separate analysis that includes the points and discuss the issue in the lab meeting. But Kamala says that if they include the data points in their talk, others will think the issue important enough to discuss in a draft paper, which will make it harder to get the paper published. Instead, she and Deborah should use their professional judgment to drop the points now.

1. What factors should Kamala and Deborah take into account in deciding how to present the data from their experiment?
2. Should the new explanation predicting the results affect their deliberations?
3. Should a draft paper be prepared at this point?
4. If Deborah and Kamala can't agree on how the data should be presented, should one of them consider not being an author of the paper?

Most researchers are not required to share data with others as soon as the data are generated, although a few disciplines have adopted this standard to speed the pace of research. A period of confidentiality allows researchers to check the accuracy of their data and draw conclusions.

However, when a scientific paper or book is published, other researchers must have access to the data and research materials needed to support the conclusions stated in the publication if they are to verify and build on that research. Many research institutions, funding agencies, and scientific journals have policies that require the sharing of data and unique research materials. Given the expectation that data will be accessible, researchers who refuse to share the evidentiary basis behind their conclusions, or the materials needed to replicate published experiments, fail to maintain the standards of science.

In some cases, research data or materials may be too voluminous, unwieldy, or costly to share quickly and without expense. Nevertheless, researchers have a responsibility to devise ways to share their data and materials in the best ways possible. For example, centralized facilities or collaborative efforts can provide a cost-effective way of providing research materials or information from large databases. Examples include repositories established to maintain and distribute astronomical images, protein sequences, archaeological data, cell lines, reagents, and transgenic animals.

New issues in the treatment and sharing of data continue to arise as scientific disciplines evolve and new technologies appear. Some forms of data undergo extensive analysis before being recorded; consequently, sharing those data can require sharing the software and sometimes the hardware used to analyze them. Because digital technologies are rapidly changing, some data stored electronically may be inaccessible in a few years unless provisions are made to transport the data from one platform to another. New forms of publication are challenging traditional practices associated with publication and the evaluation of scholarly work.

MISTAKES AND NEGLIGENCE

All scientific research is susceptible to error. At the frontiers of knowledge, experimental techniques often are pushed to the limit, the signal can be difficult to separate from the noise, and even the question to be answered may not be well defined. In such an uncertain and fluid situation, identifying reliable data in a mass of confusing and sometimes contradictory observations can be extremely difficult.

Furthermore, researchers sometimes have to take risks to explore an innovative idea or observation. They may have to rely on a theoretical or experimental technique that is not fully developed, or they may have to extend a conjecture into new realms. Such risk taking does not excuse sloppy research, but it should not be condemned as misguided.

Finally, all researchers are human. They do not have limitless working time or access to unlimited resources. Even the most responsible researcher can make an honest mistake in the design of an experiment, the calibration of instruments, the recording of data, the interpretation of results, or other aspects of research.

Despite these difficulties, researchers have an obligation to the public, to their profession, and to themselves to be as accurate and as careful as possible. Scientific disciplines have developed methods and practices designed to minimize the possibility of mistakes, and failing to observe these methods violates the standards of science. Every scientific result must be carefully prepared, submitted to the peer review process, and scrutinized even after publication.

Beyond honest errors are mistakes caused by negligence. Haste, carelessness, inattention—any of a number of faults can lead to work that does not meet scientific standards or the practices of a discipline. Researchers who are negligent are placing their reputation, the work of their colleagues, and the public's confidence in science at risk. Errors can do serious damage both within science and in the broader society that relies on scientific results. Though science is built on the

Changing Knowledge

In the early part of the 20th century, astronomers engaged in a prolonged debate over what were then known as spiral nebulae—diffuse pinwheels of light that powerful telescopes revealed to be common in the night sky. Some astronomers thought that these nebulae were spiral galaxies like the Milky Way at such great distances from the Earth that individual stars could not be distinguished. Others believed that they were clouds of gas within our own galaxy.

One astronomer who thought that spiral nebulae were within the Milky Way, Adriaan van Maanen of the Mount Wilson Observatory, sought to resolve the issue by comparing photographs of the nebulae taken several years apart. After making a series of painstaking measurements, van Maanen announced that he had found roughly consistent unwinding motions in the nebulae. The detection of such motions indicated that the spirals had to be within the Milky Way, since motions would be impossible to detect in distant objects.

Van Maanen's reputation caused many astronomers to accept a galactic location for the nebulae. A few years later, however, van Maanen's colleague Edwin Hubble, using a new 100-inch telescope at Mount Wilson, conclusively demonstrated that the nebulae were in fact distant galaxies; van Maanen's observations had to be wrong.

Studies of van Maanen's procedures have not revealed any intentional misrepresentation or sources of systematic error. Rather, he was working at the limits of observational accuracy, and his expectations influenced his measurements. Even cautious researchers sometimes admit, "If I hadn't believed it, I never would have seen it."

idea that peers will validate results, actual replication is selective. It is not practical (or necessary) to reconstruct all the observations and theoretical constructs made by others. To make progress, researchers must trust that previous investigators performed the work in accordance with accepted standards.

Some mistakes in the scientific record are quickly corrected by subsequent work. But mistakes that mislead subsequent researchers can waste large amounts of time and resources. When such a mistake appears in a journal article or book, it should be corrected in a note, erratum (for a production error), or corrigendum (for an author's

error). Mistakes in other documents that are part of the scientific record—including research proposals, laboratory records, progress reports, abstracts, theses, and internal reports—should be corrected in a way that maintains the integrity of the original record and at the same time keeps other researchers from building on the erroneous results reported in the original.

Discovering an Error

Two young faculty members—Marie, an epidemiologist in the medical school, and Yuan, a statistician in the mathematics department—have published two well-received papers about the spread of infections in populations. As Yuan is working on the simulation he has created to model infections, he realizes that a coding error has led to incorrect results that were published in the two papers. He sees, with great relief, that correcting the error does not change the average time it takes for an infection to spread. But the correct model exhibits greater uncertainty in its results, making predictions about the spread of an infection less definite.

When he discusses the problem with Marie, she argues against sending corrections to the journals where the two earlier articles were published. “Both papers will be seen as suspect if we do that, and the changes don’t affect the main conclusions in the papers anyway,” she says. Their next paper will contain results based on the corrected model, and Yuan can post the corrected model on his Web page.

1. What obligations do the authors owe their professional colleagues to correct the published record?
2. How should their decisions be affected by how the model is being used by others?
3. What other options exist beyond publishing a formal correction?

RESEARCH MISCONDUCT

Some research behaviors are so at odds with the core principles of science that they are treated very harshly by the scientific community and by institutions that oversee research. Anyone who engages in these behaviors is putting his or her scientific career at risk and is threatening the overall reputation of science and the health and welfare of the intended beneficiaries of research.

Collectively these actions have come to be known as scientific misconduct. A statement developed by the U.S. Office of Science and Technology Policy, which has been adopted by most research-funding agencies, defines misconduct as “fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.” According to the statement, the three elements of misconduct are defined as follows:

- Fabrication is “making up data or results.”
- Falsification is “manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.”
- Plagiarism is “the appropriation of another person’s ideas, processes, results, or words without giving appropriate credit.”

In addition, the federal statement says that to be considered research misconduct, actions must represent a “significant departure from accepted practices,” must have been “committed intentionally, or knowingly, or recklessly,” and must be “proven by a preponderance of evidence.” According to the statement, “research misconduct does not include differences of opinion.”

Some research institutions and research-funding agencies define scientific research misconduct more broadly. These institutional definitions may add, for example, abuse of confidentiality in peer review, failure to allocate credit appropriately in scientific publications, not

A Breach of Trust

Beginning in 1998, a series of remarkable papers attracted great attention within the condensed matter physics community. The papers, based largely on work done at Bell Laboratories, described methods that could create carbon-based materials with long-sought properties, including superconductivity and molecular-level switching. However, when other materials scientists sought to reproduce or extend the results, they were unsuccessful.

In 2001, several physicists inside and outside Bell Laboratories began to notice anomalies in some of the papers. Several contained figures that were very similar, even though they described different experimental systems. Some graphs seemed too smooth to describe real-life systems. Suspicion quickly fell on a young researcher named Jan Hendrik Schön, who had helped create the materials, had made the physical measurements on them, and was a coauthor on all the papers.

Bell Laboratories convened a committee of five outside researchers to examine the results published in 25 papers. Schön, who had conducted part of the work in the laboratory where he did his Ph.D. at the University of Konstanz in Germany, told the committee that the devices he had studied were no longer running or had been thrown away. He also said that he had deleted his primary electronic data files because he did not have room to store them on his old computer and that he kept no data notebooks while he was performing the work.

The committee did not accept Schön's explanations and eventually concluded that he had engaged in fabrication in at least 16 of the 25 papers. Schön was fired from Bell Laboratories and later left the United States. In a letter to the committee, he wrote that "I admit I made various mistakes in my scientific work, which I deeply regret." Yet he maintained that he "observed experimentally the various physical effects reported in these publications."

The committee concluded that Schön acted alone and that his 20 coauthors on the papers were not guilty of scientific misconduct. However, the committee also raised the issue of the responsibility coauthors have to oversee the work of their colleagues, while acknowledging that no consensus yet exists on the extent of this responsibility. The senior author on several of the papers, all of which were later retracted, wrote that he should have asked Schön for more detailed data and checked his work more carefully, but that he trusted Schön to do his work honestly. In response to the incident, Bell Laboratories instituted new policies for data retention and internal review of results before publication. It also developed a new research ethics statement for its employees.

observing regulations governing research, failure to report misconduct, or retaliation against individuals who report misconduct to the list of behaviors that are considered misconduct. In addition, the National Science Foundation has retained a clause in its misconduct policies that includes behaviors that seriously deviate from commonly accepted research practices as possible misconduct.

A crucial distinction between falsification, fabrication, and plagiarism (sometimes called FFP) and error or negligence is the intent to deceive. When researchers intentionally deceive their colleagues by falsifying information, fabricating research results, or using others' words and ideas without giving credit, they are violating fundamental research standards and basic societal values. These actions are seen as

Fabrication in a Grant Proposal

Vijay, who has just finished his first year of graduate school, is applying to the National Science Foundation for a predoctoral fellowship. His work in a lab where he did a rotation project was later carried on successfully by others, and it appears that a manuscript will be prepared for publication by the end of the summer. However, the fellowship application deadline is June 1, and Vijay decides it would be advantageous to list a publication as "submitted" rather than "in progress." Without consulting the faculty member or other colleagues involved, Vijay makes up a title and author list for a "submitted" paper and cites it in his application.

After the application has been mailed, a lab member sees it and goes to the faculty member to ask about the "submitted" manuscript. Vijay admits to fabricating the submission of the paper but explains his actions by saying that he thought the practice was not uncommon in science. The faculty members in Vijay's department demand that he withdraw his grant proposal and dismiss him from the graduate program.

1. Do you think that researchers often exaggerate the publication status of their work in written materials?
2. Do you think the department acted too harshly in dismissing Vijay from the graduate program?
3. If Vijay later applied to a graduate program at another institution, does that institution have the right to know what happened?
4. What were Vijay's adviser's responsibilities in reviewing the application before it was submitted?

Is It Plagiarism?

Professor Lee is writing a proposal for a research grant, and the deadline for the proposal submission is two days from now. To complete the background section of the proposal, Lee copies a few isolated sentences of a journal paper written by another author. The copied sentences consist of brief, factual, one-sentence summaries of earlier articles closely related to the proposal, descriptions of basic concepts from textbooks, and definitions of standard mathematical notations. None of these ideas is due to the other author. Lee adds a one-sentence summary of the journal paper and cites it.

1. Does the copying of a few isolated sentences in this case constitute plagiarism?
2. By citing the journal paper, has Lee given proper credit to the other author?

the worst violations of scientific standards because they undermine the trust on which science is based.

However, intent can be difficult to establish. For example, because trust in science depends so heavily on the assumption that the origin and content of scientific ideas will be treated with respect, plagiarism is taken very seriously in science, even though it does not introduce spurious results into research records in the same way that fabrication and falsification do. But someone who plagiarizes may insist it was a mistake, either in note taking or in writing, and that there was no intent to deceive. Similarly, someone accused of falsification may contend that errors resulted from honest mistakes or negligence.

Within the scientific community, the effects of misconduct—in terms of lost time, damaged reputations, and feelings of personal betrayal—can be devastating. Individuals, institutions, and even entire research fields can suffer grievous setbacks from instances of fabrication, falsification, and plagiarism. Acts of misconduct also can draw the attention of the media, policymakers, and the general public, with negative consequences for all of science and, ultimately, for the public at large.

RESPONDING TO SUSPECTED VIOLATIONS OF PROFESSIONAL STANDARDS

Science is largely a self-regulating community. Though government regulates some aspects of research, the research community is the source of most of the standards and practices to which researchers are expected to adhere. Self-regulation ensures that decisions about professional conduct will be made by experienced and qualified peers. But for self-regulation to work, researchers must be willing to alert others when they suspect that a colleague has violated professional standards or disciplinary practices.

To be sure, reporting that another researcher may have violated the standards of science is not easy. Anonymity is possible in some cases, but not always. Reprisals by the accused person and by skeptical colleagues have occurred in the past, although laws prevent institutions and individuals from retaliating against those who report concerns in good faith. Allegations of irresponsible behavior can have serious consequences for all parties concerned.

Despite these potential difficulties, someone who witnesses a colleague engaging in research misconduct has an unmistakable obligation to act. Research misconduct—particularly to fabrication, falsification, and plagiarism—has the potential to weaken the self-regulation of science, shake public confidence in the integrity of science, and forfeit the potential benefits of research. The scientific community, society, and the personal integrity of individuals all emerge stronger from efforts to uphold the fundamental values on which science is based.

All research institutions that receive federal funds must have policies and procedures in place to investigate and report research misconduct, and anyone who is aware of a potential act of misconduct must follow these policies and procedures. As noted in the previous section, institutions may define misconduct to include actions other

than fabrication, falsification, and plagiarism; hence, the responses of institutions to allegations may vary.

Scientists and their institutions should act to discourage questionable research practices (QRPs) through a broad range of formal and informal methods in the research environment. They should also accept responsibility for determining which questionable research practices are serious enough to warrant institutional penalties. But the methods used by individual scientists and research institutions to address questionable research practices should be distinct from those for handling misconduct in science. In addition, different scientific fields may approach the task of defining QRPs in varying ways. For instance, in some fields the practice of salami publishing—deliberately dividing research results into the “least publishable units” to increase the count of one’s publications—is seen as more questionable than in other fields.

The circumstances surrounding potential violations of scientific standards are so varied that it is impossible to lay out a checklist of what should be done. Suspicions are best raised in the form of questions rather than allegations. Expressing concern about a situation or asking for clarification generally works better than making charges. When questioning the actions of others, it is important to remain objective, fair, and unemotional. In some cases, it may be possible to talk with the person suspected of violating standards—perhaps the suspicion arose through a misunderstanding. But such discussions often are not possible or do not have a satisfactory outcome.

Another possibility is to discuss the situation with a good friend or trusted adviser. The possible consequences of this option need to be thoroughly considered in advance. Concerns about misconduct generally should be kept confidential, so a friend or adviser needs to be able to ensure confidentiality or to be honest about when confidentiality cannot be ensured. Sometimes the broad outlines of a case can be discussed without revealing details.

Treatment of Misconduct by a Journal

The emergence of embryonic stem cell cloning through somatic cell nuclear transfer as a “hot field” in the 1995–2005 period created pressures on all scientists to be first to achieve breakthroughs. The birth of Dolly the sheep at the Roslin Institute in Scotland in 1996 had a massive impact: the theoretical had happened and was visible. The race to clone other mammals, including humans, was seen by many as the potential capstone of a career.

In August 2005, a team at Seoul National University led by Hwang Woo-Suk reported in the pages of *Nature* the cloning of a dog, long considered to be much too complex to achieve, and Snuppy the dog became a symbol of the emergence of world-class stem cell research in Korea. The research team had been working in parallel on a project to create a stem cell line from a cloned human blastocyst, which was reported first in papers in *Science* in 2004 and 2005, stunning the scientific community worldwide.

Within weeks of the second paper appearing in print, skepticism arose about the claims made in the paper, particularly about the source and number of the oocytes used in the experiments. As an investigation looked into the research, more aspects unraveled, including the validity of the claimed data. By January 2006, the university’s investigative team had determined that the papers were largely fraudulent, had to be withdrawn, and Hwang was prosecuted for the misuse of research funds. At *Science*, an editorial retraction was published: “Because the final report of the SNU investigation indicated that a significant amount of the data presented in both papers is fabricated, the editors of *Science* feel that an immediate and unconditional retraction of both papers is needed. We therefore retract these two papers and advise the scientific community that the results reported in them are deemed to be invalid.”

From the point of view of scientists working in the field of stem cell biology, it was an enormous setback. The *Science* editorial made clear the waste of resources: “*Science* regrets the time that the peer reviewers and others spent evaluating these papers as well as the time and resources that the scientific community may have spent trying to replicate these results.”^a They effectively lost several years of work in assuming the validity of the published articles. The public’s faith in the field was shaken, with consequences for the support of stem cell research that earlier existed. An independent review of the editorial procedures at *Science* provided insights into needed changes—new rules to ensure the authenticity of images, identification of the specific contribution of each author, undertaking a “risk assessment” on papers that might be more prone to fraud.

^aKennedy, D. “Editorial Retraction” *Science* 31 (2006):335.

A Career in the Balance

Peter was just months away from finishing his Ph.D. dissertation when he realized that something was seriously amiss with the work of a fellow graduate student, Jimmy. Peter was convinced that Jimmy was not actually making the measurements he claimed to be making. They shared the same lab, but Jimmy rarely seemed to be there. Sometimes Peter saw research materials thrown away unopened. The results Jimmy was turning in to their common thesis adviser seemed too clean to be real.

Peter knew that he would soon need to ask his thesis adviser for a letter of recommendation for faculty and postdoctoral positions. If he raised the issue with his adviser now, he was sure that it would affect the letter of recommendation. Jimmy was a favorite of his adviser, who had often helped Jimmy before when his project ran into problems. Yet Peter also knew that if he waited to raise the issue, the question would inevitably arise as to when he first suspected problems. Both Peter and his thesis adviser were using Jimmy's results in their own research. If Jimmy's data were inaccurate, they both needed to know as soon as possible.

1. What kind of evidence should Peter have to be able to go to his adviser?
2. Should Peter first try to talk with Jimmy, with his adviser, or with someone else entirely?
3. What other resources can Peter turn to for information that could help him decide what to do?

Major federal agencies have instituted policies requiring that research institutions designate an official, usually called the research integrity officer, who is available to discuss situations involving suspected misconduct. Some institutions have several such designated officials so that complainants can go to a person with whom they feel comfortable.

Someone in a position to report a suspected violation of professional standards must clearly understand the standard in question and the evidence bearing on the case. He or she should think about the interests of everyone involved and ask what might be the possible re-

sponses of those individuals. It also is important to examine carefully one's own motivations and biases, since others inevitably will do so.

Institutional policies generally divide investigations of suspected misconduct into an initial inquiry to gather information and a formal investigation to reach conclusions and decide on responses. These procedures are designed to take into account fairness for the accused, protection for the accuser, and coordination with funding agencies. A model for this process can be seen in the guidelines set by the Department of Health and Human Services Office of Research Integrity.

HUMAN PARTICIPANTS AND ANIMAL SUBJECTS IN RESEARCH

Any scientist who conducts research with human participants needs to protect the interest of research subjects by complying with federal, state, and local regulations and with relevant codes established by professional groups. These provisions are designed to ensure that risks to human participants are minimized; that risks are reasonable given the expected benefits; that the participants or their authorized representatives provide informed consent; that the investigator has informed participants of key elements of the study protocol; and that the privacy of participants and the confidentiality of data are maintained.

U.S. federal regulations known as the Common Rule lay out requirements for research involving human participants. The Common Rule specifies which types of research fall under its jurisdiction, the provisions for obtaining informed consent, the procedures needed to gain approval of a project, and the training that researchers must undergo to use human participants in research. Federally funded research involving human participants also must be reviewed and approved by independent committees known as Institutional Review Boards (IRBs).² IRBs must approve all research covered by the Common Rule, must conduct regular reviews of such research, and must review and approve proposed changes in ongoing research. IRBs also have the authority to monitor informed consent procedures, gather information on adverse events, and examine conflicts of interest. These policies generally are observed for non-federally funded research as well and are followed in an increasing number of countries around the world.

The involvement of human participants in research can raise difficult questions. Should people be asked to participate in studies

²While IRBs are independent, they are local review committees that fall under the jurisdiction of the funded research institution.

Tests on Students

For his dissertation project in psychology, Antonio is studying new approaches to strengthen memory. He can apply these techniques to create interactive Web-based instructional modules. He plans to test these modules with students in a general psychology course for which he is a teaching assistant. He expects that student volunteers who use the modules will subsequently perform better on examinations than other students. He hopes to publish the results in a conference proceedings on research in learning, because he plans to apply for an academic position after he completes the doctorate.

1. Should Antonio seek IRB approval for his research project with human participants?
2. What do students need to be told about Antonio's project? Do they need to give formal informed consent?

that involve some risk to themselves with no prospect of benefits? How should consent provisions be modified for children, prisoners, the mentally ill, the undereducated, or other vulnerable populations? Should the same provisions apply to all research conducted everywhere in the world, or should standards be modified to reflect local conditions? Formal training in bioethics is sometimes needed to analyze the complex moral issues raised by human participation in research, and various bodies, such as the President's Council on Bioethics in the United States, are continuing to study these issues. At a minimum, anyone who engages in research that involves humans must be aware of all relevant regulations and have appropriate training.

The use of animals in research and research training is also subject to regulations and professional codes. The federal Animal Welfare Act seeks "to insure that animals intended for use in research facilities . . . are provided humane care and treatment." The U.S. Public Health Service's *Policy on the Humane Care and Use of Laboratory Ani-*

A Change of Protocol

Hua is doing a postdoctoral fellowship in a laboratory that studies cancer treatment. In the experiment she is overseeing, a cancer-prone strain of mice is allowed to develop visible tumors and then receives experimental drugs to observe the effects on the tumors.

Hua notices that the tumors are interfering with the ability of some of the mice to eat and drink. She also notices that some of the mice are weaker and more emaciated than the others, which she suspects is a consequence of their feeding difficulties. The protocol for the experiment states that the mice will be treated only if they exhibit obvious signs of pain or discomfort.

When she mentions her concerns to another postdoctoral fellow, he suggests not raising the issue with the rest of the lab. The mice will be euthanized as soon as the experiment is over, and their nutritional status probably has little or no effect on the drug treatment. Furthermore, if it proved necessary to change the experimental protocol, the previous work would be invalidated and the Institutional Animal Care and Use Committee would need to be notified.

1. What can Hua do to get more information about the issue?
2. If she decides to raise the issue with others, what is the best way to do so?
3. Should the original protocol have been approved?

mals, which applies to all animal research supported by the National Institutes of Health, requires institutions “to establish and maintain proper measures to ensure the appropriate care and use of all animals involved in research, research training, and biological testing.” The policy requires adherence with both the Animal Welfare Act and the *Guide for the Care and Use of Laboratory Animals*, a document prepared and regularly updated by committees under the National Research Council. Guidance for researchers who use animals recommends that researchers carefully consider the “three R’s” of animal testing alternatives: reduction in the numbers of animals used, refinement of techniques and procedures to reduce pain and distress, and replacement of conscious living higher animals with insentient material. Anyone who plans to use animals in research or teaching must be familiar with

the relevant regulations and the guide and must receive appropriate training before beginning work.

The Animal Welfare Act and the *Policy on the Humane Care and Use of Laboratory Animals* both require institutions to have Institutional Animal Care and Use Committees (IACUCs), which include experts in the care of animals and members of the public. These committees review and approve research proposals using animals, oversee animal care programs and facilities, and respond to concerns about the use of animals in research. Also, private organizations like the American Association for the Accreditation of Laboratory Animal Care accredit research institutions using existing regulations and the guide as standards.

LABORATORY SAFETY IN RESEARCH

In addition to human participants and animal subjects in research, governmental regulations and professional guidelines cover other aspects of research, including the use of grant funds, the sharing of research results, the handling of hazardous materials, and laboratory safety.

These last two issues are sometimes overlooked in research, but no researcher or scientific discipline is immune from accidents. An estimated half million workers in the United States handle hazardous biological materials every day. A March 2006 explosion at the National Institute of Higher Learning in Chemistry in Mulhouse, France, killed a distinguished researcher and caused \$130 million in damage.

Researchers should review information and procedures about safety issues at least once a year. A short checklist of subjects to cover includes:

- appropriate usage of protective equipment and clothing
- safe handling of materials in laboratories
- safe operation of equipment
- safe disposal of materials
- safety management and accountability
- hazard assessment processes
- safe transportation of materials between laboratories
- safe design of facilities
- emergency responses
- safety education of all personnel before entering the laboratory
- applicable government regulations

SHARING OF RESEARCH RESULTS

In the 17th century, many scientists kept new findings secret so that others could not claim the results as their own. Prominent figures of the time, including Isaac Newton, often avoided announcing their discoveries for fear that someone else would claim priority.

The solution to the problem of making new discoveries available to others while assuring their authors credit was worked out by Henry Oldenburg, the secretary of the Royal Society of London. He won over scientists by guaranteeing both rapid publication in the society's *Philosophical Transactions* and the official support of the society if the author's priority was questioned. Oldenburg also pioneered the practice of sending submitted manuscripts to experts who could judge their quality. Out of these arrangements emerged both the modern scientific journal and the practice of peer review.

Various publication practices, such as the standard scope of a manuscript and authorship criteria, vary from field to field, and digital technologies are creating new forms of publication. Nevertheless, publication in a peer-reviewed journal remains the most important way of disseminating a complete set of research results. The importance of publication accounts for the fact that the first to publish a view or finding—not the first to discover it—tends to get most of the credit for the discovery.

Once results are published, they can be freely used by other researchers to extend knowledge. But until the results are so widely known and familiar that they have become common knowledge, people who use them are obliged to recognize the discoverer by means of citations. In this way, researchers are rewarded by the recognition of their peers for making results public.

It may be tempting to adopt a useful idea from an article, manuscript, or even a casual conversation without giving credit to the originator of that idea. But researchers have an obligation to be scrupulously honest with themselves and with others regarding the use

of others' ideas. This allows readers to locate the original source the author has used to justify a conclusion, and to find more detailed information about how earlier work was done and how the current work differs. Researchers also are expected to treat the information in a manuscript submitted to a journal to be considered for publication or a grant proposal submitted to an agency for funding as confidential.

Proper citation, too, is essential to the value of a reference. When analyzed carefully, many citation lists in published papers contain numerous errors. Beyond incorrect spellings, titles, years, and page numbers, citations may not be relevant to the current work or may not support the points made in the paper. Authors may try to inflate the importance of a new paper by including a reference to previously published work but failing to clearly discuss the connection between their new results and those reported in the previous study. Practices such as responsible peer review are thus important tools to prevent these problems.

Citations are important in interpreting the novelty and significance of a paper, and they must be prepared carefully. Researchers have a responsibility to search the literature thoroughly and to cite prior work accurately. Implied in this responsibility is that authors should strive to cite (and read) the original paper rather than (or in addition to) a more recent paper or review article that relies on the earlier article.

Researchers have other ways to disseminate research findings in addition to peer-reviewed research articles. Some of these, such as seminars, conference talks, abstracts, and posters represent long-standing traditions within science. Generally, these communications are seen as preliminary in nature, giving an author the chance to get feedback on work in progress before full publication in a peer-reviewed journal.

New communication technologies provide researchers with additional ways to distribute research results quickly and broadly. For example, raw data, computational models, the outputs of instruments,

The Race to Publish

By any standard, the field of organocatalysis is highly competitive. The rapid growth of new research approaches in the last decade, combined with the short time frame in which experiments can be carried out (days or hours), fueled a frantic race to publish results ahead of others in the field.

The case of Armando Cordova, a researcher at Stockholm University, brought the symptoms of that environment to light in a recent investigation by the university for research misconduct. The university determined that Dr. Cordova failed to cite other work properly and, instead, took credit for discoveries that were not his own; others in the field argue that the situation is more serious, more akin to fraud than ethical misconduct. As one news article noted, "They say Cordova steals research ideas at conferences and then presents the ideas as his own by publishing the results of hasty and often poorly executed parallel experiments."^a In effect, he was able to appropriate others' ideas and get them into public view first by knowing of journals where he could publish more quickly.

As C&E News recounted the case, Cordova countered that his behavior was appropriate and that he simply practiced ethics that he learned from his mentors during graduate school and his early research career. In responding to the university investigation—which required him to attend an ethics course and submit all future papers to his dean for review before submission to journals—he acknowledged a need to cite others' work better, but he argued that there will be a continuing competition to publish first.

The university review has not ended the dispute. A continuing debate among organocatalysis researchers challenges the outcome and generates a broader discussion of the viability of community norms for ethical behavior in publication of experiments. Some conclude that the issues need to be addressed not just in the context of a specific university community. Rather, they argue that clearer international standards for acceptable competition among scientists in a given field are needed—not just for the sake of currently active scientists but also for the future practices of students trained in those laboratories. For science, the cost of such competitive publishing is more than individual careers; it tends to diminish the quality of published results. It also reduces collaboration, creates a reluctance to share research results, and generally undermines the trust that has enabled scientists to constructively build on one another's discoveries.

^aWilliam G. Schulz, "Giving Proper Credit: Ethics Violations by a Chemist in Sweden Highlight Science's Unpreparedness to Deal with Misconduct" *Chemical and Engineering News* 85 (12):35-38.

simulation tools, records of deliberations, and draft papers all can be posted online and accessed by anyone before any of these results have undergone peer review.

To the extent that these new communication methods speed and broaden the dissemination and verification of results, they strengthen research. Science also benefits when more individuals have greater access to raw data for use in their own work. However, if these new ways of disseminating research results bypass traditional quality

Publication Practices

Andre, a young assistant professor, and two graduate students have been working on a series of related experiments for the past several years. Now it is time to write up the experiments for publication, but the students and Andre must first make an important decision. They could write a single paper with one first author that would describe the experiments in a comprehensive manner, or they could write two shorter, less-complete papers so that each student could be a first author.

Andre favors the first option, arguing that a single publication in a more visible journal would better suit all of their purposes. This alternative also would help Andre, who faces a tenure decision in two years. Andre's students, on the other hand, strongly suggest that two papers be prepared. They argue that one paper encompassing all the results would be too long and complex. They also say that a single paper might damage their career opportunities because they would not be able to point to a paper on which they were first authors.

1. How could Andre have anticipated this problem? And what sort of general guidelines could he have established for lab members?
2. If Andre's laboratory or institution has no official policies covering multiple authorship and multiple papers from a single study, how should this issue be resolved?
3. How could Andre and the students draw on practices within their discipline to resolve this dispute?
4. If the students feel that their concerns are not being addressed, to whom should they turn?
5. What kind of laboratory or institutional policies could keep disputes like this from occurring?
6. If a single paper is published, how can the authors make clear to review committees and funding agencies their various roles and the importance of the paper?

control mechanisms, they risk weakening conventions that have served science well. In particular, peer review offers a valuable way of evaluating and improving the quality of scientific papers. Methods of communication that do not incorporate peer review or a comparable vetting process could reduce the reliability of scientific information.

There are several reasons why researchers should refrain from making results public before those results have been peer reviewed. If a researcher publicizes a preliminary result that is later shown to be inaccurate or incorrect, considerable effort by researchers can be wasted and public trust in the scientific community can be undermined. If research results are made available to other researchers or to the public before publication in a journal, researchers need to use some kind of peer review process that may compensate for the lack of the formal journal process. Moreover, researchers should be cautious about posting anything (such as raw data or figures) to a publicly accessible Web site if they plan to publish the material in a peer-reviewed journal. Some journals consider disclosure of information on a website to be "prior publication," which could disqualify the investigator from subsequently publishing the data more formally.

Publication practices are susceptible to abuse. For example, researchers may be tempted to publish virtually the same research results in two different places, although most journals and professional societies explicitly prohibit this practice. They also may publish their results in "least publishable units"—papers that are just detailed enough to be published but do not give the full story of the research project described. These practices waste the resources and time of editors, reviewers, and readers and impose costs on the scientific enterprise. They also can be counterproductive if a researcher gains a reputation for publishing shoddy or incomplete work. Reflecting the importance of quality, some institutions and federal agencies have adopted policies that limit the number of papers that will be considered when an individual is evaluated for employment, promotion, or funding.

Restrictions on Peer Review and the Flow of Scientific Information

In some cases, scientific results cannot be freely disseminated because doing so might pose risks to commercial interests, national security, human health, or other objectives. For example, a company may choose not to publish internally conducted research that could give it an edge in the marketplace. Or a government or university-based laboratory may not be able to publish studies involving pathogens that could be used as biological weapons or mathematical results related to cryptography. These and similar restrictions on publications are controversial and (widely) debated.

Researchers working under such conditions may need to find alternate ways of exposing their work to professional scrutiny. For example, internal reviewers or properly structured visiting committees can examine proprietary or classified research while maintaining confidentiality.

The publication of results from fundamental scientific research has generally not been restricted in the United States unless those results are deemed so critical to national security that they are classified. The most recent episodes stem from the terrorist attacks of September 11th and the subsequent anthrax incidents in Washington in 2001. The U.S. government adopted or considered measures to restrict access to an expanded range of information or materials, to increase the monitoring of foreign students and researchers, and to screen some publications for "sensitive information." All of these steps reduce the traditional openness of scientific research and must continually be carefully weighed against the national security benefits they might produce.

AUTHORSHIP AND THE ALLOCATION OF CREDIT

When a paper is published, the list of authors indicates who has contributed to the work. Apportioning credit for work done as a team can be difficult, but the peer recognition generated by authorship is important in a scientific career and needs to be allocated appropriately.

Authorship conventions may differ greatly among disciplines and among research groups. In some disciplines the group leader's name is always last, while in others it is always first. In some scientific fields, research supervisors' names rarely appear on papers, while in others the head of a research group is an author on almost every paper associated with the group. Some research groups and journals simply list authors alphabetically.

Many journals and professional societies have published guidelines that lay out the conventions for authorship in particular disciplines. Frank and open discussion of how these guidelines apply within a particular research project—as early in the research process as possible—can reduce later difficulties. Sometimes decisions about authorship cannot be made at the beginning of a project. In such cases, continuing discussion of the allocation of credit generally is preferable to making such decisions at the end of a project.

Decisions about authorship can be especially difficult in interdisciplinary collaborations or multigroup projects. Collaborators from different groups or scientific disciplines should be familiar with the conventions in all the fields involved in the collaboration. The best practice is for authorship criteria to be written down and shared among all collaborators.

Several considerations must be weighed in determining the proper division of credit between investigators working on a project. If one researcher has defined and put a project into motion and a second researcher is invited to join in later, the first researcher may re-

ceive much of the credit for the project even if the second researcher makes major contributions. Similarly, when an established researcher initiates a project, that individual may receive more credit than a beginning researcher who spends much of his or her time working on the project. When a beginning researcher makes an intellectual contribution to a project, that contribution deserves to be recognized, including when the work is undertaken independently of the laboratory's principal investigator. Established researchers are well aware of the importance of credit in science where traditions expect them to be generous in their allocation of credit to beginning researchers.

Sometimes a name is included in a list of authors even though that person had little or nothing to do with the content of a paper. Including "honorary," "guest," or "gift" authors dilutes the credit due the people who actually did the work, inflates the credentials of the added authors, and makes the proper attribution of credit more difficult. Journals, the administrators of research institutions, and researchers should all work to avoid this practice. Similarly, ghost authorship,

Who Gets Credit?

Robert has been working in a large engineering company for three years following his postdoctoral fellowship. Using computer simulations, he has developed a method to constrain the turbulent mixing that occurs near the walls of a tokamak fusion reactor. He has written a paper for *Physical Review* and has submitted it to the head of his research group for review. The head of the group says that the paper is fine but that, as the supervisor of the research, he needs to be included as an author of the paper. Yet Robert knows that his supervisor did not make any direct intellectual contribution to the paper.

1. How should Robert respond to his supervisor's demand to be an honorary author?
2. What ways might be possible to appeal the decision within the company?
3. What other resources exist that Robert can use in dealing with this issue?

where a person who writes a paper is not listed among the authors, misleads readers and also should be condemned.

Policies at most scientific journals state that a person should be listed as the author of a paper only if that person made a direct and substantial intellectual contribution to the design of the research, the interpretation of the data, or the drafting of the paper, although students will find that scientific fields and specific journals vary in their policies. Just providing the laboratory space for a project or furnishing a sample used in the research is not sufficient to be included as an author, though such contributions may be recognized in a footnote or in a separate acknowledgments section. The acknowledgments sections also can be used to thank others who contributed to the work reported by the paper.

The list of authors establishes accountability as well as credit. When a paper is found to contain errors, whether caused by mistakes or deceit, authors might wish to disavow responsibility, saying that they were not involved in the part of the paper containing the errors or that they had very little to do with the paper in general. However, an author who is willing to take credit for a paper must also bear responsibility for its errors or explain why he or she had no professional responsibility for the material in question.

The distribution of accountability can be especially difficult in interdisciplinary research. Authors from one discipline may say that they are not responsible for the accuracy of material provided by authors from another discipline. A contrasting view is that each author needs to be confident of the accuracy of everything in the paper—perhaps by having a trusted colleague read the parts of the paper outside one's own discipline. One obvious but often overlooked solution to this problem is to add a footnote accompanying the list of authors that apportions responsibility for different parts of the paper.

Who Should Get Credit for the Discovery of Pulsars?

A much-discussed example of the difficulties associated with allocating credit between beginning and established researchers was the 1967 discovery of pulsars by Jocelyn Bell, then a 24-year-old graduate student. Over the previous two years, Bell and several other students, under the supervision of Bell's thesis adviser, Anthony Hewish, had built a 4.5-acre radio telescope to investigate scintillating radio sources in the sky. After the telescope began functioning, Bell was in charge of operating it and analyzing its data under Hewish's direction. One day Bell noticed "a bit of scruff" on the data chart. She remembered seeing the same signal earlier, and by measuring the period of its recurrence, she determined that it had to be coming from an extraterrestrial source. Together Bell and Hewish analyzed the signal and found several similar examples elsewhere in the sky. After discarding the idea that the signals were coming from an extraterrestrial intelligence, Hewish, Bell, and three other people involved in the project published a paper announcing the discovery, which was given the name "pulsar" by a British science reporter.

Many argued that Bell should have shared the Nobel Prize awarded to Hewish for the discovery, saying that her recognition of the signal was the crucial act of discovery. Others, including Bell herself, said that she received adequate recognition in other ways and should not have been so lavishly rewarded for doing what a graduate student is expected to do in a project conceived and set up by others.

INTELLECTUAL PROPERTY

Discoveries made through scientific research can have great value—to researchers in advancing knowledge, to governments in setting public policy, and to industry in developing new products. Researchers should be aware of this potential value and of the interest of their laboratories and institutions in it, know how to protect their own interests, and be familiar with the rules governing the fair and proper use of ideas.

In some cases, benefiting from a new idea may require establishing intellectual property rights through patents and copyrights, or by treating the idea as a trade secret. Intellectual property is a legal right to control the application of an idea in a specific context (through a patent) or to control the expression of an idea (through a copyright). Patent and copyright protections are legal mechanisms that seek to strike a balance between private gains and public benefits. They give researchers, nonprofit organizations, and companies the right to profit from a new idea. In return, the property owner must make the new idea public, which enables others to build on the idea.

A patent owner can protect his or her intellectual property rights by excluding others from making, using, or selling an invention so long as the patent owner provides a full description of how the invention is made, is used, and functions. Researchers doing patentable work may have special obligations to the sponsors of that work, such as having laboratory notebooks witnessed and disclosing an invention promptly to the patent official of the organization sponsoring the research. U.S. patent law provides clear criteria that define who is an inventor, and it is very important that all who have contributed substantially to an invention (and no one else) be included in a patent application.

Copyright issues are becoming more prominent as digital technologies have made copying and distributing information easier. Copyrights protect the expression or presentation of ideas, but they

do not protect the ideas themselves. Thus, when a researcher writes an article or a book, a copyright (which may be transferred to the publisher) applies to the words and images in the publication, but others can use the ideas in that publication with proper attribution. Someone can make fair use of copyrighted material for nonprofit uses, such as research or education, but they cannot use the material in a way that would reduce its market value.

Industry often relies on trade secrets to maintain control over commercially valuable information generated through research. In this case, there is no requirement to make the idea public, though there is also no protection against the idea being developed independently at another research site. Legal action can be taken against someone who reveals a secret or against someone who obtains a secret illegally.

Most research institutions have policies that specify how intellectual property should be handled. These policies may specify how research data are collected and stored, how and when results can be published, how intellectual property rights can be transferred, how patentable inventions should be disclosed, and how royalties from patents are allocated. Also, patent law differs from country to country, and researchers need to take these differences into account when they are working on projects in other countries or in collaboration with researchers in other countries.

In some cases, the obligations of researchers who are doing potentially patentable work may delay the publication of scientific results. Thesis advisers and research supervisors need to make beginning researchers aware of this possibility, given the importance of publication in advancing their careers. Publication of researchers' work should not be delayed for unreasonable amounts of time to protect potentially patentable results. Decisions on whether to file a patent application should be made as quickly as possible. University technology transfer offices are a useful resource on these issues.

Institutional policies may or may not address some of the more

challenging issues that arise when considering intellectual property. For example, to what extent should a researcher or an institution benefit from intellectual property? How should the rewards from intellectual property rights be shared among established researchers, beginning researchers, and research technicians? Can researchers take original data with them when they leave an institution? Generally, institutions own the data generated by a researcher, but contracts between researchers and their institutions typically specify the details of the arrangement, and researchers generally are entitled to a copy of the data they have generated. Furthermore, new laws, regulations, and policies continue to influence intellectual property rights, with important implications for researchers.

A Commercial Opportunity?

Shen was always interested in bioinformatics and decided to use some of his free time to write a program that others in his microbial genetics laboratory would find useful. Starting with a popular spreadsheet program on his university-provided computer, he wrote the program over the summer and posted it on his personal Web page as a bundle that combined the spreadsheet program and his own program. Over the next academic year, he improved his program several times based partly on the feedback he got from the people in his laboratory who were using it.

At national meetings, he discovered that researchers in other laboratories had begun to download and use his program package, and friends told him that they knew of researchers who were using it in industry. When the issue arose in a faculty meeting, Shen's faculty adviser told him that he should talk with the university's technology transfer office about commercializing it. "After all," his adviser said, "if you don't, a company will probably copy it and sell it and benefit from your hard work."

The director of the technology transfer office was much more concerned about another issue: the fact that Shen had been redistributing the spreadsheet in violation of its license. "You do have rights to what you created, but the company that sells this spreadsheet also has rights," he said. "We need to talk about this before we talk about commercialization."

1. What obligations does Shen have to the developer of the original spreadsheet program? To the university that provided the spreadsheet and computer?
2. What are the pros and cons of trying to commercialize a program that is based on another's product?
3. What conflicts and practical difficulties might Shen encounter if he tries to operate a business while working on his dissertation?

COMPETING INTERESTS, COMMITMENTS, AND VALUES

Researchers have many interests, including personal, intellectual, financial, and professional interests. These interests often exist in tension; sometimes they clash. The term “conflict of interest” refers to situations where researchers have interests that could interfere with their professional judgment. Managing these situations is critical to maintaining the integrity of researchers and science as a whole.

Conflicting interests arise in many ways. A researcher who wants to start a company to commercialize research results generated in the laboratory might feel pressure to compromise the progress of students by having them work on company-related projects that are less related to their academic interests. A researcher might need to decide whether to publish a series of narrowly focused papers that would build the researcher’s record of publication but not help the field progress as quickly as would a single paper containing the researcher’s main conclusions. Or a researcher might have to decide whether to accept a grant to do routine work that will help the researcher financially but may not help the researcher’s career or the careers of the students in the research group.

Conflicts of interest involving financial gain receive particular scrutiny in science. Researchers generally are entitled to benefit financially from their work—for example, by receiving royalties on inventions or bonuses from their employers. But in some cases the prospect of financial gain could affect the design of an investigation, the interpretation of data, or the presentation of results. Indeed, even the appearance of a financial conflict of interest can seriously harm a researcher’s reputation as well as public perceptions of science.

Personal relationships may also create conflicts of interest. Some funding agencies require researchers to identify others who have been their supervisors, graduate students, or postdoctoral fellows, since these relationships are seen as having the potential to interfere

with judgment about grants worthy of funding or papers worthy of publication. Similarly, though not formally acknowledged, romantic relationships can interfere with a researcher's judgment (and have the potential to lead to charges of sexual harassment and discrimination). For this reason, romantic relationships between professors and their advisees are generally unwise and are often prohibited by university policy.

Regulations and codes of conduct specify how some of these conflicts should be identified and managed. Funding agencies, research organizations, and many journals have policies that require researchers to identify their financial interests and personal relationships. Researchers should be aware of these policies and understand how they benefit science and their professional reputation. In some cases, the conflict cannot be allowed, and other ways must be found to carry out the research. Other financial conflicts of interest are managed through a formal review process in which potential conflicts are identified, disclosed, and discussed. However managed, timely and full disclosure of relevant information is important, since in some cases researchers joining a team or project may not be aware of a problem.

Conflicts of interest should be distinguished from conflicts of commitment. Researchers, particularly students, have to make difficult decisions about how to divide their time between research and other responsibilities, how to serve their scientific disciplines, how to respect their employer's interests, mission, and values, and how to represent science to the broader society. Conflicts between these commitments can be a source of considerable strain in a researcher's life and can cause problems in his or her career. Managing these responsibilities is challenging but different from managing conflicts of interest.

As in the case of conflicts of interest, many institutional policies offer some guidance on conflicts of commitment. For example, there are limits in many academic institutions regarding time spent on

A Conflict of Commitment

Sandra was excited about being accepted as a graduate student in the laboratory of Dr. Frederick, a leading scholar in her field, and she embarked on her assigned research project eagerly. But after a few months she began to have misgivings. Though part of Dr. Frederick's work was supported by federal grants, the project on which she was working was totally supported by a grant from a single company. She had asked Dr. Frederick about this before coming to his lab, and he had assured her that he did not think that the company's support would conflict with her education. But the more Sandra worked on the project, the more it seemed skewed toward questions important to the company. For instance, there were so many experiments she needed to carry out for the company's research that she was unable to explore some of the interesting basic questions raised by her work or to develop her own ideas in other areas. Although she was learning a lot, she worried that her ability to publish her work would be limited and that she would not have a coherent dissertation. Also, she had heard from some of the other graduate students doing company-sponsored work that they had signed confidentiality statements agreeing not to discuss their work with others, which made it difficult to get advice. Dr. Frederick and the company's researchers were very excited about her results, but she wondered whether the situation was the best for her.

1. Has Dr. Frederick done anything wrong in giving Sandra this assignment?
2. What potential conflicts in terms of data collection, data interpretation, and publishing might Sandra encounter as she continues with her research?

outside activities by faculty members. Training in laboratory management may offer valuable information on how to manage conflicts of commitment. As with conflicts of interest, identifying the conflict is an important first step in arriving at an acceptable solution.

Beyond conflicts of interest and commitment are issues related to the values and beliefs that researchers hold. Researchers can have strongly held convictions—for example, a desire to eliminate a particular disease, reduce environmental pollution, or demonstrate the biological underpinnings of human behavior. Or someone might have

strong philosophical, religious, cultural, or political beliefs that could influence scientific judgments.

Strongly held values or beliefs can compromise a person's science in some instances. The history of science offers a number of episodes in which social or personal beliefs distorted the work of researchers. For example, the ideological rejection of Mendelian genetics in the Soviet Union beginning in the 1930s crippled Soviet biology for decades. The field of eugenics used the techniques of science to try to demonstrate the inferiority of particular human groups, according to nonscientific prejudices.

Despite such cautionary episodes, it is clear that all values cannot—and should not—be separated from science. The desire to do good work is a human value. So is the conviction that standards of honesty and objectivity must be maintained. However, values that compromise objectivity and introduce bias into research must be recognized and minimized. Researchers must remain open to new ideas and continually test their own and other's ideas against new information and observations. By subjecting scientific claims to the process of collective assessment, different perspectives are applied to the same body of observations and hypotheses, which helps minimize bias in research.

Does the Source of Research Funding Influence Research Findings?

Information about sponsorship of academic research by tobacco companies over the last several decades has served to inform the scientific community about the issues to be considered in accepting funding from an interested party. The release of internal industry documents through a series of court cases has documented the deliberate effort to release experimental findings favorable to the companies.

Central to the story was the determination by the Environmental Protection Agency in 1993 that “environmental tobacco smoke” should be classified as a Class A carcinogen. Internal industry memoranda concluded that the possible banning of smoking in public places would reduce cigarette consumption and profits. In response to this shift in the regulatory environment, the tobacco industry created a nonprofit organization, the Center for Indoor Air Research, to fund well over 200 published studies to counter the EPA finding.^a Additional steps included (1) formation of a consultant program funded by U.S., Japanese, and European tobacco companies to present favorable findings at scientific meetings and to publish findings; (2) introduction of bias into studies by misclassification of study subjects to reduce the apparent impact of secondhand smoke; and (3) placement of industry in-house scientists on journal editorial boards.^b

This history of tobacco company funding does not mean that all industry-funded research is tainted. Companies, however, tend to fund external product studies that are likely to be favorable to them. This predisposition points toward the need for strong conflict of interest policies to minimize bias.

^aMuggli, Monique E, Jean L. Forster, Richard D. Hurt, and James L. Repace. “The Smoke You Don’t See: Uncovering Tobacco Industry Scientific Strategies Aimed against Environmental Tobacco Smoke Policies.” *American Journal of Public Health* (September 2001); 91(9):1419-1423.

^bTong, Elisa K. and Stanton A. Glantz. “Tobacco Industry Efforts Undermining Evidence Linking Secondhand Smoke with Cardiovascular Disease.” *Circulation* (2007); 116:1845-1854.

THE RESEARCHER IN SOCIETY

The standards of science extend beyond responsibilities that are internal to the scientific community. Researchers also have a responsibility to reflect on how their work and the knowledge they are generating might be used in the broader society.

Researchers assume different roles in public discussions of the potential uses of new knowledge. They often provide expert opinion or advice to government agencies, educational institutions, private companies, or other organizations. They can contribute to broad-based assessments of the benefits or risks of new knowledge and new technologies. They frequently educate students, policymakers, or members of the public about scientific or policy issues. They can lobby their elected representatives or participate in political rallies or protests.

In some of these capacities, researchers serve as experts, and their input deserves special consideration in the policy-making process. In other capacities, they are acting as citizens with a standing equal to that of others in the public arena.

Researchers have a professional obligation to perform research and present the results of that research as objectively and as accurately as possible. When they become advocates on an issue, they may be perceived by their colleagues and by members of the public as biased. But researchers also have the right to express their convictions and work for social change, and these activities need not undercut a rigorous commitment to objectivity in research.

The values on which science is based—including honesty, fairness, collegiality, and openness—serve as guides to action in everyday life as well as in research. These values have helped produce a scientific enterprise of unparalleled usefulness, productivity, and creativity. So long as these values are honored, science—and the society it serves—will prosper.

Ending the Use of Agent Orange

In the early 1940s, a graduate student in botany at the University of Illinois named Arthur W. Galston found that application of a synthetic chemical could hasten the flowering of plants, enabling crops to be grown in colder climates. But if the chemical was applied at higher concentrations, it was extremely toxic, causing the leaves of the plants to fall off. Galston reported the results in his 1943 thesis before moving to the California Institute of Technology and then serving in the Navy during the final years of World War II.

Following the war, Galston learned that military researchers had read his thesis and had used it, along with other research, to devise powerful herbicides that could be used in wartime. Beginning in 1962, the U.S. military sprayed more than 50,000 tons of these herbicides on forests and fields in Vietnam. By far the most widely used mixture of defoliants was known as Agent Orange, from the orange stripe around the 55-gallon drums used to store the chemicals.

Galston later wrote that the use of his research in the development of Agent Orange “provided the scientific and emotional link that compelled my involvement in opposition to the massive spraying of these compounds during the Vietnam War.” At the 1966 meeting of the American Society of Plant Physiologists, he circulated a resolution citing the possible toxic effects of defoliants on humans and animals and the long-term consequences for food production and the environment, which he sent to President Lyndon Johnson. During the next several years, as evidence for the toxic effects of Agent Orange accumulated, Galston and a growing number of other scientists continued to oppose the use of defoliants in the Vietnam War. In 1969, he and several other scientists met with President Richard Nixon’s science adviser, whom Galston had known at Caltech, and presented him with information on the harmful effects of Agent Orange. The science adviser recommended to the president that the spraying be discontinued, and the use of defoliants was phased out in 1970, five years before the end of the war. Galton later wrote, “I used to think that one could avoid involvement in the anti-social consequences of science simply by not working on any project that might be turned to evil or destructive ends. I have learned that things are not that simple. . . . The only recourse is for a scientist to remain involved with it to the end.”^a

^aGalston, Arthur W. Science and Social Responsibility: A Case History. *Annals of the New York Academy of Science* (1972):196:223.

APPENDIX: DISCUSSION OF CASE STUDIES

The hypothetical scenarios included in this guide raise many different issues that can be discussed and debated. The following observations suggest just some of the topics that can be explored but are by no means exhaustive.

A CHANGE OF PLANS (Page 5)

Differences of opinion about when a dissertation is finished or almost finished are a common source of tension between Ph.D. students and their advisers. Good communication throughout the preparation of a dissertation is essential to avoid disappointment. Meetings should be held regularly to review progress and discuss future plans. If a student has difficulties discussing these issues with a thesis adviser, as Joseph did, the other members of a thesis committee should be willing to intervene to make sure that expectations are identified and made clear to all parties.

THE SELECTION OF DATA (Page 10)

Deborah and Kamala's principal obligation in writing up their results for publication is to describe what they have done and give the basis for their actions. Questions that they need to answer include: If they state in the paper that data have been rejected because of problems with the power supply, should the data points still be included in the published chart? How should they determine which points to keep and which to reject? What kind of error analyses should be done that both include and exclude the questionable data? How hard should they work to salvage these data given the difficulties with their measurements? Is the best course to focus on the systemic error (power fluctuations) and figure out how to eliminate the fluctuations or to repeat the experiment adjusting for the fluctuations? Consult-

ing with the principal investigator or a senior researcher may provide additional options.

DISCOVERING AN ERROR (Page 14)

When the scientific record contains errors, other researchers can repeat those errors or waste time and money discovering and correcting them. Marie and Yuan, the authors of the papers, have published erroneous results that could mislead other researchers. How should they tell the editors of the journals where the papers appeared about the errors and publish corrections?

FABRICATION IN A GRANT PROPOSAL (Page 17)

Even though Vijay did not introduce spurious results into science, he fabricated the submission of the research paper and therefore engaged in misconduct. Though his treatment by the department might seem harsh, fabrication strikes so directly at the foundations of science that it is not excusable.

This scenario also demonstrates that researchers and administrators in an institution may differ on the appropriate course of action to take when research ethics are violated. Researchers should think carefully about what courses of action could be taken in such a case.

IS IT PLAGIARISM? (Page 18)

Would it help, in all situations and in all fields, to simply place quotation marks around the borrowed sentences and attach a footnote? Writing a literature review requires judgment in the selection and interpretation of previous work. Professor Lee should consider whether copying the one-sentence summaries takes unfair advantage of the other author's efforts, and whether those summaries relate to the proposal in the same way as the paper. In addition, because the literature review in the journal paper could be erroneous or incomplete,

Lee should strive to ensure that the proposal's review of the literature is accurate. Finally, Lee should imagine what might happen if the author of the journal paper is asked to review Lee's proposal.

A CAREER IN THE BALANCE (Page 22)

Peter's most obvious option is to discuss the situation with his research adviser, but he has to ask himself if this is the best alternative. His adviser is professionally and emotionally involved in the situation and may not be able to take an impartial stance. In addition, because the adviser is involved in the situation, she may feel the need to turn the inquiry into a formal investigation or to report the inquiry to her supervisors.

Peter should also consider whether he can discuss the situation directly with Jimmy. Many suspicions evaporate when others have a chance to explain actions that may have been misinterpreted.

If Peter feels that he cannot talk with Jimmy, he needs some way to discuss his concerns confidentially. Maybe he could turn to a trusted friend, another member of the faculty (such as a senior or emeritus professor), someone on the university's administrative staff, or an ombudsman designated by the university. That person can help Peter explore such questions as: What is known and what is not known about the situation? What are the options available to him? Why should he not put his concerns in writing, an action likely to lead to a formal investigation?

TESTS ON STUDENTS (Page 25)

Although the instructional modules do not risk harming the students' health, because Antonio plans to publish the results, he must obtain IRB approval. Since the research study focuses on teaching techniques in an educational setting, this study would likely be exempt from full IRB review, but it is the IRB that decides that. Antonio should consider whether any incentives that he gives for testing the

modules might seem coercive to the students, and whether students who test the modules might have an unfair advantage over other students in the course. Explicit consent would be required if students might experience physical or psychological distress while using the modules, or if published information could be traced to individual students.

A CHANGE OF PROTOCOL (Page 26)

Guidelines for the care and use of laboratory animals are designed to both protect the welfare of animals and enhance the quality of research. Both of these goals are being undermined by Hua's action, so who can they consult in the institution? What is the responsibility of the laboratory and its leadership for animal welfare?

PUBLICATION PRACTICES (Page 32)

Contributions to a scientific field are not counted in terms of the number of papers. They are counted in terms of significant differences in how science is understood. With that in mind, Andre and his students need to consider how they are most likely to make a significant contribution to their field. One determinant of impact is the coherence and completeness of a paper. Andre and his students may need to begin writing before they can tell whether one or more papers are needed. Parts of the research can also be broken out for separate publication with a opportunity for different first authorship.

In retrospect, Andre and his students might also ask themselves about the process that led to their decision. How could they have discussed publications much earlier in the process? Were the students led to believe that they would be first authors on published papers? If so, how could that influence future policies or procedures in the lab?

WHO GETS CREDIT? (Page 36)

Robert needs to know whether his company, the journal to which he plans to submit the paper, or his discipline has written policies pertaining to his situation. If so, he must decide whether to bring those policies to the attention of his supervisor, a research official in his company, or the editor of the journal; if not, he must decide whether to appeal to guidelines describing acceptable authorship practices in other documents. What are the possible outcomes of alternative actions that could help him make a decision?

A COMMERCIAL OPPORTUNITY? (Page 42)

A software license is a legal contract, and all users must honor it, so Shen's first task is to correct his unauthorized distribution of the software. Once done, the commercialization decision can be made. Many researchers have found themselves in a position similar to the one Shen is in, and they have made different decisions. Some decide that they will continue to provide a free service to their research communities without seeking to commercialize a new idea or technique. Others decide that commercialization will best serve their communities, themselves, their institutions, or—with luck—all of the parties involved. As his adviser has suggested, Shen should work with the technology transfer officer at his university to learn more about his options.

A CONFLICT OF COMMITMENT (Page 45)

Sandra has enrolled in the university to receive an education, not to work for industry. But working on industrially sponsored research is not necessarily incompatible with getting a good education. In fact, it can be a valuable way to gain insight into industrially oriented problems and to prepare for future work that has direct applications to societal needs. The question that must be asked is whether the

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nature of the research is compromising Sandra's education. Sandra's faculty adviser has entered into a relationship that could result in conflicts of interest. That relationship is therefore most likely to be subject to review by third parties. How can Sandra get help in resolving her own uncertainties? What would be the possible effects on her career if she did so?

ADDITIONAL RESOURCES

General Guides to the Responsible Conduct of Research

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The code of conduct is in place, now we need awareness about scientific integrity

NSCR interim director Peter van der Laan about honest scientific behaviour

In the coming period, NWO-I will devote extra attention to scientific integrity. Research should be conducted as honestly, scrupulously, and responsibly as possible. Science owes that to society. Therefore, this subject should receive the regular attention of the institutes, states Peter van der Laan, interim director of NWO Institute NSCR.

Two years ago, as the successor of Catrien Bijleveld, Van der Laan was given the responsibility for the subject 'scientific integrity' as interim director of NSCR. It was one of his tasks in the allocation of portfolios between the institute directors. Bijleveld had already contributed to the realisation of the Netherlands Code of Conduct for Research Integrity in 2018. 'At that moment, I had no special expertise concerning scientific integrity, but I immediately understood the great importance of this subject', says Van der Laan. The directors meeting (DM) underlined that more attention should be devoted to scientific integrity.

Safety net

NWO-I decided to formulate a separate complaints procedure – in addition to the NWO procedures – for the institutes organisation for (suspected) violations of scientific integrity by NWO-I employees. At the same time, a Scientific Integrity Desk was established through which an employee can submit a suspected violation to a newly appointed confidential adviser scientific integrity. Van der Laan: 'Bert Warmelink, secretary to the DM, deserves a lot of credit for the leading role he played in this. It was great that we managed to create a safety net in 2020'.

More attention for supervision

According to Van der Laan, complying with the Netherlands Code of Conduct for Research Integrity goes hand in hand with a safe work environment. At the institutes, there is usually a considerable influx of young researchers. They end up in groups with other researchers in which specific standards, values and agreements apply, which become generally accepted as the 'truth'. It is questionable whether you can discuss small or large irregularities in such a setting. This is further complicated by the fact that the relationship between PhDs and their supervisors is one of dependency. Van der Laan: 'During your development as a researcher, you come across all kinds of situations: ranks and orders, status, different habits, for example with regard to the publication of research results. That can lead to difficult issues. Fortunately, the number of incidents remains limited, but they can have a lot of impact if they do occur. Supervisors play a crucial role in creating a safe environment. I observe that respected supervisors at NSCR have different supervision styles and different opinions, possibly about subjects like authorship too. Therefore, I call for more attention for supervision at NSCR and within the other NWO Institutes to ensure that we are all on the same page in terms of ideas about what it means to conduct science with integrity. This also means that supervisors need to discuss this with each other.'

Awareness

Everything stands or falls with a broad awareness of what it means to act with integrity, says Van der Laan. That is necessary to prevent violations of scientific integrity. If something still goes wrong, a complaints procedure and a scientific integrity desk are in place, and there are confidential advisers. During his long career, Van der Laan has indirectly been involved in violations that have led to a complaint. In his experience, these complaints always resulted in more losers than winners. Van der Laan: "In the more distant past, the handling of a case at NSCR did not go well. That made it clear to me that colleagues need to be properly informed about the consequences before they decide to report a violation. A lot has usually happened before a violation is reported. Some things may have gone wrong during this period, and that sometimes already has irreparable consequences for those involved. Irrespective of how meticulously the procedure is conducted, there first and foremost needs to be an atmosphere in which integrity issues can be freely raised, in confidence and without any fear of repercussions. I advise everybody to think carefully in advance about the alternatives, such as confiding in a peer or mediation by colleagues who you trust". Van der Laan applauds the fact that NWO-I has recently started a campaign for more awareness about scientific integrity.

Raising the alarm

Van der Laan: "At NSCR, ten new PhDs have just started in groups with different subjects and different styles of supervision. PhDs are usually quite assertive. Every so often, I attend a PhD student consultation. At such occasions, I reiterate the fact that they need to raise the alarm at an early stage if they suspect something is not right. And that they should turn to our PhD coordinator first, instead of immediately contacting the Scientific Integrity Desk".

More about the Netherlands Code of Conduct for Research Integrity

On the NWO-I website, there is a page about the [Scientific Integrity NWO-I Institutes Complaints Procedure](#).

About Peter van der Laan

Peter van der Laan (1954), interim director at NSCR since 2019, has worked at NSCR for twenty years. He combines this for two days per week with a professor-ship by special appointment in Probation and Parole at the Faculty of Law, VU Amsterdam. Developmental educationalist Van der Laan gained his doctorate in 1991 for his thesis on 'Experimenteren met alternatieve sancties voor jeugdigen' [Experimenting with alternative sanctions for young people]. He recently did research into JeugdzorgPlus [Youth Care Plus] institutions (2020) and violence in closed (penitentiary) youth institutions (2019).

Text: Anita van Stel

Newsletter Inside NWO-I, June 2021



Peter van der Laan

8.2 Workshops wetenschappelijke integriteit bij ARCNL, DIFFER en NSCR, Inside NWO-I November 2021

From Newsletter Inside NWO-I, November 2021

Update scientific integrity at NWO-I

Working together on a safe scientific environment

As announced in the [June 2021 edition of Inside NWO-I](#), the NWO Institutes will pay extra attention to scientific integrity. 'Science needs to be conducted as honestly, meticulously and responsibly as possible', says Peter van der Laan (NSCR). For the Institutes Organisation, NWO-I produced a separate complaints procedure for (suspected) violations of scientific integrity by NWO-I employees. This article brings you the latest scientific integrity news, such as the newly appointed confidential advisers, the online scientific integrity training for PhDs, and the Dilemma Game app from Erasmus University Rotterdam.

Confidential counsellors scientific integrity

NWO-I has appointed two confidential counsellors for scientific integrity: Dr Tanja Kulkens, Head of Chemistry and Physics at NWO, and Prof. Thom Palstra, Professor of Solid State Chemistry at the University of Twente. Both of them can be reached via vertrouwenspersoonWInwo-i@nwo.nl. The confidential counsellors can provide guidance during the submission of a complaint, but are mainly there to advise employees in situations in which it is unclear whether there is a violation of scientific integrity and what to do about this. Confidential counsellors guarantee complete anonymity for the entire procedure, from submission of a complaint to its handling. The confidential counsellor will only initiate follow-up actions with the consent of the reporting person.

Online PhD training scientific integrity

NWO-I wants to ensure that its PhDs remain aware of scientific integrity in daily practice. Making integrity discussable is vital because it contributes to an open, safe and inclusive research culture in which good scientific conduct is safeguarded. NWO-I therefore offers four online modules that can also be combined with the Dilemma Game app (see later in this article). This training is for all NWO-I PhDs as well as researchers in their first year of appointment. You can find more information about this training on the [NWO-I website](#).

Scientific Integrity Desk

NWO-I has its own [Complaints Procedure for Scientific Integrity NWO-I Institutes](#), which applies to complaints about (suspected) violations of scientific integrity by an employee of NWO-I. Complaints about a (suspected) violation of scientific integrity by an employee of NWO-I can be submitted to the Scientific Integrity Desk via meldpuntWI-NWO-I@nwo.nl. For more information, see the [NWO-I website](#).

Culture: the Dilemma Game app

Scientific integrity can only be properly discussed if there is a safe culture in which you can openly talk about difficult questions or dilemmas. In the coming period, NWO-I wants to contribute to that culture within its institutes by organising workshops and offering, for example, the Dilemma Game app. After all, integrity is not just a question of right or wrong. During his or her career, every researcher comes up against dilemmas. Making these and larger dilemmas discussable is necessary for exploring and safeguarding good scientific behaviour. The Erasmus University Rotterdam developed the Dilemma Game app, which stimulates open and critical dialogue about scientific integrity and professionalism in research. Via the app, you can consult dilemmas from science anytime and anywhere, individually or together with fellow students and colleagues. More information about this free app that can be used by everybody can be found [here](#).

Workshops scientific integrity

Recently, ARCNL, DIFFER and NSCR each organised a workshop about scientific integrity in which they underlined the importance of acting with scientific integrity, discussed possible dilemmas and introduced the confidential counsellors for scientific integrity. You can read the detailed report about these workshops [here](#).

More information

See the [NWO-I website](#) for information about how NWO-I deals with the Code of Conduct for Scientific Integrity.

Text: Anita van Stel *Newsletter Inside NWO-I, November 2021*
From *Newsletter Inside NWO-I, November 2021*

Workshops scientific integrity at ARCNL, DIFFER and NSCR

NWO Institutes discuss scientific integrity with reference to dilemmas

NWO-I has made scientific integrity (SI) a priority. In 2020 ASTRON brought in expert Ralph Wijers to introduce SI to the institute. Recently the institutes DIFFER, NSCR and ARCNL organized workshops in which colleagues discussed scientific integrity. With the help of both fictive and real-life dilemmas, scientific integrity was given a face, and the workshops also had an additional teambuilding effect.

DIFFER organised the session '500 shades of grey, the many facets of research integrity'

Luca Consoli is an associate professor at the Institute for Science in Society in Nijmegen. He is an expert in the area of scientific misconduct and scientific ethics. DIFFER invited Luca to give a workshop at the institute earlier this year, on 24 June. He asked the participants to ponder the question as to whether tightening the procedures and drawing up new rules is the best way to tackle violations of scientific integrity. Anouck Vrouwe, ambassador for scientific integrity at DIFFER: 'Of course, the answer was that the culture within your organisation is the most important factor. Subsequently, practical examples were discussed in breakout sessions. For example, what do you do if a referee asks you to add an article to your references and you suspect that it is his or her own article? It was a lively discussion. Follow-up planned: We are now itemising which trainings our researchers have had.'

NSCR: Dilemma Game app is an ideal conversation starter

'Everybody knows the external examples of violations of scientific integrity, but it concerns the everyday choices and decisions too', says Wim Bernasco, who is ambassador for scientific integrity at NSCR together with Wouter Steenbeek. On 23 September, they organised a workshop for the institute in which about 50 colleagues took part, 'young and old, from all layers of society'. After a brief introduction, Wouter and Wim made use of dilemmas from the Dilemma Game app to get the discussion going. Wouter explains: 'Ghislaine de Meij, P&O NWO-I office, enthusiastically brought this to our attention, and rightly so, because the dilemmas are an ideal conversation starter. The game can be played without the need to share personal experiences.' The discussion groups have a very diverse composition. Another advantage of that was that the individual participant became acquainted with different roles through the various dilemmas. Wouter explains: 'As a PhD, you do not know the dilemmas and choices a supervisor faces, and a professor has less insight into the conflicts that can occur between PhDs. For example, we learned from the junior researchers that they found it interesting to make acquaintance with subjects they knew nothing about, such as peer review. The workshop also had a team-building effect.' Wim: 'Our aim was to initiate a dialogue and to ensure that colleagues confronted with a violation know what they can do.' During the workshop, the new NWO-I confidential counsellors for scientific integrity Kulkens and Palstra, introduced themselves. They emphasised that they were open to every question in this area. NSCR has plans for more follow-up meetings. Initially, the emphasis will be on developing practical skills that are relevant for scientific integrity, such as preregistration, data management, writing reviews and recording of the contributions by authors.

ARCNL: Every researcher is confronted by it sooner or later

One-act play for two researchers at ARCNL

Joost: Our Zoom session has not really started yet, and nobody can hear us, Roland. I want to ask you something. Our paper about thin-film alloys incurred some delays last semester, but we are going to submit it next

week.

Roland: Great, we are also planning to complete our paper about pulsed laser disposition of alloys next month. Our subjects are pretty similar. Perhaps we could use this to benefit the output of both our groups. I could certainly benefit from co-authorship of your article for my interim evaluation and, in turn, I'll add you to the article that we will submit in October. That way, we both benefit. What do you think?

Joost: Sounds like a good deal.

Subsequently, Joost turns to the Zoom public, which is listening speechless and shocked: '*What do you think? Is this indeed a good idea?*'

With this short one-act play from ARCNL director Joost Frenken and ARCNL researcher Roland Bliem, 55 PhDs and postdocs from ARCNL were immediately on track. Joost and Roland, ARCNL ambassadors for scientific integrity, introduced the fictive dilemma at the opening of the online workshop scientific integrity, held recently on 27 September, to show that dilemmas arise close to home and that sooner or later, every researcher will be confronted by these. After that, Prof Ralph Wijers (Anton Pannekoek Institute for Astronomy, University of Amsterdam) gave an introduction to what scientific integrity is and why it is relevant for everybody's research. He used examples to illustrate where dilemmas occur in scientific work. Subsequently, the ARCNL colleagues discussed the dilemmas in breakout sessions. Who is the first author of an article and when do you have the right to be called an author? Another dilemma concerned intellectual property, which was close to home due to the relationship between ARCNL and industrial partner ASML. What do you do if you come across errors in already published data? Opinions about this differed. The outcomes of the breakout sessions were discussed in the plenary setting. Roland explains: 'The discussion, with a broad range of opinions, reflected the fact that dilemmas occur at a wide range of levels, but that there is not a single correct answer and that strong convictions can shift as a result of other insights. Our aim was to create awareness about this. And from the positive feedback we received, we can conclude that this was successful.' ARCNL also presented the possible steps that colleagues can take if they are confronted by a small or large violation, including consulting the confidential counsellors for scientific integrity.

Text: Anita van Stel

Newsletter Inside NWO-I, November 2021

Various reports of workshops at the NWO institutes

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Luca Consoli is an associate professor at the Institute for Science in Society in Nijmegen. He is an expert in the area of scientific misconduct and scientific ethics. DIFFER invited Luca to give a workshop at the institute earlier this year, on 24 June. He asked the participants to ponder the question as to whether tightening the procedures and drawing up new rules is the best way to tackle violations of scientific integrity. Anouck Vrouwe, ambassador for scientific integrity at DIFFER: 'Of course, the answer was that the culture within your organisation is the most important factor. Subsequently, practical examples were discussed in breakout sessions. For example, what do you do if a referee asks you to add an article to your references and you suspect that it is his or her own article? It was a lively discussion. Follow-up planned: We are now itemising which trainings our researchers have had.'

NSCR: Dilemma Game app is an ideal conversation starter

'Everybody knows the external examples of violations of scientific integrity, but it concerns the everyday choices and decisions too', says Wim Bernasco, who is ambassador for scientific integrity at NSCR together with Wouter Steenbeek. On 23 September, they organised a workshop for the institute in which about 50 colleagues took part, 'young and old, from all layers of society'. After a brief introduction, Wouter and Wim made use of dilemmas from the Dilemma Game app to get the discussion going. Wouter explains: 'Ghislaine de Meij, P&O NWO-I office, enthusiastically brought this to our attention, and rightly so, because the dilemmas are an ideal conversation starter. The game can be played without the need to share personal experiences.' The discussion groups have a very diverse composition. Another advantage of that was that the individual participant became acquainted with different roles through the various dilemmas. Wouter explains: 'As a PhD, you do not know the dilemmas and choices a supervisor faces, and a professor has less insight into the conflicts that can occur between PhDs. For example, we learned from the

junior researchers that they found it interesting to make acquaintance with subjects they knew nothing about, such as peer review. The workshop also had a team-building effect.' Wim: 'Our aim was to initiate a dialogue and to ensure that colleagues confronted with a violation know what they can do.' During the workshop, the new NWO-I confidential counsellors for scientific integrity Kulkens and Palstra, introduced themselves. They emphasised that they were open to every question in this area. NSCR has plans for more follow-up meetings. Initially, the emphasis will be on developing practical skills that are relevant for scientific integrity, such as preregistration, data management, writing reviews and recording of the contributions by authors.

ARCNL: Every researcher is confronted by it sooner or later

One-act play for two researchers at ARCNL

Joost: Our Zoom session has not really started yet, and nobody can hear us, Roland. I want to ask you some-thing. Our paper about thin-film alloys incurred some delays last semester, but we are going to submit it next week.

Roland: Great, we are also planning to complete our paper about pulsed laser disposition of alloys next month. Our subjects are pretty similar. Perhaps we could use this to benefit the output of both our groups. I could certainly benefit from co-authorship of your article for my interim evaluation and, in turn, I'll add you to the article that we will submit in October. That way, we both benefit. What do you think?

Joost: Sounds like a good deal.

Subsequently, Joost turns to the Zoom public, which is listening speechless and shocked: 'What do you think? Is this indeed a good idea?'

With this short one-act play from ARCNL director Joost Frenken and ARCNL researcher Roland Bliem, 55 PhDs and postdocs from ARCNL were immediately on track. Joost and Roland, ARCNL ambassadors for scientific integrity, introduced the fictive dilemma at the opening of the online workshop scientific integrity, held recently on 27 September, to show that dilemmas arise close to home and that sooner or later, every researcher will be confronted by these. After that, Prof Ralph Wijers (Anton Pannekoek Institute for Astronomy, University of Amsterdam) gave an introduction to what scientific integrity is and why it is relevant for everybody's research. He used examples to illustrate where dilemmas occur in scientific work. Subsequently, the ARCNL colleagues discussed the dilemmas in breakout sessions. Who is the first author of an article and when do you have the right to be called an author? Another dilemma concerned intellectual property, which was close to home due to the relationship between ARCNL and industrial partner ASML. What do you do if you come across errors in already published data? Opinions about this differed. The outcomes of the breakout sessions were discussed in the plenary setting. Roland explains: 'The discussion, with a broad range of opinions, reflected the fact that dilemmas occur at a wide range of levels, but that there is not a single correct answer and that strong convictions

can shift as a result of other insights. Our aim was to create awareness about this. And from the positive feedback we received, we can conclude that this was successful.' ARCNL also presented the possible steps that colleagues can take if they are confronted by a small or large violation, including consulting the confidential counsellors for scientific integrity.

Text: Anita van Stel

Newsletter Inside NWO-I, November 2021

Introducing the confidential advisers scientific integrity

Thom Palstra and Tanja Kulkens introduce themselves

NWO-I is pleased that Thom Palstra and Tanja Kulkens are willing to take on the task of confidential adviser scientific integrity for NWO-I in its entirety. In this issue of Inside NWO-I, Thom and Tanja introduce themselves.

Can you tell us something about yourself and your relationship with NWO/NWO-I?

Thom: I am Professor of Solid State Chemistry at the University of Twente. I was Rector Magnificus there from 2016 to 2020. Before coming to Twente, I worked for twenty years at the Zernike Institute for Advanced Materials in Groningen and I was its scientific director during my last years there. My scientific career started at AT&T Bell Laboratories in the United States, where I worked for ten years. Bell Laboratories is like a large institute. Back then, it had 600 scientific employees who did research important for the telecommunication industry. I studied at, and gained my doctorate from the Kamerlingh Onnes Laboratory at Leiden University. My research interest lies in the electronic properties of materials at the interface of physics, chemistry, crystallography and nanosciences. Because of this background, I have come to know many colleagues at various NWO Institutes.

Tanja: I obtained a degree in chemistry and then did a PhD in biochemistry and molecular biology at VU Amsterdam and the University of California Irvine. After gaining my PhD in 1992 and a brief postdoc period, I did not pursue a career as a researcher but came to work at NWO in 1994. Since then, I have been committed to facilitating and connecting science and science policy. In 2017, I became head of Chemistry & Physics at the NWO Domain Science (ENW) of NWO-D. Many chemists and physicists at the NWO Institutes are part of the NWO Science field.

What motivated you to fill this sensitive position? What is your affinity with scientific integrity?

Thom: This is my first experience as a confidential adviser. I was asked to fill this position six months ago by Miriam Luizink (former director of NWO-I, Ed.). As rector of the University of

Twente, I was responsible for setting up and organising the House of Integrity. This concerns not only scientific integrity but also ethics committees, a safe (social) work environment and business integrity. At Bell Laboratories, I learned about the importance of scientific integrity because the entire research system was built on that. Therefore, scientific integrity plays an important role in how I do research and how I supervise students and PhDs. With the introduction of the revised [Netherlands Code of Conduct for Research Integrity](#), scientific integrity has been embedded. At the same time, it also provides a good opportunity to discuss dilemmas with colleagues.

Tanja: I have been the confidential adviser for the NWO-I Whistleblowing policy for some time now. Partly due to that, the NWO-I office approached me at the start of this year to ask whether I would be willing to fill the position of confidential adviser scientific integrity as well. I have no experience with violations of scientific integrity, but integrity also plays an important role in the peer-review process and other activities that we realise and support at the NWO Domain Science. I know both the scientific field and the researchers, and my position has familiarised me with the dilemmas they can come up against. These must be discussable in an early stage.

How will you fulfil this special role and how will the collaboration/allocation of responsibilities take place?

We have not agreed a clear allocation of responsibilities. Our priority is to be as accessible as possible for employees with questions or dilemmas about scientific integrity that they don't want to discuss with their immediate colleagues. To this end, we will also physically visit the institutes and talk with both the management and the employees. The board has tasked us with letting employees know how to contact us if they are confronted by scientific integrity issues. We will listen, advise and, if necessary, provide guidance.

Can you tell us something about the online research integrity workshop of NSCR that was held on 23 September 2021?

We were invited to introduce ourselves there and we listened to how the NSCR colleagues discussed a wide range of dilemmas. A workshop is a fantastic way to raise awareness about scientific integrity. In this meeting, it clearly emerged that scientific integrity is not about black and white issues, but mainly about the difficult dilemmas that each researcher is confronted with sooner or later.

What will NWO-I employees notice about your role?

If scientific integrity is actively discussed within the institutes and on the work floor, then an NWO-I employee will scarcely notice us. However, we will begin to worry when we hear nothing at all from employees. NWO-I is a large organisation in which difficult dilemmas will always arise. During our visits to the institutes, we want to ensure that it at least becomes better known who we are and what our role is. Then colleagues at the institutes are more likely to approach us should that become necessary.

Which message do you have for NWO-I employees?

Consider it your own responsibility to actively deal with scientific integrity issues but remember to contact us if you cannot work things out!

More information?

Would you like to know more about scientific integrity at NWO-I and how you can reach Thom and Tanja? Then click [here](#).

Newsletter Inside NWO-I, December 2021



Thom Palstra en Tanja Kulkens

Factsheet

2022 | www.nwo-i.nl/wi-toolbox

Guest experts

NWO-I has a list of experts who are willing to introduce seminars, to start a discussion, to spar or in another way to share knowledge. Scientific integrity is a multi-colored subject: dilemmas arise in all forms and at all levels. Practice points out that there is not one correct answer to 'how do you tackle a dilemma' and also that firm convictions can shift during discussions. Awareness is an ongoing process. As a researcher, there is often a lack of time to gather knowledge about scientific integrity. In recent years, ethicists and philosophers, some of whom are also science scientists, have focused on developing expertise in the field of scientific integrity and on ways to make it a topic for discussion. An institute can call on these experts.

- Lecture/presentation
- Knowledge
- Exchange
- Inspire
- Confront

What does this mean?

This depends on the demand. The exchange with guest experts can lead to new insights. A guest expert can introduce or moderate a webinar based on his/her expertise in the field of scientific integrity.

How much time does it take?

Matching the question with the expert takes some time, but certainly not hours.

How much is this?

This depends on who is hired, but in principle experts associated with universities are not allowed to charge a fee.

What preparation is needed?

The preparation consists of answering the question: what does an institute want to deploy an expert for? What needs to change or be done differently?

How do you deploy this?

This depends on the demand.

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.

Factsheet

2022 | www.nwo-i.nl/wi-toolbox

On being a scientist (the movie)

"On Being a Scientist" is a fictional film (2016, 56") made by the Dutch scientists Bas Haring, Joost van Ginkel, Frans van Lunteren and Remco van Schadewijk of Leiden University. The film addresses the dilemmas that everyone involved in the science engages. On Being a Scientist is attractive, entertaining and exciting, with good actors. The working language is English, with Dutch subtitles.

- Movie (56")
- Inspire
- Confront
- Free

What does this mean?

The film can contribute to a discussion about the dilemmas that appear in the film.

How much time does it take?

The movie lasts 56 minutes.

How much is this?

"On Being a Scientist" (all episodes) - YouTube can be downloaded for free at [On Being a Scientist \(all episodes\) - YouTube](#)

What preparation is needed?

No special preparation is needed.

How do you deploy this?

As a start or reason for discussing dilemmas in the field of scientific integrity. PhD students, postdocs and other participants could watch the film online prior to a discussion meeting. There are also positive experiences with a live screening with discussion afterwards. The film can be streamed via, for example, Zoom, after which the discussion could be continued immediately via Zoom. More information about streaming via Zoom: <https://support.zoom.us/hc/en-us/articles/202954249-Optimizing-a-shared-video-clip-in-full-screen>

Other comments

The film is from 2016, that is, before the renewed Netherlands Code of Conduct (2018) Scientific Integrity.

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.

Factsheet

2022 | www.nwo-i.nl/wi-toolbox

Knowledge building blocks

Knowledge building blocks Some knowledge institutions have come a long way in developing study material and didactic methods related to scientific integrity. NWO-I is in contact with experts in this field at Eindhoven University of Technology (TU/e) and University of Twente (UT) who are willing to share their knowledge, experience, insights and methods with you and us.

- Course material
- Knowledge and behaviour
- To inform

What does this mean?

If you are considering setting up training for institute employees (such as PhD students and postdocs), you do not have to reinvent the wheel: you could use the input from TU/e and UT. That saves a lot of time.

How much time does it take?

Consultation about what both parties can do for each other takes time, but certainly less than setting up a training yourself.

How much is this?

There are no costs involved.

What preparation is needed?

The preparation consists of answering the question: what do you need knowledge and experience building blocks for? What do you want to achieve, solve or change in the field of scientific integrity in your organization?

How do you deploy this?

This depends on the demand.

Other comments

Team Communicatie has the contact details and can put you in touch with the relevant experts and provide support.

Who do I ask my other questions?

To the WI ambassadors of your own institute, via the Communication team of the NWO-I office or by sending an email to info-nwoi@nwo.nl.