



Scientific Freedom and Scientific Responsibility

Recommendations for Handling Security-Relevant Research

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¹ This text is based on the "Guidelines and Rules of the Max Planck Society on a Responsible Approach to Freedom of Research and Research Risks" of March 19, 2010, which the DFG and Leopoldina adapted in their "Approach to Security-Relevant Research" working group.

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Preface

Science needs freedom, freedom entails responsibility

Article 5 of the German Basic Law protects scientific freedom. Freedom of research must be accorded high priority because it plays a fundamental role in ensuring social progress and prosperity. And yet in nearly every branch of science, important and useful research findings can also potentially be misused to do harm. This dilemma of dual use, as it is called, always sparks wide debate over the benefits and risks of specific research proposals. A current example involves experiments to determine whether humans can contract highly pathogenic avian influenza, also known as bird flu viruses. The public debate of this issue has expressed the expectation that researchers themselves develop ethical principles and mechanisms for a responsible approach to freedom of research and research risks. In response, the German Ethics Council published a position paper in May 2014 on behalf of the Federal Government entitled *Biosecurity - Freedom and responsibility of research*, which focuses on research conducted into highly pathogenic viruses and bacteria while also evaluating the validity of subject-specific codes of conduct in light of recent advances in the life sciences.

In this context, the German Research Foundation and the National Academy of Sciences Leopoldina set up an interdisciplinary, cross-institutional working group in 2013 to debate and analyze the complex relationship between *Freedom of research and responsibility*. It aimed to stimulate debate in scientific communities and among DFG and Leopoldina members as well as to develop general guidelines on handling security-relevant scientific research based on the “Guidelines and Rules on a Responsible Approach to Freedom of Research and Research Risks”, which the Max Planck Society approved in 2010. In doing so, the DFG and Leopoldina are fulfilling their statutory mandate of advising researchers, policymakers and the public. The members of the working group deserve special thanks for their great commitment.

Weighing the risk of potential misuse of research findings versus their benefits presents special challenges for the responsibility and self-control of researchers. This is true for every area of research. It is therefore necessary to make both researchers and research institutions aware of the security-relevant aspects of their work and to provide them with a guideline for dealing with potential risks.

With the present recommendations, the DFG and Leopoldina hope to foster scientific discourse on the dilemma of dual use and thereby focus the attention of scientific communities and research institutions on the dilemma. The guidelines are meant as an aid for researchers as well as a blueprint for research institutions implementing corresponding regulations. They are aimed primarily at the government-funded research sector but their principles can also be applied in industrial research.

The recommendations offer assistance in answering ethical questions, thus contributing to defining standards and codes of conduct beyond statutory norms for scientists dealing with security-relevant research. The DFG expects those involved in the research projects it funds to adopt a responsible approach to ethical questions. Furthermore, DFG and Leopoldina offer the

establishment of a board advising on issues arising from the implementation of these recommendations.

The DFG and Leopoldina advocate greater awareness of the problem of potential misuse of research findings and minimising associated risks without disproportionately restricting freedom of research and its further development for peaceful purposes and the well-being of society.

May 2014



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Summary

Research plays a fundamental role in ensuring progress. Freedom of research, which is enshrined in the German Basic Law, is a fundamental requirement in this respect. Yet free research is also associated with risks. These risks result primarily from the danger of useful research findings being misused (known as the *dual use dilemma*). Legal regulations can only cover these risks to a limited extent.

The German Research Foundation (*DFG*) and the National Academy of Sciences (*Leopoldina*) urge researchers not to content themselves with just complying with legal regulations. After all, researchers' knowledge, experience and freedom give them a special ethical responsibility that goes beyond legal obligations. In addition, research institutions should create framework conditions for ethically responsible research. The self-regulatory tools of science are highly significant in this regard. They are founded on a high level of familiarity with the subject and can react flexibly.

The *first section* of the *DFG* and *Leopoldina's* recommendations are aimed at *individual scientists*. They need to be aware of the danger of misused research. In critical cases, these individuals must draw on their knowledge and experience to make a personal decision about what is responsible in their research. In doing so, they need to weigh the opportunities offered by the research against the risks for human dignity, life and other important values. The present recommendations specify these considerations in terms of necessary risk analysis, measures for reducing risk, evaluating the publication of research results, and abstaining from research as a last resort. The primary goal in all of this is to carry out and communicate research in a responsible way. In isolated cases, a responsible decision on the part of the researcher may even mean that a high-risk project can only be carried out following a research moratorium or not at all.

The *second section* of the recommendations is aimed at *research institutions*. They need to raise awareness of the problem, convey the required knowledge of *legal constraints* on research and support corresponding training measures for scientists. Research institutions need to develop *ethics rules* for handling security-relevant research that go beyond compliance with legal regulations. Each institution should set up a special committee on research ethics to implement these rules and to advise scientists.

I. Introductory guidelines

A. Freedom of research and responsibility of scientists

Research plays a fundamental role in ensuring the progress of mankind. It serves to increase knowledge and promote the health, prosperity and security of mankind and the protection of the environment. The freedom of research, which is enshrined in Article 5 Paragraph 3 of the German Basic Law and may only be legally restricted to protect other important constitutionally protected values, is the main requirement for this. Furthermore, scientifically successful research requires transparency, which is afforded primarily by the free exchange of knowledge and the publication of research findings.

Yet free and transparent research is also associated with risks. Such risks do not necessarily result from negligence or deliberate misconduct by scientists. In all areas of science, there is also the danger that findings – which are neutral or useful per se – may be misused by third parties for harmful purposes. In defence technology, materials research and nanotechnology can lead to the development of offensive weapons; research on industrial robots can enable the construction of robots for combat; atomic energy can be used for non-peaceful purposes. Research findings on pathogenic microorganisms and toxins can also be used for new biological weapons and terrorist attacks, and genetic analyses of plants at the molecular level can lead to biological attacks on seeds. In computer science, research into protecting systems against computer viruses can facilitate not only their prevention but their spread and new forms of cyber warfare. Misuse of research is also feasible in medicine as well as in the behavioural sciences and social sciences. Psychological, medical and neurobiological research can support aggressive interrogation techniques up to and including torture. Optimising the collection, matching and analysis of personal data can lead to a violation of personal rights. Linguistic research on speech recognition systems can also be employed to inappropriately monitor communications. Legal and philosophical publications can be misused to justify human rights abuses. Risks of misuse therefore exist in most areas of research. At the same time, failing to conduct research can also entail significant risks, such as when a vaccine needs to be found to avert an imminent epidemic.

This possibility of using research findings for both beneficial and harmful purposes (known as the dual use dilemma) makes it difficult to make a clear distinction in many fields between “good” and “bad” research, defensive and offensive research, and research for peaceful or terrorist purposes. This dual use dilemma also exists in knowledge-oriented basic research, where results often cannot be predicted and research findings are not good or bad in and of themselves. Judging this kind of research is also difficult because future use chains are often unknown and estimating risks and consequences tricky. These problems are particularly acute when research findings can be misused as is, without intermediate steps (known as *dual use research of concern* – DURC).

Within this complex matrix of benefits and risks, the role of science is to carry out research for the welfare of humankind and the protection of the environment and other values – especially those that are constitutionally protected. Scientists must therefore prevent or minimise direct or indirect harm to values deserving of protection as far as possible. In addition to the feasibility of research, they should therefore also take its consequences and controllability into account where possible. In individual areas, they must decide how much protection specific values deserve, assuming the decision has not already been regulated by law. Science is therefore subject to ethical as well as legal constraints.

B. Legal and ethical constraints on research

Research constraints are in the first instance determined by *legal provisions*. These may restrict the freedom of research to protect significant constitutionally protected values, provided this is proportionate. The relevant provisions have different objectives and approaches. They may prohibit research objectives (e.g. the development of nuclear and biological weapons), regulate methods (e.g. certain experiments on humans) or ban the export of knowledge, services and products to certain countries (e.g. within the framework of German foreign trade law or EU regulation 428/2009 on the control of exports of dual use items and technology).

Scientists are individually responsible for adhering to applicable legal provisions.² They must inform themselves of the provisions applicable to their area of research and ensure they are adhered to within the scope of their responsibilities. Violations of legal provisions can lead to protracted proceedings with prohibitions, sanctions and penalties as well as a loss of reputation for the scientist, their institution and their entire field. Research institutions also have a legal responsibility. They should therefore support their staff in complying with applicable legal provisions (*compliance*). By doing so, they are also protecting themselves and meeting their legal duty of supervision, which may require them to intervene in the event of a legal violation.

Yet *individual scientists* cannot content themselves with just complying with legal regulations. Their knowledge and experience and the freedom afforded to them gives them a special responsibility that goes beyond legal obligations. They must therefore use their knowledge, experience and skills to recognise, estimate and assess relevant risks. In critical cases, these individuals must make a personal decision about the constraints on their work, and take responsibility for that decision within the scope of their freedom of research. In some cases, the result may be that some projects – even those that are not prohibited by law – must be carried out in a different form or not at all.

In addition to laws imposed by governments, the *self-regulation of science* is highly significant. Self-regulatory instruments are founded on a high level of expertise and familiarity with the subject and can take on a preliminary warning function in the face of new problems. They can also react quickly and flexibly and can autonomously solve problems connected with security-relevant research. In the process, they are often better able than legal regulations to stay abreast of the continually changing research landscape, account for difficult dual-use risk estimates, and make the difficult value judgments that follow – especially in cooperation with specialised committees.

Similarly, *scientific organisations* have a duty to create aids and structural framework conditions for ethically responsible research. The same is true for influential institutions that promote research.

C. The aim of the following recommendations

With the present guidelines and recommendations, the German Research Foundation (DFG) and the National Academy of Sciences (Leopoldina) intend to raise awareness of the problems

² Researchers and institutions in Germany are subject to German law. Outside of Germany, they are subject to the applicable law of that location. In addition, researchers and institutions working abroad may also be subject to their own national law. International law also applies (e.g. protection of human rights, international humanitarian law, law of war, bans on torture and the use of force, Convention on Biological Diversity).

mentioned above, raise awareness of risks, provide ethical guidelines to assist with answering ethical questions, and minimise risks through self-regulation.

The following recommendations are aimed at all persons who are involved in scientific research. They were developed primarily for the government-funded research sector. Statements about researchers' personal ethical responsibility for their work and statements about risk analysis and risk reduction requirements also generally apply to researchers in the industrial sector.³³ The recommendations are also intended to encourage scientific institutions to create corresponding organisational framework conditions for themselves.

The DFG and Leopoldina urge researchers to reflect on the ethical principles cited in these recommendations and to take them into account and put them in concrete terms during their work. Research institutions should implement the proposed regulations – after adapting them for their particular needs – and supplement them if necessary with additional subject-specific self-regulatory measures (e.g. subject-specific codes and committees)⁴ in order to identify and minimise potential risks. The DFG, as an institution for the advancement of research, and the Leopoldina, in its superordinate role as National Academy of Sciences, will provide strong support for the dissemination and broad acceptance of the recommendations and will work towards ensuring compliance with the principles laid down.

II. Recommendations on a responsible approach to security-relevant research

A. General recommendations on ethically responsible research

1. *General principle*

Science serves to increase knowledge and has a duty to promote human well-being and the protection of the environment and other values – especially those that are constitutionally protected. Researchers need to prevent direct and indirect harm to these values as far as possible.

When making decisions in this context, they cannot content themselves with complying with legal regulations but must also observe ethical principles. They need to be fundamentally aware of the danger of misused research. In critical cases, these individuals must draw on their knowledge and experience to make a personal decision about what is responsible with regard to their research. In doing so, they need to weigh the opportunities offered by the research against the risks for human dignity, life, health, freedom and property, the protection of the environment and other values.

³ However, recommendations regarding how industrial research should be performed as well as those regarding the integration of ethics committees in industrial research are covered and qualified in particular by labour law.

⁴ See, for example, for the field of *medical research on humans*: Declaration of the World Medical Association of Helsinki/Tokyo (1964/75) with various subsequent revisions. For the field of *bio-security*: German Research Foundation – Code of Conduct: work with highly pathogenic microorganisms and toxins, 2013; National Science Advisory Board for Bio Security, Proposed Framework for the Oversight of Dual Use Life Sciences Research: Strategy for Minimizing the Potential Misuse of Research Information, 2007, Strategic Plan for Outreach and Education on Dual Use Research Issues, 2008; Royal Netherlands Academy of Arts and Sciences, Biosecurity Committee, Improving Bio Security – Assessment of Dual-Use Research, Advisory Report, 2013. See also the recommendations published by the German Ethics Council 7 May 2014 entitled “Biosecurity – freedom and responsibility of research”.

The following concrete measures must not be permitted to inappropriately hinder research and are subject to feasibility and proportionality.

2. Risk analysis

Awareness of the potential risks is a prerequisite for responsible research. Raising awareness of the relevant dangers is thus a key requirement in the avoidance, or at least control, of research risks. Researchers should therefore take account of the consequences and opportunities for application and misuse of their work and its controllability. In doing so, they should also consider the risks of not conducting the research in question.

The identification of research risks not only concerns risks relating to individual conduct. In cases where research is susceptible to risk of misuse, researchers should also take account of the consequences of their work and the possibility that useful research findings could be misused for harmful purposes by third parties. Risk analysis and the evaluation of consequences require an open-minded and responsible approach. It may be necessary for researchers to find out about the context of the research project or about the commissioning parties and cooperation partners.

3. Minimising risk

Researchers and other persons involved in their projects should minimise, as far as possible, the risks associated with the implementation or use of their work. Measures on risk minimisation should be assessed and carried out both before and during an ongoing research project.

This may result in the implementation of security measures (e.g. to prevent the release or theft of dangerous substances from laboratories) or special protection of the confidentiality of research results through physical, organisational and information technology means (e.g. encryption of saved and transmitted data). Such security measures and access restrictions do not conflict with the requirement for transparency because research results are not required to be made accessible to everyone at all times (see also II.A.4).

Employees and cooperation partners working on research susceptible to misuse must be selected meticulously based on their reliability and sense of responsibility. In the event that the spread of security-relevant research results poses a particular risk (such as in the context of weapons of mass destruction or export restrictions), it may be appropriate to work with special advisory services, legal departments at research organisations, or government security authorities.⁵

Risk minimisation measures may also consist of only carrying out specific research for or with certain cooperation partners. While international cooperation is a fundamental element of successful research, in individual cases a restriction of international cooperation or avoidance of partners or staff from certain countries may nevertheless be recommendable from a risk minimisation perspective. National and international provisions and lists on export restrictions may constitute a basis for identifying countries where misuse of certain research results is a danger.

⁵ See, for example, regarding biological threats the *Centre for Biological Threats and Special Pathogens (ZBS)* at the *Robert Koch Institute*; for computer security issues the *Federal Office for Information Security (BSI)*; regarding embargo violations the *Federal Office of Economics and Export Control (BAFA)*.

4. Evaluating publications

The possible consequences of publishing results in high-risk research areas should be evaluated even before the start of the project. This applies, in particular, in cases where research results alone – without additional knowledge or elaborate implementation or application processes – can lead to specific dangers or significant damages (dual use research of concern).

In such cases, security interests conflict with the interest of publishing research results. The free exchange of information and especially the publication of results are important factors for scientific knowledge and scientific progress, particularly in government-funded and knowledge-oriented research. They also benefit transparency, reproducibility, scrutiny and in turn quality assurance for the research process. Moreover, the publication of results can promote the development of protective measures (e.g. vaccines in healthcare or antivirus programs in IT). Suppression of research results may prevent effective protection against their misuse by totalitarian regimes, terrorist groups, organised criminal groups or individual criminals.

The requirements for transparency and communication do not, however, prevent scientists from minimising specific risks of their research by delaying the publication of the results of their work instead of publishing immediately. In the case of research results with a high degree of potential for misuse, parts of the results which are particularly susceptible to misuse may be excluded from the publication or published in an abridged form in special cases – provided that the reader is made aware of these changes. In certain cases, researchers may only share specific results of their work with certain persons.

Complete avoidance of the communication and publication of research results may only be considered if there are no other ways of countering the dangers. However, this is only justified in extraordinary cases.

The above principles also apply to researchers who are involved in the scientific publication process, for example as peer reviewers or editors. Researchers in such positions working in relevant risk areas should ensure that the publication of research results and the policy of the publishing houses and other institutions they are working with conform to the principles set out here.

5. Forgoing research as a last resort

The primary goal of risk analysis is to carry out and communicate research in a responsible way. However, responsible decision-making by researchers may in individual cases – when no other protective mechanisms exist – lead to a high-risk project only being carried out at a later point in time, following a research moratorium, or perhaps not at all, even when the project is not prohibited by law.

In dual use research, which can have harmful as well as beneficial effects, it is difficult to determine and apply criteria for the constraints mentioned here. The necessary ethical evaluation of the remaining risks that follows the definition of possible protective measures may be assisted by examining whether the potential damages of the research outweigh the potential benefits.

Scientific freedom and the benefit of the research as well as the risk of damages should be taken into account when examining this point. The following factors should be considered: the probability that damages will occur, the extent of possible damages, the extent to which the research results could be used for harmful purposes with or without complex implementation

processes. Finally, consideration should be given to whether misuse can be prevented and the extent to which the consequences can be controlled. Other decisive factors include the identity of the cooperation partners, customers, users and funders of the research.

6. Documentation and communication of risks

If research entails risks for human dignity, life or well-being or for the environment or other significant values with constitutional protection, scientists should document these risks, how they weigh up against possible benefits, and the measures taken to minimise them both before and, in the event of changes, during their work. Scientists should bring this documentation to the attention of the research ethics committee responsible for these problems (see II.B.2 below) or the head of their institution before the research begins.

Relevant risks and measures taken to minimise them should be noted on applications for research funding. Scientific advisory boards and other groups evaluating the research should be informed of these risks and measures as early as possible and should take a position on them in their reports.

7. Training and information

In their university teaching and their training of junior scientists, researchers should communicate the principles of a responsible approach to research risks and set a good example. When doing so, researchers should also cover the subject-specific rules on risk minimisation for their respective field of research. Researchers should also contribute to raising awareness about these issues when they carry out their projects (see also II.B.3 below).

8. Persons responsible

Evaluating whether research complies with legal provisions, self-regulatory measures and ethical principles is, in the first instance, the task of the scientists responsible for the project. In addition, the scientists' superiors bear responsibility, in particular within the scope of their legally required duty of supervision.

The persons involved in the research should primarily inform the scientist responsible for the project, but if necessary also that scientist's supervisor and the responsible research ethics committee (see II.B.2), of legal violations that have occurred or could occur, as well as any ethical reservations.

The principles set out here also apply when scientists are involved in evaluating the projects of other researchers. Employees in such positions should ensure that research applications set out and minimise possible risks in risk areas and account for these principles.⁶

⁶ On the area of application of these recommendations, see also I.C. above.

B. Supplementary organisational recommendations for research institutions

1. Legal provisions and compliance units

Research institutions need to raise awareness of the issue among their staff and convey the required knowledge of *legal constraints* on research in their specific areas of activity.

Research institutions that carry out work at the margins of the law or high-risk work should have a special unit for ensuring compliance with legal provisions (known as a compliance unit). This unit should support the head of the institution and their staff in complying with legal provisions on research constraints, provide relevant policies and train those persons doing the research in relevant measures. The unit should be able to report directly to the head of the research institution if possible and collect any necessary information from the institution's staff members. Small institutions may transfer these tasks to an existing organisational unit (e.g. legal department or auditing).

Research institution staff members should be able to turn to the compliance unit at any time if they are of the opinion that the institution or its cooperation partners are not complying with legal provisions to prevent the misuse of research. Regulations to protect whistleblowers should be in place and should ensure that people can report incidents without this disadvantaging them.⁷

If research violates *legally binding provisions*, the institution head must take the necessary steps.

2. Ethics rules and research ethics committees

Research institutions should also define *ethics rules* for handling security-relevant research that meet the provisions listed in II.A and B or that achieve the goals of those provisions in another equivalent form. Special additional provisions can be considered for specialised areas of research when these must accommodate relevant international regulations and recommendations.

Each research institution should form a special research ethics committee to advise on issues arising from the implementation of ethics rules. This committee should provide researchers with support on issues of research ethics, mediate in differences of opinion between researchers on relevant matters, and issue recommendations on the implementation of research projects. The committee's powers and actions must be compatible with researchers' scientific freedom. This is particularly true when committee decisions are set to be compulsorily enforced or reinforced with sanctions.

The process of selecting committee members should lend committee decisions a high degree of legitimacy (e.g. election of members or nomination by the institution's research associates). Committee members should perform their committee responsibilities independently of all binding mandates. The committee should be made up of persons with sufficient scientific expertise to handle each particular case in question. The committee should be able to request in an appropriate way information from all staff members to ascertain the facts it needs and

⁷ See the DFG's recommendations on good scientific practice of 2013, No. 17.

consult appropriate sources in person or in writing. A set of bylaws should regulate the most important procedural issues (legal hearings of affected scientists, protection of whistleblowers, impartiality of deciding committee members, powers of committee to collect information) and the committee's decision-making powers.

Every researcher at the institution should be able to task the research ethics committee with verifying whether planned and ongoing projects are compatible with the institution's ethics rules.

3. Education and training

Research institutions should promote the necessary awareness of ethical constraints on research, e.g. through relevant campaigns, educational events and corresponding information requirements on funding applications. They should promote the training events cited above (in II.A.7) for their employees at the institutional level and incorporate them in their teaching and training programmes.⁸

⁸ See also the German Association of University Professors and Lecturers' (DHV) resolution from the 60th DHV Day entitled "Wissenschaft im Dienst des Menschen" (science in the service of mankind), published in *Forschung und Lehre* 2010, p. 324.

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