Towards a Sustainable and Open Science

Recommendations for Enhancing Responsible Research and Innovation in the Biosciences at the University of Bremen

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The following 12 institutions are members of the Starbios2 consortium:

European partners:

- Università degli studi di Roma Tor Vergata, Italy (coordinator of the project)
- Oxford University - Medical Sciences Division, United Kingdom
- Univerza na Primorskem Università del Litorale, Slovenia
- AgroBioInstitute, Bulgaria
- Uniwersytet Gdanski, Poland
- University of Bremen, Germany
- Laboratorio di Scienze della Cittadinanza, Italy
- Aarhus University, Denmark
- Uppsala University, Centre of Research, Ethics and Bioethics, Sweden

International partners:

- International Centre for Genetic Engineering and Biotechnology, South Africa
- University System of Maryland, USA
- Fundacao Oswaldo Cruz, Brazil

About the Starbios2 Project

Starbios2 is a four-year project (2016–2020) within the European Commission's 'Science with and for Society' Programme, focusing on Responsible Research and Innovation (RRI). The project is generously funded by the European Union under the HORIZON 2020 Programme. Nine research institutions from European countries and three international partners are involved in the project coordinated by the Università degli studi di Roma Tor Vergata in Italy. The project has the following main objectives:

1) Develop RRI-oriented structural change processes, by designing, implementing and evaluating six RRI Action Plans (APs) in research institutions from Europe (in Bulgaria, Germany, Italy, Poland, Slovenia and the United Kingdom), and developing three further APs in non-European entities (in Brazil, South Africa and the United States), all active in the field of biosciences. Within the APs, five RRI issues are considered: public engagement, gender, education, open access and ethics.

2) Develop a learning process on RRI-oriented structural change, based on the implementation of APs. The following issues are considered: resistances and barriers to RRI; key factors favouring or supporting RRI; and strategic options and RRI-oriented tools. The outputs of the learning process will result in the development of a set of recommendations on how to support RRI in research institutions.

3) Develop a sustainable model for RRI in the biosciences. The model would provide the staff and leaders of Biosciences Departments and Divisions with further and better formalised orientations and practical knowledge about the key issues related to the implementation of RRI and how they can be encompassed.

A comprehensive description of the Starbios2 objectives, supported measures and structural change processes in different partner institutions is offered in *Colizzi et al. (2019). For more information about Starbios2, visit: https://starbios2.eu

The booklet *Towards a Sustainable and Open Science – Enhancing Responsible Research and Innovation in the Biosciences at the University of Bremen* contains 35 recommendations developed for the implementation of the RRI issues societal engagement, gender, ethics, open access and education. It is primarily directed at researchers and students of the Biosciences at the University of Bremen. It is also intended to encourage other research institutions to engage with RRI in practice.

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*Colizzi V, Mezzana D, Ovseiko P, et al. (2019). Structural Transformation to Attain Responsible BIOSciences (STARBIOS2): Protocol for a Horizon 2020 Funded European Multicenter Project to Promote Responsible Research and Innovation. JMIR Research Protocols, 7 March 2019.

Enhancing Responsible Research and Innovation (RRI) in the Biosciences at the University of Bremen

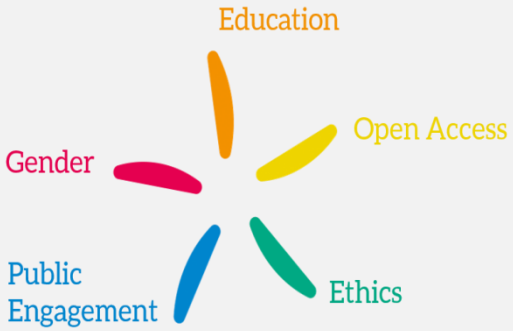
What is Responsible Research and Innovation?

The idea of strengthening connections between science and society through building effective cooperation is driven by a belief that science should be fully integrated with broad societal needs. At the same time, scientists have an increasing obligation to become involved with policymakers and the public in finding and implementing solutions to issues that are both local and global. Knowledge often brings the greatest benefit if it increases public understanding and awareness. Involving multiple stakeholders in research and innovation will therefore lead to a better connection of the processes and outcomes with the values, needs and expectations of society.

The mentioned factors come together in the idea of **Responsible Research and Innovation (RRI)**, which is a priority under the EU Programme Horizon 2020 focusing on building capacities and developing innovative ways to connect science to society. In particular, the RRI approach allows all societal actors (researchers, citizens, policymakers, business, third sector organisations, etc.) to work together during the entire research and innovation process to better align both the process and the outcomes with the values, needs and expectations of European society.

In practice, RRI consists of designing and implementing policy that will:

- **engage society** more broadly in its research and innovation process;
- increase **open access** to scientific results;
- ensure **gender equality** in both research process and research content;
- take into account the **ethical dimension**; and
- promote formal and informal **science education**.



Respecting these five key elements would help to make science more attractive for young people and society, open up further research and innovation activities and raise awareness of the meaning of responsible science.

Societal Engagement

Societal Engagement (SE) in RRI is about co-creating the future with citizens and civil society organisations, as well as bringing on board the widest possible diversity of actors that would not normally interact with each other on matters of science and technology. Benefits from SE include:

- contributions to build a more scientifically literate society able to actively participate in and support democratic processes, and science and technology developments;
- differing perspectives and creativity in research design and results; and
- contributions to foster more societal relevant and desirable research and innovation outcomes to tackle societal challenges.

Open Access

Open Access (OA) seeks to make research findings available free of charge for readers to improve knowledge circulation and innovation. Making research more accessible contributes to a better and more efficient science. At the European level, the idea of OA is progressively moving into the broader picture of 'Open Science'.

Gender

Gender equality strategy (GES) is about fostering gender diversity in research institutions. Benefits from GES include:

- fostering gender balance in research teams and in decision-making processes and removing barriers that generate discrimination against women in scientific careers; and
- integrating the gender dimension into research and innovation content with the goal to improve the scientific quality and societal relevance of produced knowledge.

Ethics

Ethics is an integral part of the research process. According to EU priorities, ethical research conduct implies the application of fundamental ethical principles in all possible domains of research, including the nature sciences, social sciences and humanities. Research must comply with ethical principles at the national level. Ethical issues include the involvement of children, patients and vulnerable populations; the use of human embryonic stem cells; privacy and data protection issues; and research on animals.

Education

Science education (SE) is a trigger of RRI by focusing on:

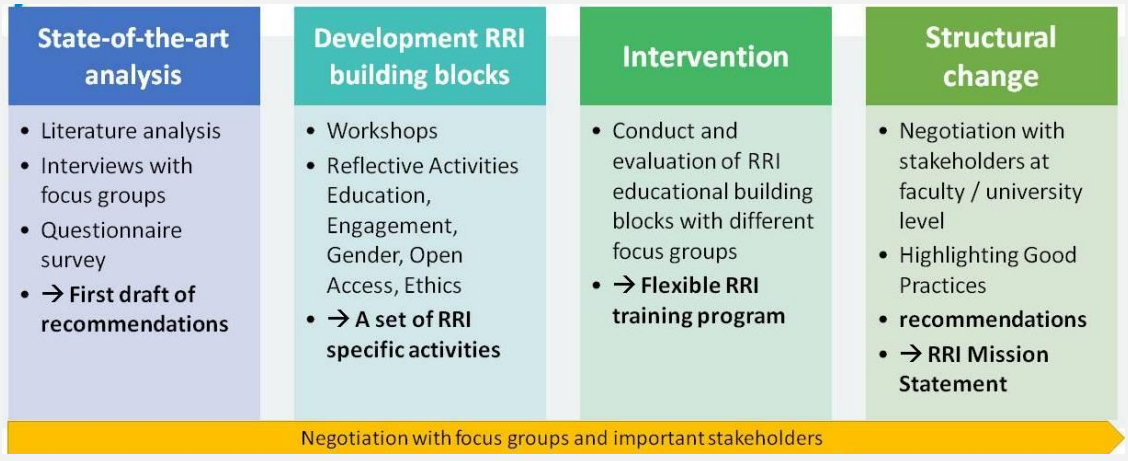
- attracting young people to science and scientific careers in STEM (Science, Technology, Engineering, Mathematics);
- improving the level of science literacy in the society;
- providing innovative science activities in both formal and informal education;
- raising young people's awareness of scientific and technological issues in the society; and increasing society's interest in science, technology and innovation.

Faculty of Biology and Chemistry and Its Contribution to RRI

Since May 2016 the Faculty of Biology and Chemistry at the University of Bremen has been implementing the project **Starbios2 – Structural Transformation to Attain Responsible Biosciences** under funding from the Horizon 2020 EU Programme. The objectives of the project's Action Plan in Bremen include:

- the initiation and conduct of an RRI structural change process at the **Faculty of Biology and Chemistry**;
- involving important stakeholders and members of permanent focus groups (students, doctoral students, researchers) in a **bottom up – top down process**;
- conduct state of the art analyses (literature, research projects) and identification of RRI **supportive structures** such as the Graduate School NanoCompetence and the outreach lab Backstage Science (BaSci Lab Biology);
- running an interview survey with stakeholders and a faculty-wide questionnaire survey and deduction of **RRI criteria**;
- SE as a trigger to attain responsible research;
- development, testing and evaluation of **educational building blocks** like reflective activities and workshops for different target groups; and
- negotiation of **RRI recommendations** and **RRI mission statements**.

Roadmap of structural change (2016–2020)



The roadmap demonstrates the important steps of structural change (Elster, 2018). The recommendations for structural change (see step 4) are summarised in this booklet.

RRI in Practice: Overview of RRI Recommendations

Using the Starbios2 project data, analysis of the European and German guidelines and the findings of the interview and questionnaire surveys, a series of RRI recommendations for the Faculty of Biology and Chemistry at the University of Bremen have been developed. According to the RRI keys, there are five elements of 'RRI in Practice': societal engagement, gender, ethics, open access and education. These are mainly targeted to students and researchers of the Faculty of Biology and Chemistry, but could be used by all persons interested in RRI issues tailored to the University of Bremen. They are linked to existing guidelines and background information and to the local Starbios2 website via QR codes and internet links. The information is provided in both English and German.

Local Starbios2 website:

Local Starbios2 website

Public engagement in practice	▪ **Research and transfer** ▪ **Research and popularisation** ▪ **Openness and conflicts of interest**
Gender in practice	▪ Fostering gender balance in research teams and decision-making bodies ▪ Integrating the gender dimension in the research and innovation content
Ethics in practice	▪ Good scientific practice ▪ Anchoring ethics in the curricula for young scientists ▪ Protection of living organisms in research
Open access in practice	▪ Anchoring open access in curricula for young scientists ▪ Transparency about open access policies at the University of Bremen ▪ Transparency about open access support at the University Library (SuUB)
Education in practice	▪ Promotion of RRI in lectures ▪ Promotion of RRI in curricula ▪ Promotion of RRI in outreach events

Societal Engagement in Practice

A handout for Faculty 2 members of the University of Bremen

Public engagement with science has been evolving over the last 20 years. It started with a willingness to promote public understanding of science with the one-way communication of scientific findings. This follows a deficit model assuming that an ignorant public has to be trained. Within the paradigm of RRI, the creation of and communication about scientific achievements proceeds with scientists and citizens as equal partners.

A. Research and Transfer

Recommendation 1:

Scientists should actively involve public, economic and political partners from the beginning of a research project.

Early collaboration between the different stakeholders ensures the inclusion of different perspectives and objectives into project planning. These considerations may influence the project outcome and pave the way for a later exploitation or transfer of project results. They also provide for a broad diversity of thoughts and ideas, which are beneficial for the research process and for meeting actual public needs.

The University of Bremen supports transfer activities through a transfer strategy and maintenance of cooperation with co-institutes, organisations and companies. Furthermore, transfer of technology-based solutions, complex services and knowledge are facilitated through contacts with organisations of innovation, economic support and in-service training, as well as apprenticeships.

The involvement of diverse stakeholders in the research process can enhance the transferability of technology and knowledge due to regular communication and the resulting knowledge about stakeholders' requirements.

Public Engagement and RRI

Technology Transfer (Risdon, 1992)

University of Bremen Transfer Strategy

Recommendation 2:

Scientists should be aware of the University of Bremen's transfer support.

UniTransfer offers assistance for scientists and their partners regarding their cooperative activities. Information on start-ups, patents, fund raising and transfer of personnel is also provided.

UniTransfer University of Bremen

For business start-ups from Bremen Universities, the network BRIDGE (University of Bremen, University of Applied Sciences Bremen, University of Applied Sciences Bremerhaven and Bremer Aufbau-Bank) supports start-up activities and constantly develops support options for the students, graduates and academic staff of the participating universities.

BRIDGE
University of Bremen

B. Research and popularisation

Recommendation 3:

Scientists should be aware of or informed about the importance and/or advantages of societal engagement in the context of RRI.

The communication between science and society is a vital part of the Third Mission of universities. An open discussion of the methods and risks of research issues enables both scientists and stakeholders to sound out possible actions and reactions. The necessities, countermeasures and considerations can then be explored collaboratively.

The responsibility showed by communicating openly about research issues facilitates social acceptance and trust, which is necessary both to attain public funding and to ensure the possibility of scientific freedom.

EUA - Beyond the Third Mission

AAAS - Social Responsibility

Recommendation 4:

Scientists should actively use suitable models of communication to reach relevant recipients, stakeholders and groups of interest.

Communication between scientists and citizens is characterised by participants' different goals, knowledge bases and terminologies. Nevertheless, both parties play an equal role in the communication process. It is important to consider the pre-requisite differences to enable citizens to participate equally in communication about research. The degree of scientific language has to be adapted to the targeted recipient group. Furthermore, scientists have to choose the complexity and extent of the research topic carefully when they want or need to present it. To facilitate access to a research topic, there may be connections to more familiar concepts, the living conditions of the target group or aspects of general interest. Embedding in research within social contexts with examples and analogies suitable for the targeted recipient group may provide researchers assistance in giving an elevated understanding of the research topic.

Science Communication

Addressing Science Communication

Recommendation 5:

Scientists and research institutions should have in place clear routines that reward researchers who popularise research and participate in research-related public debates.

Scientists at all career levels are obligated to disseminate their research to the public. At the University of Bremen there is, for example, the possibility to present and discuss research issues at the Science Chat with students and scientists from diverse disciplines. The House of Science facilitates exhibitions, lectures, talks, discussions and more to promote co-operation of different actors within society and science.

Because of the additional workload, special attention should be paid to the accompanying benefits, such as facilitated access to public funding and scientific freedom due to earning citizens' trust. Because these benefits are difficult to measure, researchers should be appreciated and rewarded accordingly.

Science Chat University of Bremen

AAAS - Public Engagement Reward

Recommendation 6:

Scientists should be aware of different activities and channels to promote societal engagement.

Communication about research issues, results and processes may pursue different objectives as visualised in the Public Engagement Triangle. For dissemination, the communication activities focus on transmitting information, e.g. through press or website articles, lectures or symposia. At the University of Bremen, the Press Office organises press releases and social media on request.

It may be necessary to receive opinions, ideas or suggestions for research topics, which can be gathered through feedback talks at symposia or public discussions, among other venues. In Bremen, the event series Science Goes Public facilitates the presentation and discussion of research topics in a casual and humorous fashion.

For successful collaborative communication, the public partners can be integrated in the publication and presentation process through consultation and steering meetings.

Public Engagement Triangle

Science Goes Public Bremen

C. Openness and conflicts of interest

Recommendation 7:

Scientists are obliged to be open about possible conflicts of interest.

The transparency of research issues and processes may raise public opposition, caused by misunderstandings, different priorities or values. These contentions need to be discussed and reflected openly to ensure the researchers' trustworthiness and to achieve mutual understanding, as demanded in the European Code of Conduct for Research Integrity.

European Code of Conduct

Gender in Practice

A handout for Faculty 2 members of the University of Bremen

In the context of RRI, Gender Equality is a crosscutting issue and consists of the following objectives: **fostering gender balance in research teams and decision-making bodies** and **integrating the gender dimension in research and innovation content**.

Gender Equality in Research

Fostering gender balance in research teams and decision-making bodies implies a structural component that includes the creation of a culture and working conditions that allow men and women to have equally fulfilling careers. **Gender in research and innovation content** means outlining the gender dimension of research by considering sex and gender as key variables at all levels of the research process to address the different needs and aspirations of men and women and to discover gender-specific differences.

STAGES project

A. Fostering gender balance in research teams and decision-making bodies

Recommendation 1:
Scientists should be aware of existing measures and activities respecting gender

The University Bremen offers many measures and activities regarding gender. These measures aim to promote gender conscious culture and research, the reconciliation of private and professional life and career promotion for women (mentoring programmes). In the scope of the Starbios2 project, we established an RRI Toolbox on our local Starbios2 website to highlight the already existing measures and activities in respect to RRI and collect them in one place.

RRI Toolbox

In the **Gender Toolbox**, university measures and activities relating to gender as well as general information on this topic are collected.

PRAGES Guidelines

Recommendation 2:
Scientists should be aware of the underrepresentation of women in science.

Women are underrepresented in science and engineering careers, especially in higher academic positions. This is called the leaky-pipeline phenomenon. Based on the lack of women in leading positions, females are also underrepresented in decision-making bodies. There is thus a strong need to generate working conditions that allow gender balance and the equal participation of men and women.

University in Numbers 2018

Recommendation 3:
Scientists should balance the number of male and female researchers in their research teams.

The composition of the research team has a major impact on research. Based on empirical studies, the most important scientific innovations have increasingly been generated by collaborative teams, and group collaboration is strongly improved by women due to improvement of the collective intelligence of the team and by the representation of a different perspective (European Commission, 2012). Both men and women appreciate working in a balanced team.

EC, 2012

Recommendation 4:
Qualified women should be nominated for posts and awards, and a positive image of women should be promoted by all scientists.

It is not by chance that when one thinks of a 'scientist', the majority imagine an old man with dishevelled grey hair and glasses. To break down this stereotype and promote a positive image of women is important. More females in leading positions would create more female role models and would lead to a positive impact on other women aspiring to a leadership position. The visibility could also be improved by nominating qualified women to posts and awards. Worth mentioning in this context are the International Award for Women in Science by the L'Oréal-UNESCO Foundation and the Emmy Noether Programme funded by the Germen Research Association (DFG).

International Award for Women in Science

Emmy Noether Programme

B. Gender in research and innovation content

Recommendation 5:
Scientists should be aware of the difference between sex and gender.

Whereas sex refers to the biologically determined characteristics of men and women (genitalia, genetic differences), gender refers to the social construction of women and men. The World Health Organisation (WHO) provides the following definition: 'Gender refers to the socially constructed characteristics of women and men, such as norms, roles, and relationships of and between groups of women and men. It varies from society to society and can be changed' (WHO, 2011).

In all research areas where people are involved, the presence or absence of a gender dimension and the biological sex should also be identified. This is especially the case in the field of biosciences, where the work often includes animals, tissues and cell cultures, where gender is a key variable that could be eliminated, and the consideration of sex as a key variable is strongly important in the discovery of sex-specific differences. The Canadian Institute of Gender and Health offers a website with useful information, including a video and online training modules on this topic.

Video: Learning about Sex and Gender

Online Training: Sex and Gender

Recommendation 6:
Scientists should be aware of the importance of the gender dimension in research content.

In the field of biosciences, the consideration of sex and gender in research content takes a high priority at present. Whenever people are involved in the research process, be it as a consumer, user, patient or in trials, gender and sex should be considered and addressed. An integration of a sex and gender analysis in all phases of basic and applied research yields more high-quality research and excellence. In addition, it is increasingly important to outline the gender dimension in research proposals to receive research funds. The University of Stanford offers the website Gendered Innovation with useful information and examples of best practices on this topic.

Gendered Innovation

Recommendation 7:
Scientists should consider sex and gender in all phases of the research cycle.

Sex and gender should be taken into account at all stages of the research cycle. Here, gender takes a twin approach: on the one hand the creation of working conditions and a culture that enables the equal participation of men and women in research teams at all levels, and on the other hand, the outlining of the gender dimension in research content to address the reality of both men and women.

Toolkit Gender in EU-funded research

The Toolkit Gender in EU-funded research is a practical tool and guideline to integrate gender in research content and includes a corresponding checklist.

An overview is given in the following table:

Research phase	Equal opportunities for men and women in research	Gender in research content
Research idea phase		Generate gender-sensitive ideas for research proposals Make research hypotheses gender sensitive
Research proposal phase	Select a mixed team of men and women Create gender-equal working conditions	Formulate gender-sensitive research questions Choose a gender-sensitive methodology
Research phase	Value the work of women and men equally Manage and monitor men's work equally	Collect gender-sensitive data Analyse data in a gender-sensitive way
Dissemination phase		Report data in a gender-sensitive way Use gender-impartial language Disseminate results in a gender-sensitive way

Ethics in Practice

A handout for Faculty 2 members of the University of Bremen

Consideration of the ethical aspects in science is an essential part of RRI. Science is inextricably linked to responsibility and moral considerations and this must be continually incorporated in the selection of research topics and in the conduct of research and innovation. High ethical standards merit public trust. They refer to a better alignment of research with social needs and expectations and support the societal uptake of products, processes and services that are the results of scientific research.

A. Good scientific practice

Recommendation 1:
Scientists should be aware of the rules of 'Good scientific Practice' and implement them consequently.

Uni HB Order for Safeguarding GSP

Academic integrity means adherence to the rules and standards of Good Scientific Practice (GSP). Honesty and truth have the highest priority in scientific work. GSP describes the scientific activities according to the written rules and laws, but also according to the unwritten rules of the scientific community. Any violation of these rules will be considered scientific misconduct. Scientific misconduct is always present when intentional or grossly negligent misrepresentations are made, intellectual property infringes others or their research activities are impaired in other ways. A detailed listing of scientific misconduct can be found in the Order for Safeguarding Good Scientific Practice of the University of Bremen (only in German).

Recommendation 2:
Scientists should be aware of dealing with scientific misconduct.

DFG Scientific Misconduct

Scientists at all career levels are obligated to follow the rules of GSP and implement them appropriately. In case of suspicion of scientific misconduct, an ombudsperson as independent mediator should be called in for a preliminary investigation. If a case of scientific misconduct arises, it will be submitted to the Commission for Investigating Scientific Misconduct. The commission examines whether scientific misconduct has occurred and what measures are to be taken.

Ombudsperson for the field of natural sciences at the University of Bremen is Professor Dr Reinhard X. Fischer and in replacement Professor Dr Rolf Drechsler:
Phone 0421 218 6516, rfischer@uni-bremen.de

Phone 0421 218 63932, drechsler@uni-bremen.de

The procedure for investigating scientific misconduct is detailed in the Order for Safeguarding Good Scientific Practice (only in German). Applicants, grant recipients and other individuals responsible for the use of DFG funds have to follow the Rules of Procedure for Dealing with Scientific Misconduct.

Recommendation 3:

Scientists should be aware of dealing with uncertainty and risk and apply precautionary principles.

In very complex and new fields of science such as nanotechnology or biotechnology, especially, one often has to deal with uncertainty and risk. To prevent possible danger to the health of humans, animals and plants, as well as to protect the environment, the researcher must clarify the degree of certainty and indicate any elements of risk. Whenever the scientific data do not allow a complete assessment of risk, the precautionary principle should be applied.

EC Precautionary Principle

Recommendation 4:

Scientists should be aware of handling research data.

With increasing digitisation, the management of research data is becoming increasingly important. Even after the end of a research project, the underlying data should be made available for third parties. Only in this way can the research results be made comprehensible and reproducible and, by combining them with other data, new insights and hypotheses can be generated. The University supports the FAIR principles of the European Commission in handling research data. According to FAIR research data should be findable, accessible, interoperable and reusable. According to the rules of GSP, it is recommended to preserve and publish research data safely and for the long term (at least 10 years) in suitable repositories. For the handling of research data, a counselling service has been established at the university:
Björn Oliver Schmidt bschmidt@vw.uni-bremen.de
Noemi Betancord-Cabrera Noemi betancort@suub.uni-bremen.de

UNI HB Recommendations Research data

EC: FAIR-Guidelines

B. Anchoring ethics in curricula for young scientists

Recommendation 5:
Scientists should be aware of dealing with copyrights for teaching and research.

When digital media are created or integrated into research and teaching, a number of legal issues have to be addressed. Since March 2018, an amended version of the copyright law has entered into force, which provides for a wider use of copyrighted material for teaching and research purposes. On the websites of the ZMML (Centre for Multimedia in Teaching) and the Akademie für Weiterbildung (Academy for Continuing Education) of the University of Bremen, much useful information on the legal use of digital media in research and teaching can be found. The ZMML and the Rechtsstelle (law office) of the University of Bremen provide advice on legal issues regarding copyright.

Copyright for the University

Website ZMML

Recommendation 6:
Scientists should be aware of privacy and data protection.

When human beings are the subjects of scientific research, privacy and data protection issues arise. The collection, processing and storage of personal data, as well as the recording of photos, videos or audio material is only allowed if the affected person has previously given voluntary written consent. For this purpose, an informed consent form will be submitted to the affected person, in which the reason for, as well as the execution of the data collection, processing and use, is comprehensible formulated. Only data that are actually required for research purposes may be collected and may be used only for the purpose that underlies the survey. Additionally, the collected data must be protected by access restrictions and the use of secure programs and hardware.

EC: Ethics & data protection

Recommendation 7:
Scientists should be aware of the different offers regarding scientific writing at Faculty 2 and the University of Bremen.

The ability to create scientific writing is a basic requirement for making research findings accessible to the scientific community as well as society and to avoid scientific misconduct such as plagiarism. Within Faculty 2 there exists a Guideline for writing a bachelor's thesis (in German only). All students should be informed about this.

"Writing Bachelor Thesis"

The University also offers a series of workshops for scientific writing via the support centre BYRD (for graduates) and the Studierwerkstatt (for undergraduate students). Helpful material about scientific writing is available on the website of the Studierwerkstatt.

BYRD Events

Studierwerkstatt

C. Ethical principles for living organisms in research

Recommendation 8:

Scientists must show due care and respect for animal welfare in the preparation and execution of animal experiments.

Scientists have to accommodate their research so that the use of research results is not contrary to the fundamental demands of animal welfare. The guidelines are regulated by the German Protection of Animals Act (Tierschutzgesetz). It has to be clarified whether there are alternatives to animal experiments. If this is not the case, then special attention must be paid to exemplary livestock farming and the experimental conditions that meet the requirements of the Animal Welfare Act and the RRR rules (Replacement, Reduction, Refinement). In the case of bachelor's or master's theses in which animal experiments subject to authorisation have been carried out, a brief reference to the existence of a corresponding animal test approval must be given in the method section of the thesis.

Animal protection law

DFG: Animal Experimentation

Recommendation 9:

In case of uncertainty, scientists should be supported by an independent ethics committee.

If there are ethical questions in the research project that relate to experiments with human cells and/or animals, a researcher must ask an independent ethics committee for their assessment.
The responsible contact person at Faculty 2 of the University of Bremen is Professor Dr Juliane Filser and in replacement Professor Dr Rita Groß-Hardt:
Phone 0421 218 63470, filser@uni-bremen.de
Phone 0421 218 50203, gross-hardt@uni-bremen.de

Uni-HB: Ethics Committee - Rules of Procedure

Recommendation 10:

Scientists should be aware of their responsibility for the protection of threatened species while doing research.

NBSAP

For the protection of our natural heritage, scientists should be aware of global, national and regional regulations concerning working with plants. In 2002, the UN Global Strategy for Plant Conservation (GSPC) was launched to promote actions towards a better understanding of species that are most at risk to promote the conservation of threatened species. Launched in 2013, the European programme 'Living Well with the Limits of our Planet' draws on a number of strategic initiatives in the field of environment, including the 2020 Biodiversity Strategy.
The German National Biodiversity Action Plan (NBSAP) is the principle instrument for implementing the GSPCs at the national level.

Open Access in Practice

A handout for Faculty 2 members of the University of Bremen

RRI also involves making research findings accessible not only to the scientific community, but also to society at large.

Open Access

Open access publishing means open and free access to scientific publications via the internet. An open access publication can be read, downloaded, printed, linked and saved by the user for free. Especially in the natural sciences, open access has become increasingly important in recent years (for more information, see the QR code or the link below the QR code).

OA Movement

In Germany overarching decisions on open access are regulated on the national level. The DEAL project is commissioned by the "Alliance of German Science Organisations" and it is represented by the "German Rectors Conference". The goal of DEAL is to negotiate new license contracts with the major e-journal publishing houses Elsevier, Springer Nature and Wiley to achieve a transition to more open access. More than 700 institutions in Germany are concerned by the DEAL project and this also includes the University of Bremen.

DEAL project

A. Anchoring open access in curricula for young scientists

Recommendation 1:
Scientists should be aware of the procedure for open access publishing.

There are two types of open access: golden and green. The golden way indicates the primary publishing of a scientific publication via an electronic open access peer-reviewed journal. The funding for golden open access publications is borne by the authors, the research organisations or funders – the reader does not have to pay. The green way signifies the secondary publishing of a publication that has already been published in a subscription-based journal. After a certain period of time (embargo) there is usually the possibility of publishing the preprint or post-print in open access on a university or institute server (repository) or otherwise on the internet, such as at Research Gate. The conditions for different publishers and the associated journals can be found on the SHERPA/ROMEO database.

OA Strategies

SHERPA/ROMEO

Recommendation 2:
Scientists should be aware of avoiding predatory publishing.

Once deciding to pursue open access publication, it should be ensured that the selected journal is a 'true' open access journal, where quality control in the context of a peer review is carried out. In the past, so-called 'predatory publishers' have cast a shadow on open access; these are publishers who pretend to be a full-fledged scientific journal, without ensuring the services of a reputable journal, such as a proper peer review or worldwide discoverability of the publications.

Predatory Publishing

Recommendation 3:
Scientists should be informed about open access journals in their research domains.

The Directory of Open Access (DOAJ) provides a comprehensive list of open access journals. All journals listed here maintain appropriate quality control and the articles are available free of charge worldwide immediately after publication.

DOAJ

B. Transparency about the open access policy of the University of Bremen

Recommendation 4:
Scientists at all levels should be encouraged to publish their research results in open access.

Since 2010, the University of Bremen has pursued an open access strategy. An open access policy came into force in 2011. This includes the signing of the Berlin Declaration and encourages the scientists of the University of Bremen to publish their research results in open access venues. It is not mandatory and the publication method remains the free decision of every scientist.

Uni-HB: OA Policy

C. Transparency about open access support by the University Library (SuUB)

Recommendation 5:
Scientists should be aware of the costs of publishing open access and the financial support of the library.

Depending on the length and the selected journal, the costs for an open access publication are between €300 and €3000, which are paid by the author of the publication. The library of the University has established an open access publication fund to cover these costs.

OA criteria

Subject to certain criteria, the costs of an open access publication for university members can be covered.

Recommendation 6:

Scientists should be aware of the ELIB SuUB Bremen Repository.

The Bremen State and University Library has its own repository where members and alumni of the university can publish their work freely and free of charge worldwide (ELIB SuUB Bremen Repository).

ELIB

Recommendation 7:

Scientists should be aware of the support by the university library for publishing in open access.

The State and University Library Bremen provides information on open access in general and on open access publishing procedures on its website. As a further service, the library regularly offers information events on open access via the support centre BYRD and Faculty 2 (see Starbios2 training modules and BYRD events).

OA SuUB

BYRD Events

Training modules

Recommendation 8:

Scientists should be aware of the representative of open access.

The contact person for open access questions in the library is Benjamin Ahlborn:
Phone 0421 218 59440, ahlborn@suub.uni-bremen.de
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Science Education in Practice

A handout for Faculty 2 members of the University of Bremen

Science education has an important role in educating future scientists and university students. What scientists do, how they work, innovate and make decisions are important subjects for contemporary science education. While science and technology develop, science education needs to renew itself and work along with these developments. New educational models should trigger an inspiring and fruitful structural change regarding RRI issues. As a consequence, within the Starbios2 project, new educational concepts has been developed at the level of students' individual training by reflective activities, RRI modules as inspiring practices, RRI in curricula and outreach programmes.

A. Promotion of RRI issues in lectures

Recommendation 1:
Scientists should be encouraged to integrate reflective activities about RRI issues in their lecturing.

Local Starbios2 website

The promotion of critical thinking is one of the key issues of good scientific RRI practice. Students and researchers should be encouraged to question critically what is good and conscientious practice within their scientific domain. They should be aware of societal needs and see to it that research is not oblivious towards societal values.

Reflexive capacities are crucial for understanding the role and responsibilities of research. Students and researchers should therefore be aware of the interrelationship of their own research with other areas of science. The goal is to be open to collaboration and coproducing knowledge with other researchers, as well as professionals outside their own fields and with citizens.

Within the Starbios2 project a series of **reflective activities** regarding the societal engagement, research contextualisation, open access publication, gender in research, diversity team management and ethics in science communication are developed, tested and evaluated. They are summarised in the RRI toolbox at the local website.

Recommendation 2:
Scientists should be encouraged to use problem-oriented socio-scientific contextualised educational models to raise awareness of RRI issues.

In the context of Starbios2 at the University of Bremen, the concept of raising awareness for RRI issues through RRI

educational building blocks is based on an educational model called CitizenSIP. The model is based on problem-based learning (PBL) in socio-scientific contexts (SSC) and inquiry-based science education (IBSE) with a specific focus on citizenship education (CE). PBL in SSC in authentic research projects as real-world scenarios offers powerful opportunities to develop critical thinking about the nature of science and its implications (Lederman et al., 2014). IBSE is an appropriate educational instrument for acquiring process skills and an adequate view of the nature of science (Capps & Crawford, 2013), as well as a meaningful understanding of science in a societal context. Citizenship education takes into account the moral and social function of education at a socio-political level.

RRI in science education requires that students have creative thinking and problem solving skills. RRI deals with dilemmas and uncertain situations where students' arguments are as important as the scientific facts. Examples of RRI modules are 'Promotion of Risk Literacy in Regard to Nanotechnology', 'Wake up – Sensitisation of adolescents for the stem cell donation for leukaemia patients' and 'Biodiversity loss and climate change in the Wadden Sea'. These are summarised at the local website of the BaSci Lab Biology.

BaSci Lab Biology

B. Promotion of RRI in curricula

Recommendation 3:

The connection of RRI to the curricula of bachelor's and master's study programmes should be ensured

University students as ongoing researchers should acquire the knowledge and skills needed to work responsibly during their academic careers. In their academic development, the ideas and concepts of RRI should be fostered and developed throughout the formative process of education. Traditional academic hierarchies should be modified to enhance voluntary participation and debate among students. In an atmosphere of openness and trust, students should be encouraged to draw own conclusions and provide valuable contributions to the debate.

The integration of research and teaching can provide valuable ways to enhance student learning experiences. Nevertheless, making this connection can be challenging and the understanding of 'research-based education' and 'research-informed teaching' within and between disciplines is diverse. The nexus of research and teaching is influenced by departmental structural arrangements for organising research and teaching activities, and a potential gap in making connections between staff research outputs and students' learning occurs when this research is too far ahead of the undergraduate curriculum to be accessible to students (Jenkins

2004).

Graffiths (2004) and Healey (2005) distinguish five research-informed teaching approaches:

- research-led (RL): Students learning 'about' the research of others;
- research-oriented (RO): Students learning about research processes;
- research-based (RB): Students learning as researchers;
- research-tutored (RT): Students learning through critiquing research; and
- scholarship of teaching and learning (STL): Enquiring and reflecting on teaching and learning.

In the bachelor's programme of Biology and the different master's programmes at Faculty 2 all five approaches to research-informed teaching are offered. They provide different ways and door openers for RRI learning. Whereas during the bachelor's programme different concepts, ideas, relevance and aims of research and RRI are discussed (RL and/or RO), the integration in research groups and writing of the bachelor's thesis offers the possibility for students to learn as researcher (RB). That allows the student to relate RRI processes in his or her own field and the role of responsibility in these processes. Especially within the associated interdisciplinary key qualifications (general studies) modules, students are informed about the criteria of good research and ethical issues in scientific writing.

Study programmes

In the master's programmes for biosciences, students focus on the specific topics of their fields of research and RT learning may be at the core. Science Chats and master's seminars allow doing and experiencing dialogical reflection on research and innovation (STL) and a perspective within the wider society

Recommendation 4:
The connection of RRI to the curricula of doctoral programs should be ensured

Most of the reflective activities developed in the Starbios2 project target PhD students and young researchers. When doing more or less self-reliant research, applying of RRI issues are of great importance. The assessment of the possible societal impacts of one's own concrete research activities, as well as ethical issues regarding the research are of increased importance. The goal is to propose pathways to better align research projects with societal needs, values and expectations.

A good practice example at the University of Bremen is the Graduate School NanoCompetence – Research – Mediation – Design. This interdisciplinary graduate school combines expertise

in the natural sciences and humanities, aiming for improved societal information on applied aspects of nanotechnology.

C. Promotion of RRI in outreach events

Recommendation 5:
Scientists should open their research to the public

There are different possibilities for bringing scientists and/or scientific questions into direct contact with societal needs. One example is the citizen science project My Ocean Sampling Day (MyOSD), part of the Max Planck Institute in Bremen. It is a global scientific campaign to analyse marine microbial biodiversity and function, taking place during the solstice on 21 June. The goal of the MyOSD citizen initiative is to involve citizens, school classes and teachers in the research process. Supported by scientists and equipped with the MyOSD Sampling Kit and a smartphone application, which can be used to collect marine microbes and important environmental data, participants help gain a better understanding of the world's oceans and their microbial biodiversity.

Another fruitful example is the Open Campus Day in Bremen. According to the motto 'Science for You and Me', the Starbios2 core team presents and discusses the topics of genetic engineering and its future. For children, hands-on activities, such as DNA isolation from strawberries and construction of DNA models with pearls, are offered. In addition, a reflection activity on future topics of genetic engineering is discussed, such as 'Should mammoths be brought to life?' or 'Green genetic engineering as a solution to global hunger?'

Open Campus Day

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