WR

Recommendations on Academic Integrity

Position Paper

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Preliminary remarks

Academic integrity means a fundamental ethical approach and a broad culture of honesty in scientific work that is to be preserved and fostered. In light of the continuously increasing importance of scientific knowledge for the development and prosperity of society, trust in the common professional ethics of the scientific community is crucial. Even if the vast majority of scientific work is carried out on the basis of these professional ethics, cases of scientific misconduct such as deception, manipulation, plagiarism or concealment in theses right up to scientific articles undermine this essential trust and damage the reputation of the overall system. For this reason, the scientific community has the ongoing task of striving for framework conditions and rules that support scientific honesty in accordance with an approach of self-monitoring and self-regulation.

In recent years, the German Council of Science and Humanities (Wissenschaftsrat) has addressed various aspects of academic integrity. Most recently, it published a position paper in 2011 entitled *Anforderungen an die Qualitätssicherung der Promotion* together with *Empfehlungen zur Bewertung und Steuerung von Forschungsleistung*, each including also suggestions for improved framework conditions for good scientific practice with particular foci. |[1] In recent years, there have been significant developments: scientific organisations have updated their guidelines and procedural rules, universities have implemented recommendations and, in some cases, established new structures. The present position paper will take stock of the activities, assess which measures and instruments have proved to be successful in strengthening academic integrity, and will identify the areas where action is still required.

In Part A "Taking stock", the position paper first presents an overview of the existing national and international guidelines on good scientific practice and describes the implementation status of its central recommendations. On this basis, the second part of the paper, "Areas of action and recommendations", de-

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|[1] In its recommendations on career goals and paths at universities (2014), the Council has also issued key recommendations for the restructuring of academic career paths, and these also serve as framework conditions for academic integrity. Refer also to B.IV in this regard.

scribes how a culture of academic integrity can be strengthened in the system in the long term. It focuses on prevention structures and dealing with suspected misconduct, but not on issues of legal sanctions in cases of fraudulent behaviour. The paper does not only address the prevention of serious cases of scientific fraud such as falsification of data or plagiarism, but also those forms of scientific misconduct – such as "poor scientific practice" or questionable research practice – that often inhabit a grey area and receive less public attention.

With the present review of the system, the Council wishes to draw attention to achievements so far as well as to persisting problems – not least with the aim of acknowledging the value of the scientific system, which is also accountable to society. The position paper aims to identify the most important areas of action and framework conditions to strenghten academic integrity. This is supposed to serve as a stimulus for scientific and science policy institutions to expand their activities in this area and to develop specific standards for different institutions and research fields. An overview of the existing rules, recommendations and potential actions will also be provided here for these institutions.

Fostering academic integrity is an ongoing and shared task for persons and institutions in the scientific community, who participate in an ongoing dialogue and continuous development. Thus the recommendations of other stakeholders should be regarded as complementary to this position paper. The *Sicherung guter wissenschaftlicher Praxis (Safeguarding Good Scientific Practice)* |² recommendations of the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) are but one example here. In summer 2013, the Council invited various stakeholders in science and politics to engage in a dialogue at the conference *Wissenschaft in der Verantwortung*. The results of the conference have served as an input for this paper. External experts from other scientific organisations (DFG, HRK, AFT) have participated in developing these recommendations in the *Tertiäre Bildung (Tertiary education)* committee. Additionally, interviews with representatives of various institutions were conducted during the preparation of this paper. The Council owes them a particular debt of gratitude.

This position paper (Drs. 4609-15) was approved by the Council on 24 April 2015.

|² Deutsche Forschungsgemeinschaft: Sicherung guter wissenschaftlicher Praxis. Denkschrift, Weinheim 2013 (expanded edition).

Preamble: The term Academic Integrity

Honesty, a sense of responsibility and truthfulness are prerequisites in all areas of society and work. Why does science in particular have to make certain of this ethical foundation and continually ensure its stability? Misconduct, fraud and negligence, which can occur in other areas of life, are also possible in science; nonetheless, science has a particular ethical responsibility that compels it to carry out continuous self-monitoring. Science's claim to autonomy – in terms of the freedom of persons and institutions in science – reinforces this ethical responsibility. As a system that is self-regulating and operates according to its own rules, science must pass on its professional ethics to each new generation by creating responsibility structures and framework conditions that strengthen a reliable culture of *academic integrity* in the long term. The prosperity, development and growth of modern societies depend on the quality and progress of scientific knowledge and on integrity within the research process.

In this paper, academic integrity is understood as a comprehensive ethical awareness, a culture of honesty and responsibility for quality in science. |[3] It encompasses the teaching and use of norms during university studies and applies to the entire research process in all phases of scientific education and careers. The standards of good scientific practice are understood as *knowledge* that is applied in everyday research practice. The practice and exercise ultimately lead to *ability* and an *attitude* (in the sense of habitus and as an expression of a personal philosophy) of academic integrity. This attitude must be trained and put into practice at universities and scientific institutions in order to strengthen a culture of academic integrity in the long term. It is not

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|[3] In this paper, we will not consider any ethical issues on topics or subjects of research – such as armaments research or animal testing – under the term *academic integrity*. Within the confines of this paper, the topics of corruption and the influencing of research by (commercial) clients and the issue of discrimination shall not be dealt with, even though these are important issues in the context of academic integrity.

limited to independent research in theses or the correct representation of data, but also includes the transparency of overall research and publication practice. It is the task of scientific organisations to develop framework conditions to strengthen academic integrity. The recommendations given in the present position paper focus on these structural conditions for the personal responsibility.

The position paper is structured chronologically. It begins with a review of the main guidelines on good scientific practice of various stakeholders, presenting the consensus of existing norms. As a next step, it gives an analysis of the implementation of the described guidelines in Germany. This should help to identify which changes have since been initiated, which recommendations have been implemented and have proved to be effective measures for the prevention of scientific misconduct, and which areas still require action. The second part will describe the main areas of action and prospects for the future to strengthen academic integrity. Finally, the paper addresses the practical implementation of these recommendations by assigning specific areas of responsibility and tasks to various target groups.

A. Taking stock

I.1 National

The recommendations on good scientific practice published by scientific organisations in Germany emerged in two periods. Each of them represented reactions to particularly serious cases of scientific misconduct that attracted a lot of publicity. The first of these two periods began in 1997 as a reaction to a scandal concerning falsified data in cancer research. As a result, the German Research Foundation (DFG) published *Vorschläge zur Sicherung guter wissenschaftlicher Praxis (Proposals for Safeguarding Good Scientific Practice)* in 1998, a set of recommendations by the *Kommission Selbstkontrolle in der Wissenschaft (Commission on Professional Self-Regulation in Science)*. Its recommendation to develop standard rules of procedure for dealing with scientific misconduct was implemented that same year by the German Rectors' Conference (Hochschulrektorenkonferenz, HRK). Many universities and scientific institutions developed their own rules of procedure, as well as guidelines, and established ombudsperson's offices. |4

A second period of recommendations on good scientific practice followed from 2011 onwards, as a reaction to scandals concerning plagiarism in the doctoral theses of prominent politicians. That same year, the German Council of Science and Humanities published the position paper *Anforderungen an die Qualitätssicherung der Promotion*, and the German Research Foundation (DFG) revised its *Denkschrift zur Sicherung guter wissenschaftlicher Praxis (Memorandum on Safeguarding Good Scientific Practice)* and published it in 2013 with additional discussions of

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|4 The Council does not have accurate figures on the number of universities and institutions that have taken such measures.

topics such as whistleblowers, ombudspersons, procedures in cases of scientific misconduct, and authorship. Other organisations such as the German Rectors' Conference (HRK), the German General Faculty Association (Allgemeiner Fakultätentag, AFT) and the German Association of University Professors and Lecturers (Deutscher Hochschulverband, DHV) approved their own recommendations for their relevant target groups.

The national guidelines, their functions and their relevant target groups will be outlined below. They show that many detailed recommendations on good scientific practice already exist in Germany with a broad consensus on the most important issues. |⁵

The DFG memorandum *Sicherung guter wissenschaftlicher Praxis (Safeguarding Good Scientific Practice, 1998, expanded edition 2013)* represents the most comprehensive national guideline on good scientific practice. It considers the overall scientific system as well as dealing with individual topics. It is addressed to all scientists, member organisations and recipients of funding and is referred to in many guidelines by other stakeholders. Its core recommendations relate to the following areas: ombudspersons, training of young scientists, performance evaluation, the safeguarding and storing of primary data, procedures in suspected cases of scientific misconduct, publications and journals, research funds and whistleblowers. In addition, a section in the memorandum is dedicated to fundamental *problems in the scientific system*, i.e. to framework conditions that could provide incentives for dishonesty in science. The transformation of the science system towards "entrepreneurial knowledge production" and the competitive productivity and quantity-based ideology in science are identified as important influential factors for the motivation to achieve success through misconduct. |⁶

In 2013, the *German Rectors' Conference* published the recommendation *Gute wissenschaftliche Praxis an Hochschulen (Good scientific practice at German higher education institutions)*, a short paper with five recommendations that are largely based on the revised DFG memorandum and are addressed to member universities and the management of these universities. The annex to this paper contains the German Rectors' Conference's standard rules of procedure *Zum Umgang mit wissenschaftlichem Fehlverhalten in den Hochschulen (Dealing with Scientific Misconduct at Higher Education Institutions, 1998)*, which identified process steps and responsible committees from allegations up to possible sanctions.

In 2011, the *German Council of Science and Humanities* published two papers on the subject of good scientific practice from two differing perspectives, addressing

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| 5 A synopsis of the individual specific recommendations is presented in Annex 1.

| 6 Deutsche Forschungsgemeinschaft: Sicherung guter wissenschaftlicher Praxis. Denkschrift, Weinheim 2013 (expanded edition), p. 31.

those in responsible positions at universities and scientific institutions as well as in science and funding policy. The position paper *Anforderungen an die Qualitätssicherung der Promotion* also deals with important requirements for good scientific practice during doctoral studies. It focuses on the areas of supervision of doctoral students, reviewing, the establishment of standards, the responsibility of other academic staff, and dealing with scientific misconduct. The recommendations *Empfehlungen zur Bewertung und Steuerung von Forschungsleistung*, published that same year, deal with issues such as good scientific practice in connection with evaluation procedures (including rankings, ratings, evaluation and peer review processes). The paper discusses the issues of dependency on external funding, publication pressure and competition in scientific activity as framework conditions that are contributing factors to scientific misconduct. |[7] The types of misconduct identified do not only include plagiarism or the falsification of data, but also methodologically sloppy work, improper authorship or citing potential reviewers just to win favour. The paper also reflects critically on other framework conditions such as quality assurance in peer review procedures, accelerated review procedures and the evaluation of quantitative indicators (e.g. the amount of external funding, numbers of doctorates).

The joint position paper of the German General Faculty Association (AFT), the faculty associations and the German Association of University Professors and Lecturers (DHV) *Gute wissenschaftliche Praxis für das Verfassen wissenschaftlicher Qualifikationsarbeiten (2012)* and the paper *Maßnahmenkatalog zur Gestaltung von Promotionsverfahren (2013)* represent further important guidelines. The former publication deals with theses (from bachelor's theses to the 'Habilitation' as a postdoctoral qualification) at universities in Germany, particularly addressed to examiners and exam candidates. The 2013 catalogue of measures considers issues such as the integration of the topic *good scientific practice* into the curricula, the establishment of local ombudsperson's offices and the improvement of the quality of supervision.

The paper *Wissenschaftsadäquates Publikationsverhalten – Empfehlungen des Deutschen Hochschulverbandes (2011)* by the German Association of University Professors and Lecturers (DHV) emphasizes the issue of the authorship(s) of scientific publications. It focuses on scientific texts apart from theses and considers topics as the legal differentiation between authorship and copyright. It calls for a detailed listing of contributors and claims that persons who did not actively participate should not be listed as authors. It also recommends establishing transparency of the order in which authors are listed and, in this way, transparency of the individual contributions to the research project and the publication.

|[7] "It seems reasonable to suppose that the inherent high expectations of quality and originality in research combined with high time pressure would encourage such misconduct." (Wissenschaftsrat: Empfehlungen zur Bewertung und Steuerung von Forschungsleistung, Halle 2011, p. 31.)

Most non-university research institutions and organisations within the Alliance of Science Organisations in Germany already formulated their own guidelines at a very early stage, generally based on the guidelines of the German Research Foundation (DFG). In addition, they have often put in place their own rules of procedure based on the standards of DFG and HRK (see above). These include the Max Planck Society's *Regeln zur Sicherung guter wissenschaftlicher Praxis* |[8], the Leibniz Association's *Empfehlungen zur Sicherung guter wissenschaftlicher Praxis in den Instituten der Leibniz-Gemeinschaft* |[9], the resolution of the Assembly of Members of the Helmholtz Association *Sicherung guter wissenschaftlicher Praxis und Verfahren bei wissenschaftlichem Fehlverhalten* |[10], which are all explicitly based on the rules in the DFG memorandum. The German National Academy of Sciences Leopoldina's *Junge Akademie* has been working on the rules and issues of good scientific practice for a number of years in its *Manieren* working group. Furthermore, the organisations within the *Alliance of Science Organisations* approved their *Grundsätze zum Umgang mit Forschungsdaten (Principles for working with research data)* in 2010 with the intention of contributing to a "coordinated ongoing course of action". These principles refer to the following topics: storage of and generally open access to data, with regard to the differences between disciplines, professional recognition of the additional time and financial costs, teaching and training on data management, standardisation and meta data, development of infrastructures (international and interdisciplinary interoperability).

I.2   International

In a growing global science system that increasingly features multinational research teams and collaborations, similar challenges and problems are also being discussed on a European and/or international level. The goal is a definition and codification of common values and norms and the resulting practice. An ethos that claims universal validity is becoming more and more important in the light of the fact that the international scientific community is increasingly growing

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|[8] The guidelines from the year 2000 were revised in 2009. The revised guidelines also discuss conflicts of interest between science and industry (consideration of the problem of parallel secondary positions as a reviewer, membership of supervisory boards, etc.). In addition, the Max Planck Society (MPG) published a comprehensive document *Verantwortliches Handeln in der Wissenschaft – Analysen und Empfehlungen* in 2001, which describes in detail the relevant background history of science and conflicts within science and which makes reference to the rules mentioned above.

|[9] It is worth emphasising the detailed definition of scientific misconduct in the 1998 recommendations, which goes further than the definition in other publications and also identifies issues such as misleading review evaluation, co-responsibility through knowledge of misconduct by others and gross neglect of a duty to provide supervision as types of misconduct. In addition, a set of procedural rules was developed and possible sanctions were identified in detail.

|[10] In the 1998 resolution, it was recommended that the individual centres should adopt their own rules as suited to their subject areas.

closer together. For this reason, a number of international and, in some cases, very comprehensive recommendations on good scientific practice and academic integrity have been published recently with the aim of establishing standards with broad applicability. A few of these are briefly presented below.

In 2010, the *European Science Foundation (ESF)* published *Fostering Research Integrity in Europe*, which formulates a *European Code of Conduct for Research Integrity* with the aim of achieving a common understanding of good scientific practice in Europe. It recommends a platform for an international network for exchange and support when dealing with the topic of *good scientific practice*. In addition, it recommends strengthening the culture of integrity and establishing rules for international collaborations. The *Code of Conduct* is considered as a *canon for self-regulation* and formulates important principles of good scientific practice. These include the secure and accessible storing of primary and secondary data, an expectation of transparency regarding the participating persons and the identification of research funding in the case of publications, as well as editorial responsibility and the replacement of reviewers who have conflicts of interest. It is also recommends that national institutions should introduce governance structures for research integrity.

In 2005, the *European Commission* published recommendations that include important aspects of good scientific practice. The *Commission Recommendation on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers* covers issues such as "Professional responsibility", "Accountability", "Relation with supervisors", "Co-authorship" and "Complaints/Appeals". The Code of Conduct also recommends that selection procedures should focus on the quality rather than the quantity of publications.

Comprehensive recommendations on an international scale have been presented in a paper by the *InterAcademy Council/IAP* (the global network of science academies): *Responsible Conduct in the Global Research Enterprise: A Policy Report (2012)*. The paper recommends strengthening the willingness of researchers to share data. |[11] Research institutions should establish their own clear rules, train

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|[11] The accessibility of research data and scientific results is discussed in detail in the *Berliner Erklärung über den offenen Zugang zu wissenschaftlichem Wissen (Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, 2003)*, one of the foundation stones of the international open access movement. Researchers and authors should allow open access to their scientific articles and a full version of each, including all supplementary materials, should be deposited in at least one online repository (original scientific research results, raw data, meta data, source materials, digital representations, etc.). Support is to be provided for the transition to a culture of open access and of evaluation systems for open-access publications and journals in order to maintain the standards of quality assurance and good scientific practice. The movement's aim is the unlimited and free accessibility of scientific information. 497 international

young scientists in good scientific practice, remove unintentional factors that could promote dishonest behaviour and establish effective mechanisms for the investigation of scientific misconduct. Funding agencies should also avoid strategies that reward the quantity rather than the quality of research. Publishers should make retracted articles visible, take steps to prevent double publications and refrain from asking authors to cite articles from the publisher's own journals with the sole aim of increasing the journal's impact factor.

The recommendations of the OECD Global Science Forum in *Investigating Research Misconduct Allegations in International Collaborative Research Projects: A Practical Guide (2009)* focus on scientific misconduct in international scientific collaborations (with regard to both prevention and sanctions). These recommendations include a boilerplate text – to which other relevant rules should be added – for all members of international research groups to sign. The recommendations also specify requirements for investigations of scientific misconduct in agreement with the members (knowledge of the norms and training of the participants, compatibility with national law, standard procedures for dealing with allegations of scientific misconduct). Another paper by the Global Science Forum – *Unofficial Report on Best Practices for Ensuring Scientific Integrity and Preventing Misconduct (2007)* – deals with scientific misconduct, its consequences, and possible prevention and investigation of misconduct. The recommendations concentrate on the precedence of prevention over sanctions (promotion of good scientific practice by all participants) and offer specific suggestions on the following topics: dealing with scientific misconduct, establishing standards, installing committees for disputes, and the strengthening of international dialogue.

In addition to the guidelines of international scientific organisations, a number of countries have published their own guidelines or codices for good scientific practice and academic integrity. |[12] The documents differ in terms of scope and level of detail; they have often been developed by the relevant national bodies responsible for the investigation of cases of scientific misconduct. |[13] An example is the *Australian Code for the Responsible Conduct of Research*, which was published jointly by the Australian Government, research councils (i.e. funding

research institutions had signed the declaration, see: *http://openaccess.mpg.de/3883/Signatories.* [Accessed 02/03/2015.]

|[12] An overview of the activities and documents of European states has been prepared by the European Science Foundation, cf. European Science Foundation: Stewards of Integrity. Institutional Approaches to Promote and Safeguard Good Research Practice in Europe, Strasbourg 2008.

|[13] The *Office of Research Integrity* (ORI) in the USA is often identified as an example of this type of national office, but this body is an office within a ministry and is thus an exception in an international context. For information on the various national offices and their functions cf. B. III.

agencies) and Universities in 2007. |[14] This 40-page document explicitly identifies the responsibility of the various institutions, researchers and reviewers in the areas of data management, supervision of young scientists, publication practice and authorship credits, peer reviewing, conflicts of interest and research collaborations. This Code is intended to provide assistance and advice to the scientific community and its institutions. Even though the Code is not legally binding, its application is obligated in order to receive funding from the signatory research councils.

A.II   IMPLEMENTATION IN GERMANY

II.1   Data situation and definition

The national and international recommendations described above refer to issues that are not equally well documented and statistically measured. For this reason, it is not possible to precisely evaluate the degree to which the recommendations have been implemented so far. For example, this applies to procedures in scientific publishing houses such as the display of retracted articles or transparency of the individual contributions to a publication. Other developments may be possible to assess but have not yet been recorded in any database as these are very specific instruments (e.g. ombudspersons' committees or procedural rules at universities). Accurate knowledge of the situation can only be achieved by recording data nationwide at all universities, research institutions, scientific publishers and funding bodies in Germany, as the statistical offices and university researchers do not record this data themselves.

To obtain an overview of the status of implementation, the German Council of Science and Humanities has conducted a survey among departments ("Fakultäten") of public universities in Germany that provides informative insights, even though the responses are not formally representative. |[15] The findings of this survey are supplemented by data available from other studies, e.g.

|[14] Australian Government, National Health and Medical Research Council, Australian Research Council (jointly issued): Australian Code for the Responsible Conduct of Research, Canberra 2007, *https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/r39_australian_code_responsible_co nduct_research_150107.pdf as accessed on 26/3/2015.*

|[15] The survey was sent to the heads of all publicly funded universities in Germany (including universities of applied sciences) with a request for forwarding it to the departments ("Fakultäten") at their universities; thus it is not known how many departments actually received the survey. The exact number of all departments at publicly funded universities in Germany is also unknown, and there is no mailing list for contacting them directly. The completed questionnaires were sent directly to the Council in anonymous form. After four weeks, 198 questionnaires had been received from faculties.

surveys of doctoral students – although it must be considered that the overall number of doctoral students in Germany has not yet been statistically recorded. | ¹⁶

In Germany, the German Research Foundation (DFG) and the German Rectors' Conference (HRK) have given an appropriate definition of scientific misconduct that corresponds with the international consensus: "[Approximate translation:] Scientific misconduct occurs when falsehoods are stated in an intentional or grossly negligent manner in a scientific context, when the intellectual property rights of others are violated or another person's research work is impeded." | ¹⁷ According to the DFG and HRK, the responsibility for misconduct can also result from failed supervision and from co-authorship of publications that involve falsifications. Some international guidelines deliberately avoid the term *misconduct* by using the term *irresponsible conduct* in order to promote a broader approach to preventing various forms of "bad scientific practice". | ¹⁸ The present position paper takes over this more comprehensive approach. Academic integrity should not only counteract deception and serious misconduct, but should also prevent dishonest and irresponsible practice in science. This also includes practices such as ignoring or omitting relevant facts in research documentation as well as subtle forms of intellectual property theft.

II.2 Enabling academic integrity

In order to implement the measures recommended in the guidelines it is initially necessary that universities and institutions are aware of these recommendations so they can serve as a foundation for additional disciplinary and institutional rules. The results of the survey among university departments are not very promising, with only a half and two thirds of the respondents knowing the DFG memorandum and the HRK guideline, respectively, which are the most popular directives (see Figure 1). University-internal guidelines are not very

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| ¹⁶ The Council has already drawn attention to the unsatisfactory data situation in its 2011 position paper *Anforderungen an die Qualitätssicherung der Promotion* and has asked universities on a number of occasions to establish data on the numbers of doctoral students in a uniform manner. The German University Statistics Act (Hochschulstatistikgesetz) is currently being amended with the intention of recording the number of doctoral students in the future.

| ¹⁷ HRK: Zum Umgang mit wissenschaftlichem Fehlverhalten (= Beiträge zur Hochschulpolitik 9 / 1998), p. 9.

| ¹⁸ For example, cf. InterAcademy Council/IAP: Responsible Conduct in the Global Research Enterprise: A Policy Report, Alkmaar 2012.

common, although procedural rules for suspected cases of scientific misconduct do exist in almost all cases. |[19]

Figure 1   **Awareness and use of selected guidelines and model procedures [multiple answers possible]**
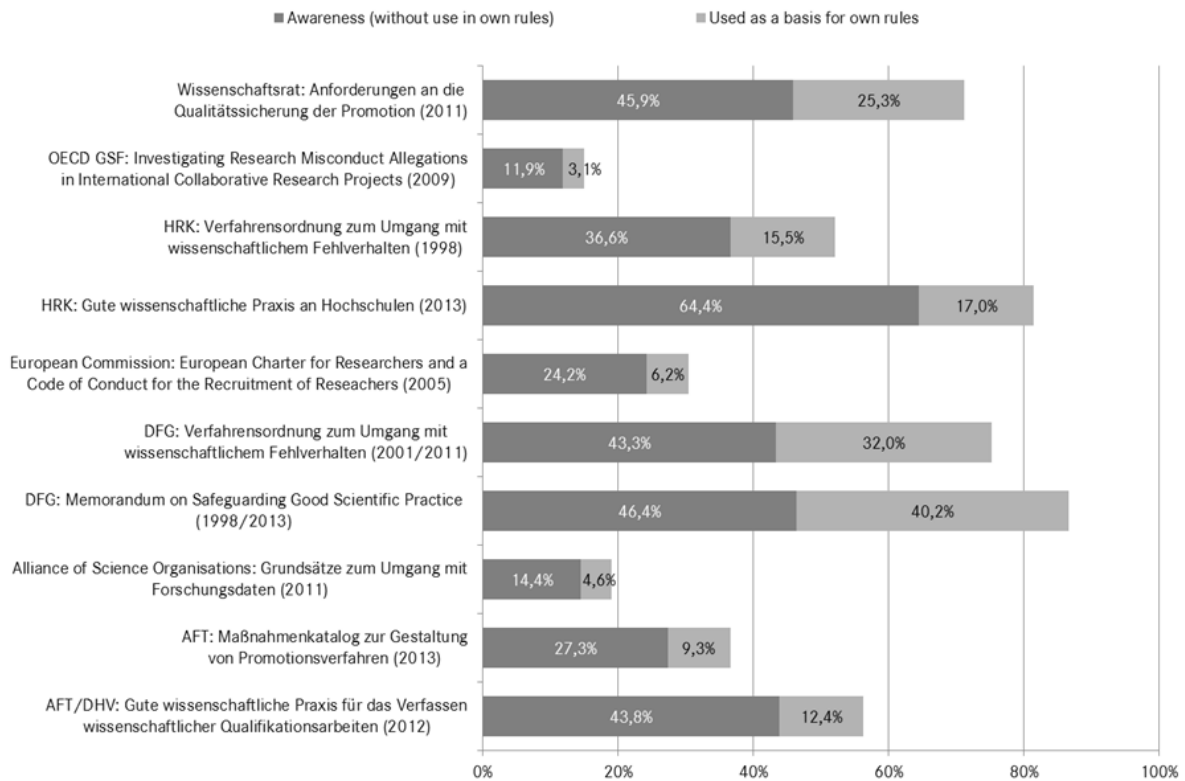
Source: Survey of faculties by the Council, 2014; calculation of percentages based on total number of responses (n=194).

Even though the guidelines are not very well known, some of the recommended measures appear to be implemented to a large extent. For example, this applies to the supervision agreements between doctoral students and supervisors, which were recommended by the Council in 2011 and have since been implemented at some universities. According to the ProFile panel of doctoral students, around 20 percent of those surveyed have such agreements, with only small differences between the disciplines. |[20] These documents specify the rights and obligations of both sides and fix agreements on the working progress. They ensure that doctoral students will have reliable contact with their supervisors, who in turn obtain a better and more regular insight into the stu-

|[19] Nonetheless, it is possible that the guidelines and model procedures of the HRK and DFG serve as bases for university documents without this link being identified explicitly.

|[20] Cf. Kalle Hauss et al.: Promovierende im Profil: Wege, Strukturen und Rahmenbedingungen von Promotionen in Deutschland. Ergebnisse aus dem ProFile-Promovierendenpanel (= iFQ-Working Paper 13, 2012).

dents' working methods and interim results. This is particularly important to so-called external doctoral students who are not connected to the university that will award their doctorate (i.e. by means of a doctoral programme or employment position). The German Council of Science and Humanities has recommended university-wide umbrella structures for all internal and external doctoral students – e.g. in the form of graduate centres – with the aim of integrating them better into the scientific community, promoting exchange with other young scientists and taking advantage of other support services. |[21] This recommendation appears to be implemented in many cases. However, these graduate centres often only offer services and platforms solely for doctoral students in graduate schools. However, the Council had recommended that graduate centres should provide support to all doctoral students so they can equally profit from a better socialisation in good scientific practice by being integrated into the research community. There are no indications of increased scientific misconduct among external doctoral students; conversely, however, good supervision and advice for all doctoral students is an important foundation to convey the norms of the scientific community. Despite the changes that have been initiated so far, a large gap still exists between the reality of supervision and the wishes of doctoral students, particularly for external doctoral students. |[22]

Most of the guidelines barely consider the imparting of good scientific practice before the doctoral studies. As the Council's survey of departments has shown, universities organize the introduction and application of good scientific practice differently (see Figure 2). |[23] The measures take place at different times during studies (start, accompanying, as part of final thesis, as part of doctoral studies) and are either obligatory or voluntary (lecture, seminar, practical exercise, tutorial, etc.). Only around half of the respondents stated that the issue of good scientific practice was integrated into bachelor's and master's studies at their university. Often the teachers decide individually whether, when and how good scientific practice is taught. In these cases, it is apparently assumed that good scientific practice and honest behaviour can be taken for granted and that all teachers serve as role models to a sufficient degree. Differences regarding the discussed topics result mainly from the different disciplinary cultures (focus in experimental subjects on dealing with research findings, lab notebooks, repro-

|[21] Cf. Wissenschaftsrat: Empfehlungen zur Doktorandenausbildung, Saarbrücken 2002.

|[22] Cf. Kalle Hauss et al.: Promovierende im Profil: Wege, Strukturen und Rahmenbedingungen von Promotionen in Deutschland. Ergebnisse aus dem ProFile-Promovierendenpanel (= iFQ-Working Paper 13, 2012), p. 105 f.

|[23] Most of the guidelines do not consider the early study phase; they usually focus on doctoral studies and recommend measures such as courses on good scientific practice within graduate schools.

ducibility, etc.; greater focus in the humanities on citation, systematic bibliographic research; focus on other ethical aspects for experiments on human and animal subjects).

Figure 2   **Imparting of good scientific practice**
             [Multiple answers possible]
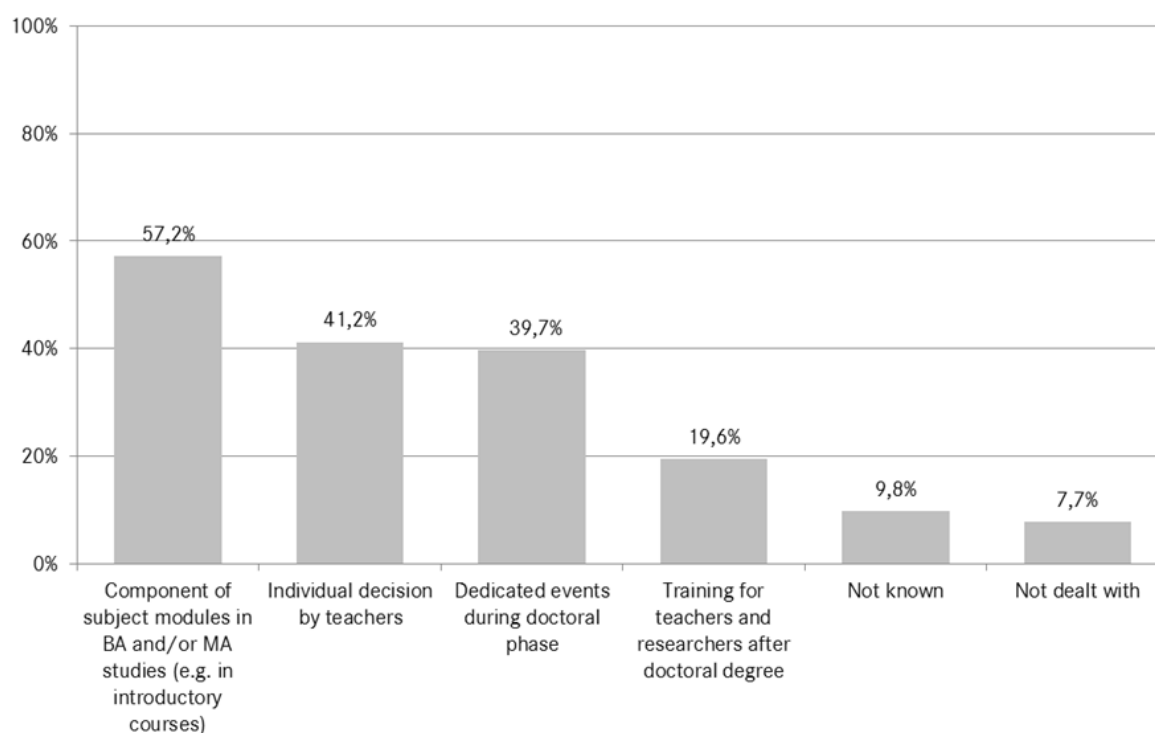
Source: Survey by the Council, 2014; calculation of percentages based on total number of responses (n=194).

According to reports by ombudspersons, especially young scientists or doctoral students inform the committees about alleged misconduct. This can also be interpreted as an expression of academic integrity by the whistle-blowers that proves stronger than any possible or feared conflicts or personal disadvantages.

II.3   Research process and publication practice

In the past, cases of non-reproducible research results have helped to uncover deficits in quality assurance of research processes and subsequent publication practice; these deficits often lie somewhere between scientific misconduct and "bad scientific practice". More frequent than major falsification scandals are cases of omission of undesired results, undocumented repetition of experiments until the desired result is obtained, and experiments with very small samples, for example. The replication of studies can help to uncover such cases and prevent the distribution of unreliable or even false results. However, replication studies require access to the original data, which is often not available. The reproducibility and transparency of research methods, of working processes and results are essential components of academic integrity. For this reason, many

guidelines recommend that research data should be stored and made accessible for a long period. This recommendation has been implemented by around half of the universities who responded to the Council's survey. However, there is no information available on the specific rules with regard to data access, particularly in research groups (*data sharing*, *open access*). Due to the complexity of this topic, various stakeholders and initiatives have worked on recommendations for data management. |[24]

The available guidelines provide recommendations for publication practice mainly with regard to the listing of authorship. They state that main authorship and co-authorship should be based on clear guidelines with regard to participation and the order in which authors are listed. It is difficult to assess the implementation of these recommendations; however, an iFQ-survey of scientists in 2010 shows that a significant percentage of the various forms of committed or observed misconduct occurs in the publication process. |[25] This misconduct mainly concerns improper peer reviewing and the listing of authors who have not made a substantial contribution.

The trend in the science system towards the sequential publication of partial results and the resulting increase in the amount of publications with low information content is also identified as an incentive for dishonest behaviour in the DFG memorandum. In 2010, the DFG reacted by introducing new rules for publication lists in applications and final reports, according to which only the five most important publications should be named. |[26] It was intended to initiate a "paradigm shift" away from quantity towards quality in research assessment. Even though this paradigm shift has not yet been completed, this step does appear suitable for raising awareness on these problems and influencing publication habits in the long term. In addition, the amount of publications for

|[24] These include the *Allianzinitiative Digitale Information (2010)*, the *Kommission Zukunft der Informationsinfrastruktur (2011)* and *Nestor – Kompetenznetzwerk Langzeitarchivierung und -verfügbarkeit digitaler Ressourcen für Deutschland: Langzeitarchivierung von Forschungsdaten (2012)*. The *Rat für Informationsinfrastrukturen (Council for information infrastructures)*, which was recommended by the German Council of Science and Humanities, has been implemented by the Joint Science Conference (Gemeinsame Wissenschaftskonferenz, GWK) as a four-year pilot project and has started its work in autumn 2014.

|[25] Wissenschaftler-Befragung 2010: Forschungsbedingungen von Professorinnen und Professoren an deutschen Universitäten (= iFQ-Working Paper 8, 2011), p. 149-160.

|[26] This rule was expanded in 2014 to include the ten most important publications in order to present various research focuses. For the first resolution from 2010, refer to: *Qualität statt Quantität – Neue Regeln für Publikationsangaben in Förderanträgen und Abschlussberichten*, a statement by Prof. Dr.-Ing. Matthias Kleiner, President of the German Research Foundation (DFG), at a press conference on 23 February 2010. Similar rules exist in other countries – for example, in the guidelines of the National Science Foundation (NSF) in the Unites States, which now only allows for the citation of the five most important publications with reference to the submitted project and up to five further publications for applications.

peer-review is increasing more than the number of potential reviewers. Therefore, it is becoming more difficult to find suitable reviewers to carry out careful quality assurance. This overburdening of the peer review system can lead to an increase in careless reviewing and may thus also favour misconduct, as the results of the iFQ-Survey of scientists suggest.

Citation databases – such as *Scopus* or the *Science Citation Index*, which is used as a basis for the annual determination of the impact factor of scientific journals based on their citation figures – may promote so-called citation cartels among scientists. |[27] Some of the international guidelines address the scientific publishers and recommend that they should make retracted articles visible and implement steps to counteract increased impact factors based on citation ratio. Apparently, these recommendations have been implemented only to a minor extent. Nonetheless, a few major scientific publishers are now making corrections and retractions of articles systematically visible as part of the *Crossmark* project. |[28] Most of the activity in the promotion of academic integrity in publication practice is coming from bottom-up initiatives from the scientific community itself. These include open-evaluation platforms, which allow for public discussion and evaluation of research results before and/or after they are published. |[29] In addition, publication organs for negative research results (i.e. disproved hypotheses) or unsolved problems are being founded – e.g. *JUnQ – Journal of Unsolved Questions* – in order to facilitate the publication of negative or inconclusive results. |[30] The *Reproducibility Initiative* has been established for the dissemination of replication studies and offers independent and anonymous re-

|[27] The systematic manipulation of the reputation of journals through *coercive citation* was illustrated by a study published in Science in 2012: Allen W. Wilhite, Eric A. Fong: Coercive Citation in Academic Publishing, in: Science 3 (2012).

|[28] This gives scientists the opportunity to ensure that they obtain the latest and most reliable version of an article or of research results instead of using an old version that possibly contains errors, *http://www.crossref.org/crossmark*, as accessed on 26/3/2015. A similar aim is being pursued by the *Retraction Watch* blog, which publishes retractions and investigates their reasons, *www.retractionwatch.com, as accessed on 26/3/2015*.

|[29] One example is the *PubPeer* website, which publishes information on errors in scientific articles and aims to promote a more careful examination of results in the evaluation process. A similar project is the *arXiv.org* website, where scientists from the areas of physics, mathematics and computer science can upload their manuscript to a server and let them be commented by other arXiv users. This process often prevents deficient articles from being submitted to a journal or else to an improved version being published subsequently, *www.arxiv.org as accessed on 26/3/2015*.

|[30] This project by a team of young researchers received the German Ideas Award (Deutscher Ideenpreis) by the *Stifterverband für die Deutsche Wissenschaft* in 2012. However, just like the few disciplinary journals of negative results (e.g.: *Journal of negative Results in Biomedicine, Journal of Pharmaceutical Negative Results, Journal of Negative Results: Ecology & Evolutionary Biology*), this journal has major difficulties in finding articles and peer reviewers, *www.junq.info as accessed on 26/1/2015*.

production of experiments. |[31] Up to now, the chances of publishing replication studies or negative research results were low, particularly in journals with a strong reputation. Instead, there is an increasing tendency to describe one's own research results as groundbreaking (particularly from an application-oriented perspective) in order to be able to publish them. Although scientists believe that there is a great need for the publication of negative results, the low reputation of journals for negative results apparently keeps scientists from publishing those results. It is also difficult for these journals to find experts for peer reviews.|[32] Some publishers have recognised these problems by now and have agreed on a code of conduct within the framework of the *COPE (Committee on Publication Ethics)*; this code recommends that articles with negative results should not be excluded and that replication studies that falsify previous findings should be supported. |[33]

II.4 Dealing with disputes

One of the main recommendations of the DFG memorandum on the safeguarding of good scientific practice is to establish and support impartial counsellors or ombudspersons at universities and institutions. These persons primarily provide advice and mediation in the case of conflicts of interest or other problems, while a special-purpose commission is often responsible for the investigation process in suspected cases of scientific misconduct. Ombudspersons have a crucial function in the prevention of scientific misconduct. They also offer a confidential environment and protection to whistleblowers, who are often employees and might hesitate to express suspicion with respect to colleagues or superiors; ombudspersons generally provide advice to all scientists in a confidential manner in cases of doubt. According to the Council's survey, ombudsperson's offices have now been set up at a majority of universities at both the university and department level (see Figure 3). However, there is often a lack of clear assignment of responsibilities and of standardised procedures in cases of suspected misconduct. In some cases, the same persons or offices provide advice, conduct investigations and decide on sanctions. In addition, ombudspersons are often


|[31] *www.scienceexchange.com/reproducibility as accessed on 26/3/2015.*

|[32] The journals for negative results often receive only two or three submissions a year, according to an article in Science: Jennifer Couzin-Frankel: The Power of Negative Thinking. Gaining ground in the ongoing struggle to coax researchers to share negative results, in: Science 342 (2013), p. 69.

|[33] COPE Code of Conduct, 2008, *http://publicationethics.org/files/2008 Code of Conduct.pdf as accessed on 26/3/2015.* Alongside this document, the forum has published other guidelines, standards and discussion papers on the subject of research integrity. The forum was originally established as a coalition of a number of medical journals and now has over 9,000 members from various research areas and includes many journals of the major publishing groups Elsevier, Wiley-Blackwell and Springer.

individuals who carry out these duties voluntarily and without administrative support. |[34]

Figure 3   **Ombudsperson's offices at university level**
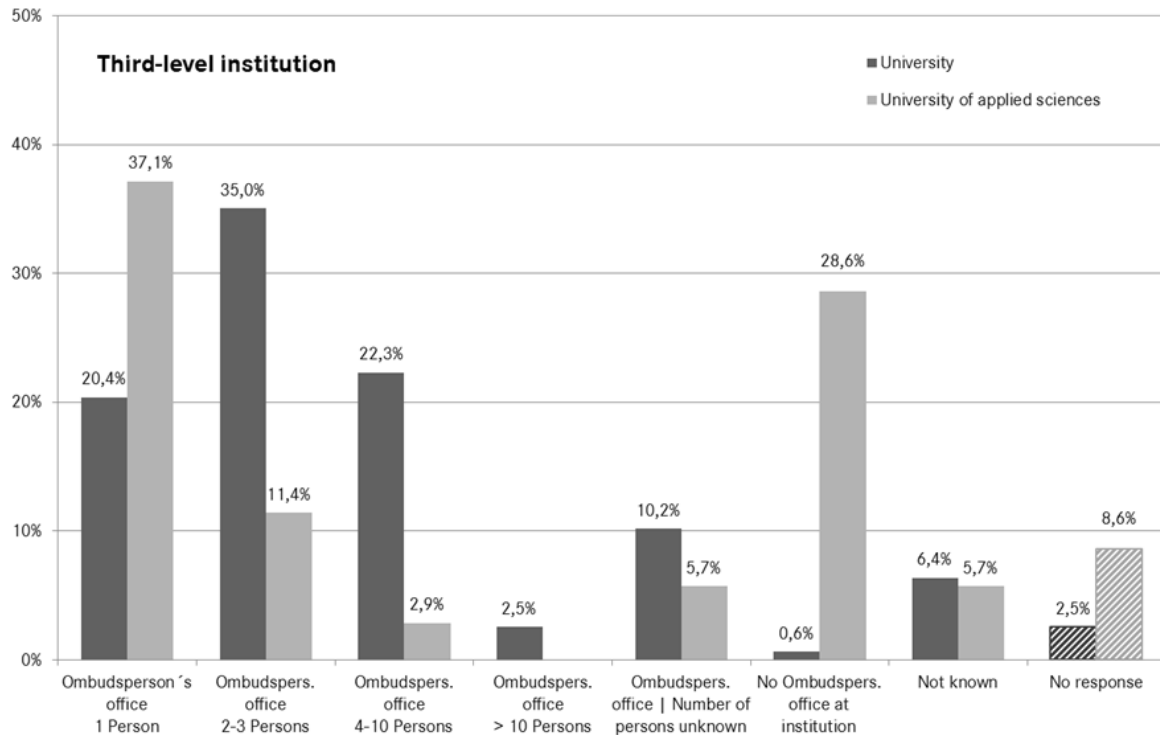
Source: Survey by the Council, 2014; calculation of percentages based on total number of responses (n=194).

With the *Ombudsman für die Wissenschaft (Research Ombudsman)* committee, the DFG has created a point of contact for scientists (particularly as whistleblowers). This office, consisting of three professors as voluntary members, investigates allegations of suspected cases of misconduct, organises conferences, promotes networking among ombudspersons and publishes annual reports on cases that have been investigated. |[35]

|[34] Regulations on ombudspersons can also be stipulated at the level of state higher education acts as in the case of the amended State Higher Education Act of Baden-Württemberg, which prescribes rules on the use of ombudspersons in the doctoral degree regulations. Cf. State Higher Education Act of Baden-Württemberg (Landeshochschulgesetz – LHG) of 1 January 2005 (act completely revised on 1 April 2014), §38, para. 4.

|[35] *http://www.ombudsman-fuer-die-wissenschaft.de as accessed on 26/3/2015.*

In many guidelines, the dominance of quantitative indicators in the performance assessment (e.g. number of publications, acquisition of external funding) in appointment procedures for professorships and in the allocation of funds is identified as an incentive for scientific misconduct. This dominance is regarded as a symptom and a consequence of the overburdening of the peer review system. Bibliometric indicators are used to evaluate the relevance of research but are often mainly based on the impact factors of journals and on the citation ratio of articles (e.g. Hirsch index). In its memorandum, the German Research Foundation (DFG) recommends that the use of quantitative criteria as the dominant assessment tools should be reconsidered. The memorandum also explicitly criticises the additional focus on the impact factor of journals, which is based on citation ratio and thus also presents just a quantitative factor that can only be interpreted to a limited extent. |[36]

Quantitative indicators in teaching and research (e.g. numbers of graduates and doctoral students, amount of external funding acquired) also build the basis of the performance-based resource allocation processes between states and universities and within universities themselves that have been introduced since the 1990s. Although there is no direct evidence that this quantitative focus in finance models compromises the quality of research, but many professors are of this opinion. |[37] The existing recommendations, including those of the Council, frequently note the diminishing utility of a performance assessment mainly based on quantitative indicators such as numbers of doctorates and amounts of external funding. |[38] In single cases, the assessment criteria for resource allocation have since been changed. |[39] The assessment criteria for the appointment of professors also have an influence on publication habits. If these selection procedures are based primarily on quantitative publication output and the acquisition of external funding, this can create an incentive to publish partial re-

|[36] Cf. Deutsche Forschungsgemeinschaft: Sicherung guter wissenschaftlicher Praxis. Denkschrift, Weinheim 2013 (expanded edition), p. 20.

|[37] "[Approximate translation:] In particular, there is agreement with the arguments that performance-related resource allocation rewards 'mainstream research' more strongly, favours the production of many short articles ('salami tactics') and that there are now more conflicts about co-authorship." René Krempkow and Uta Landrock: Welche Effekte hat die LOM? Das Beispiel der deutschen Universitätsmedizin. In: René Krempkow et al. (eds.): Völlig losgelöst? Governance der Wissenschaft. Band der 6. iFQ-Jahrestagung (= iFQ-Working Paper 16, 2014), p. 83.

|[38] Cf. Wissenschaftsrat: Empfehlungen zur Bewertung und Steuerung von Forschungsleistung, Halle 2011, p. 42.

|[39] For example, financial coupling with the number of doctoral students has been repealed in the 2014 amendment of the State Higher Education Act in Baden-Württemberg.

sults sequentially, to omit contradictory data or to withhold or embellish negative results in order to provide many articles in prestigious journals.

There are specific features in the science system that reinforce the factors discussed above and create undesired side effects. These include a discussion culture that is not always open and the high pressure to acquire external funding with competing research topics. The surrounding situation of early career researchers is particularly difficult. Short term employment contracts can compromise the quality and academic integrity of their work. Performance pressure and existential dependence on external funding can provide a motivation for them to act in a dishonest manner – e.g. to embellish or withhold undesired results.

B. Areas of action and recommendations

All stakeholders in science and science policy are responsible for strengthening academic integrity. In many cases, they already assume this responsibility in a dependable manner: in recent years, important changes have been initiated and the recommendations of central guidelines have been implemented. However, further efforts and developments are necessary in order to strengthen a culture of academic integrity in the long term. In a growing international scientific community, there must also be agreement between stakeholders on an international level in addition to national guidelines and activities.

The following discussion will present the crucial areas of action for promoting academic integrity. In these areas, the German Council of Science and Humanities considers further changes necessary as well as more commitment from various stakeholders. These include both areas where the existing recommendations have not yet been implemented to a sufficient extent (e.g. in the publication system) and areas that have not been in the focus of the existing guidelines (e.g. imparting good scientific practice during university studies). Overall, the recommendations intend to promote a culture of academic integrity through supporting systemic conditions. This will serve as a stimulus for institutions and persons in science to expand their activities in this area and to develop defined subject- and institution-specific standards themselves.

B.I   ENABLING ACADEMIC INTEGRITY

An essential element of promoting academic integrity is to impart good scientific practice to students right from the start of university studies. This helps to acquire an attitude and skills that are not only essential for a career in research. Ethical and qualitative standards apply in all professional fields, and therefore

honesty, accurateness and an ability to engage in ethical reflection should be an aim of all study programmes. |⁴⁰

The German Council of Science and Humanities recommends that good scientific practice should become a compulsory part of the curricula at an early stage in university studies. The awareness of scientific standards in the overall research process must be raised right at the beginning of university studies – e.g. as regards data collection and storage, the documentation of experiments, adequate knowledge of methods and the ability to apply them. It is too late to impart this knowledge during the doctoral studies phase. The imparted standards should be specified for the different disciplines and taught to the students as binding as well as put into practice by the teachers. The specific standards should be defined by learned societies, faculty associations and departments.

Opportunities to practice scientific working methods are very important for the development of academic integrity. These concern, for example, scientific reports (e.g. seminar reports or final theses). These types of smaller research projects during university studies are beneficial for practising good scientific practice in all disciplines. |⁴¹ Written examinations (and multiple-choice formats, in particular) as the primary assessment method cannot fulfil this function. Examination formats have a significant influence on the development of academic integrity. Therefore, suitable formats should be used that do not just check positive results and knowledge, but also evaluate the (critical) handling of data or the methodological design in the exam tasks. In addition, random checks for plagiarism or manipulation should be carried out in seminar reports and theses; the possible consequences of these types of misconduct should be communicated in introductory courses. A combination of scientifically challenging and varied tasks with a systematic monitoring system can play a significant role in strengthening academic integrity right from the start of university studies.

|⁴⁰ This type of fundamental ethical approach begins to develop long before entry into the third-level education sector. Current studies show that second-level students develop little awareness of the problems and consequences of a lack of truthfulness and handling intellectual property in a careless manner. The vast majority of surveyed students in Year 12 regard 'cheating' at school as normal. At this point, students are generally just a few months away from beginning university studies (cf. Fischer, A.; Kurzeja, S.; Latzko, B.: Mogeln in der Schule. Unveröffentlichter Forschungsbericht, Erziehungswissenschaftliche Fakultät der Universität Leipzig, Leipzig 2014). For this reason, awareness of integrity in the education of students should be taught in teacher training.

|⁴¹ In the area of medicine, for example, the Council recently recommended that the scientific character of medical education should by strengthened by increasingly integrating research work and good scientific practice into courses of study. Cf.: Wissenschaftsrat: Empfehlungen zur Weiterentwicklung des Medizinstudiums in Deutschland auf Grundlage einer Bestandsaufnahme der humanmedizinischen Modellstudiengänge, Dresden 2014.

Teachers should receive suitable training in order to carry out their educational duties in a competent manner – also with regard to the increasing complexity of equipment, the use and interpretation of results, and the use of new technologies, media and methods. It is a serious failure on the supervision level if education and instruction on good scientific practice is not carried out in a systematic manner. It is also an organisational deficit on the part of institutions if they do not provide appropriate structures, processes and resources so that teachers can fulfil these duties.

B.II   RESEARCH PROCESS AND PUBLICATION PRACTICE

The quality of research depends on honesty, truthfulness, completeness and research skills. Dishonest behaviour may occur in various phases of the research process – from research design and data collection methods, right through to evaluation procedures and the documentation of results. Some parts of the process have difficult conditions that can be conducive to dishonest behaviour in the research process. These include the processing of data and publication practice.

Particular attention should be focused on the reproducibility of research results. Scientific communities have a special responsibility here. In order to check research results independently in replication studies some disciplines require access to primary research data. The survey of faculties showed that less than half of the universities that responded had implemented the recommendations on long-term data storage at that point. The German Council of Science and Humanities has published several recommendations in the past few years that deal with the topic of data archiving. |[42] In the present position paper, the Council reaffirms it's demand that research data should be processed in accordance with international standards, stored for a sufficiently long period and made accessible for follow-up research. Due to the impact and complexity of this topic, the Council recommends that stakeholders such as *Nestor* |[43] and the *Rat für Informationsinfrastrukturen (Council for information infrastructures)* should – in cooperation with international bodies such as the *Research Data Alliance* – develop models with specific technical measures for long-term archiving and accessi-

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|[42] In particular, cf. Wissenschaftsrat: Empfehlungen zur Weiterentwicklung der wissenschaftlichen Informationsinfrastrukturen in Deutschland bis 2020, Berlin 2012. As regards the archiving and accessibility of research data, refer to p. 53 f.

|[43] Nestor – Kompetenznetzwerk Langzeitarchivierung und -verfügbarkeit digitaler Ressourcen für Deutschland: Langzeitarchivierung von Forschungsdaten, *http://www.langzeitarchivierung.de as accessed on 26/3/2015.*

bility of various data types to meet the challenges in the area of data management, taking into account issues of data protection and copyright. |[44] They should also take into account the consequences for academic integrity, such as the transparency and usability of original data for follow-up research as well as the possibility of independent confirmation or falsification of results by replication studies. Strategic initiatives by German federal states for the promotion of the scientific infrastructure, as recently adopted in Baden-Württemberg, are worth imitating in other states. |[45]

The Council recommends that the publishers of scientific journals should encourage access to research data and promote the transparency of the research process as a whole. |[46] For this purpose, the possibilities to publish replication studies and negative results must also be improved. The policies of publishers must not lead to the selection of research topics that attract attention, thus creating unintended incentives for scientific misconduct. The falsification of hypotheses and the independent replication of research results serve to promote not just academic integrity, but also the progress in research fields, as they help to avoid redundancies and simplify follow-up research. This also includes the transparent publishing of errata and corrigenda and the accessibility of the original data that articles are based upon. Forums for ethical guidelines for journals such as *COPE* (cf. A.II.3) show the efforts being made by many publishers to promote academic integrity; these should be used by all scientific journals

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|[44] The German Council of Science and Humanities appreciates the recent announcements by the German Research Foundation (DFG) on the continuation of the Pact for Research and Innovation (2016-2020) and the decisions to implement the 2011 recommendations of the Council and "[Translation:] to institute and maintain helpful structures for research data" with a new funding instrument for research data infrastructures (Erklärung der Deutschen Forschungsgemeinschaft (DFG) zur Fortsetzung des Paktes für Forschung und Innovation (Pakt III), *http://www.gwk-bonn.de/fileadmin/Papers/PFI-III-2016-2020.pdf as accessed on 26/3/2015*).

|[45] The federal state of Baden-Württemberg has published a policy paper with measures that will be applicable to all universities in the state in the future. In particular, this applies to support for in-house open access journals at universities and to access to research data. The state is providing 3.7 million euros for the implementation of this concept (Cf. the policy paper E-Science – Wissenschaft unter neuen Rahmenbedingungen. Fachkonzept zur Weiterentwicklung der wissenschaftlichen Infrastruktur in Baden-Württemberg, *https://mwk.baden-wuerttemberg.de/fileadmin/redaktion/m-mwk/intern/dateien/pdf/Forschung/066_PM_Anlage_E-Science_Web.pdf as accessed on 26/3/2015*). A working group in Berlin is developing a policy paper with similar aims.

|[46] Some journals, such as Nature, are already making use of potential tools such as digital online repositories for access to primary research data, for example. In general, the competing aims of the desired transparency of the research process, the generation of further publications and requirements for data protection and anonymity must be taken into account.

to engage in exchange on ethical standards and to develop and implement ideas to strengthen academic integrity.

The acceleration of processes in the science system has an effect on the way scientists use to publish. If performance assessment is mainly based on quantitative factors it creates a high pressure for scientists to publish many articles. In the opinion of the German Council of Science and Humanities, long-term changes must take place in this area that cannot be implemented on a national level alone. Indicators based on citation databases are not sufficient to evaluate the quality of research and can have a distorting effect. Simple citation indicators encourage citation cartels and can be manipulated by such cartels. In addition, monographs and other indicators of research performance (e.g. awards, patents, invited papers) are not taken into account in this evaluation system. In many disciplines, citation indicators are therefore not suitable as an assessment tool. |[47] In recent times, the scientific community has been increasingly criticising the primarily quantitative research assessment based on citation indices. |[48]

In 2011, the German Council of Science and Humanities already supported the demand that research assessment should be based more on quality than on quantity. |[49] In the Council's opinion, the responsibility lies with a number of stakeholders: universities and funding organisations should take into account more quality-related than quantity-related criteria in the performance assessment, as also intended by the DFG guideline (limitation to only the most important publications in applications and reports to the DFG). The German Coun-

|[47] For example, criticism is often expressed in engineering sciences that the citation index is not compatible with the nature of their work and their differing publication culture – e.g. in the case of appointments. More important here are factors such as practical experience and innovations. Also, the particularly important monographs for some subject areas (such as the humanities) are not taken into account in this system of research assessment.

|[48] For example, cf. the *San Francisco Declaration on Research Assessment* (DORA), an initiative by researchers and publishers of scientific journals to counter the citation-dependent, quantitative evaluation of research using the impact factor. This declaration has been signed by 12,377 persons and 572 organisations, including many German and European research institutions, *http://am.ascb.org/dora as accessed on 3/3/2015*. In addition, Nobel Prize winners have recently strongly criticised the impact factor and the publication policy of major journals. For example, Randy Schekman, Nobel Prize winner for Medicine/Physiology: "Luxury-journal editors […] accept papers that will make waves because they explore sexy subjects or make challenging claims. This influences the science that scientists do. It builds bubbles in fashionable fields where researchers can make the bold claims these journals want, while discouraging other important work, such as replication studies." (How journals like Nature, Cell and Science are damaging science, in: The Guardian, 9 December 2013)

|[49] Cf. Wissenschaftsrat: Empfehlungen zur Bewertung und Steuerung von Forschungsleistung, Halle 2011. The Council has also developed an alternative model of comparative research in its *Empfehlungen zum Forschungsrating* (2008) and, after a number of pilot studies, recommended that these recommendations should be systematically used in its *Empfehlungen zur Zukunft des Forschungsratings* (2013).

cil of Science and Humanities supports quality-promoting rules like these and recommends that other research-funders and evaluation agencies should adopt them, too. |⁵⁰

Crucial conditions to strengthen academic integrity are procedures for quality assurance within the scientific community. Their effectiveness must be checked when framework conditions change. Long-term solutions to avoid the overburdening of the peer-review system need to be found. |⁵¹ The Council again points out that unmanageable amounts of publications defeat the purpose of the obligation to publish, which was originally intended to promote both communication and the review of new research contributions by the scientific community. In the long term, all stakeholders are called upon to promote the changeover to a research assessment based more on quality than quantity. They should also promote a reduction in the overall numbers of publications. |⁵² In addition, the workload on reviewers must be reduced by making structural changes so they can adequately fulfil their personal responsibilities in the peer review process. All bodies that award funding on the basis of peer reviews should consider this workload and examine the scope of peer review that has to be carried out.

Ultimately, clear standards for joint publications must be established and met. These standards must represent the individual contributions of the scientists in a transparent manner and should be specified by learned societies and faculty associations. Research groups should be notified of these binding standards at the start of their projects. Some of the guidelines identified in A.I.1 include very specific suggestions on possible rules, and these suggestions also take into account the differing cultures of various research fields.

B.III   DEALING WITH DISPUTES

The establishment of ombudsperson's offices and commissions for the investigation of scientific misconduct shows the effort to strengthen a culture of academic integrity at universities and research institutions. Transparent, effective structures for investigation and providing advice in cases of disputes or suspected misconduct are an important part of this culture. They guarantee reliable

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|⁵⁰ Alongside the limitation of the use of quantitative criteria, active criteria on the strengthening of academic integrity could also be included when awarding funding and in appointment procedures at universities; cf. B.IV here.

|⁵¹ The Council reserves the right to make a statement on this issue at an appropriate point in time.

|⁵² Various new models such as *open review procedures* and *post-publication reviews* are being discussed by the science community as alternatives for the task of evaluating research within scientific fields.

procedures, fairness, as well as the protection of whistleblowers and those accused of misconduct. |[53] Independent ombudsperson's offices serve as a useful interface for the bodies and persons involved. The German Council of Science and Humanities recommends that the ombudsperson system should be expanded and made more professional at universities by providing administrative support, e.g. in the form of an administrative office at larger institutions. These can help to establish an institutional memory, ensure continuity and professionalism and also facilitate better coordination of the work of ombudspersons. |[54] Clear assignment of responsibilities, sufficient resources for carrying out the relevant tasks and the transparency of procedures are important for the overall process. The transparency of procedures should be promoted by regular activity reports by ombudspersons. Also, cases should be published anonymously after completion of the proceeding.

The German Research Foundation and the German Rectors' Conference have already developed detailed model procedures for the investigation of cases of suspected scientific misconduct. |[55] The introduction and use of these model procedures at universities and institutions should be further encouraged, particularly with regard to the investigation of scientific misconduct and the imposition of sanctions. |[56] This applies to evaluation standards, procedures, structures and processes for the investigation of allegations, to responsibilities within the institution, and to penalty for scientific misconduct, particularly after the doctoral phase. As these investigation cases are often handled in a confidential manner, it is crucial to ensure standards of procedure. The German Council of Science and Humanities urges that the model procedures should be applied more widely in universities and institutions. Implementing this is a task

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|[53] The German Research Foundation (DFG) has published steps and measures for the protection of whistleblowers in 2013 in the revised version of its memorandum *Sicherung guter wissenschaftlicher Praxis (Safeguarding Good Scientific Practice)*. Cf. in particular Recommendation 17, p. 36 f.

|[54] In many cases, ombudsperson's offices also offer conflict mediation outside of issues of scientific honesty, e.g. for personal disagreements in research teams or between superiors and employees. This broad spectrum of functions is an additional reason for providing sufficient infrastructure for ombudsperson's offices at universities.

|[55] Cf. DFG: Verfahrensordnung zum Umgang mit wissenschaftlichem Fehlverhalten, Bonn 2001/2011, *http://www.dfg.de/formulare/80_01/80_01_de.pdf as accessed on 26/3/2015* and the German Rectors' Conference's resolution: Zum Umgang mit wissenschaftlichem Fehlverhalten in den Hochschulen.
Empfehlung des 185. Plenums vom 6. Juli 1998, *http://www.hrk.de/positionen/gesamtliste-beschluesse/position/convention/zum-umgang-mit-wissenschaftlichem-fehlverhalten-in-den-hochschulen as accessed on 26/3/2015.*

|[56] Even though the present paper does not make any recommendations on the sanctioning of misconduct, the Council urges that awareness should be increased of the consequences of various forms of misconduct and deception in science under criminal law.

for the university management. It is reasonable to impose sanctions for scientific misconduct at the management level, but there is the self-interest at play to protect the institution's reputation. The investigation and uncovering of misconduct should be promoted as a sign of well-functioning structures and high quality standards at universities and research institutions. The Council recommends that effective structures and processes for dealing with suspected cases of scientific misconduct (ombudsperson's offices, procedural rules, guidelines) should be checked as a condition in the system accreditation of universities and in the evaluation of scientific institutions. They should also be considered as assessment criteria of funding applications from universities and institutions (see B. IV on this matter).

Marginal cases that are often regarded as grey areas, such as the non-transparent listing of authors, require clear standards for each discipline; these standards must be established within the scientific community (peers, learned societies, faculty associations). Disputes that cannot be resolved in this way become the responsibility of ombudspersons. The comparability of cases and forms of scientific misconduct is important for ombudspersons and investigation committees. Even decisions in legal proceedings are not always consistent – however, these decisions must consider previous legal decisions and they must be reasoned publicly. In the same way, it is necessary to avoid the impression of arbitrary decisions in (suspected) cases of scientific misconduct.

The German Council of Science and Humanities recommends that a cross-institutional platform should be set up at a national level to collect information and bring together ombudspersons and other relevant actors at universities and research institutions. In the long term, this platform should serve as an institutional forum for the establishment of standards and harmonisation of procedures. This type of office would support a learning system by collecting and documenting previous decisions and making them available anonymously. It would allow for standard-based evaluation of misconduct according to common criteria. This office could also contribute to a common use of sanctions. In addition, it would be responsible to develop clear standards of good scientific practice and definitions of misconduct for the different disciplines in a continuous process– e.g. in the form of disciplinary forums and events where faculty associations and learned societies are included. As an advisory body, this office could also provide recommendations to individual institutions on quality assurance systems for universities and scientific institutions (e.g. suitable procedures and structures for dealing with suspected cases of scientific misconduct).

In the opinion of the German Council of Science and Humanities, this office should not impose sanctions itself and should not take decisions on individual cases, but should instead be consulted during the investigation process. Ombudspersons at universities and research institutions should engage in regular ex-

change with this office and should thus become distributors of knowledge within their institutions in the long term. The office would also carry out important communication and networking functions for other relevant bodies (support departments, commissions, etc.) For these reasons, a forum like this is essential for strengthening the culture of academic integrity. It must be independent, openly accessible and supported by all stakeholders. This new office will differ in terms of functions from the three-person *Ombudsman für die Wissenschaft* set up by the German Research Foundation. With its profile as described here it will carry out tasks that are not yet conducted by this body. To fulfil its purpose as a high-level advisory forum, all organisations within the Alliance of Science Organisations, major research-funding bodies, universities, faculty associations and learned societies would have to be involved. Whereas the *Ombudsman* body set up by the German Research Foundation investigates suspected cases of scientific misconduct, the core task of this new office is the strengthening of academic integrity by means of cross-stakeholder networking and establishment of standards. This type of national office, which operates beyond individual funding institutions, has been established in almost all European states, and internationally too; in certain cases, these bodies are even state institutions with legal mandate. |[57] One possible way of including various stakeholders is the foundation of an association like the *Austrian Agency for Research Integrity*, which was founded in 2008. The members of this agency are universities, national academies and research-funding bodies. It consists of six committee members who are nominated every two years by the Austrian Council for Research and Technology Development, and is supported by a Chairperson and an administrative office. |[58]

|[57] One such state body is the *Office of Research Integrity* (ORI), which is affiliated with the US Health Department, offers technical assistance in cases of alleged research misconduct and has been providing transparent information about investigated cases for over twenty years. In Europe, Denmark is the only country with a state body for the investigation of misconduct and the safeguarding of academic integrity (the Danish Committee on Scientific Dishonesty - DCSD); in other European countries, the relevant bodies consist of representatives of national academies and/or university associations, for example, and have an advisory function. They generally have a number of members and are supported by administrative offices in some cases. An overview of the various national systems can be found in the following publication by the European Science Foundation: Stewards of Integrity. Institutional Approaches to Promote and Safeguard Good Research Practice in Europe. Strasbourg 2008. An overview of national committees in Europe is presented by ENRIO (European Network of Research Integrity Offices), *http://www.enrio.eu/organization-3/member-organizations as accessed on 26/3/2015*.

|[58] According to the Agency's website, it has "neither an arbitrary nor an adjudicative function". It deals with specific alleged cases of scientific misconduct, but also has many other tasks in the areas of networking and providing advice: "Furthermore, the agency is aiming to prevent research misconduct and to raise awareness offering lectures and workshops on 'good scientific practice' to its member institutions. As to

The German Council of Science and Humanities recommends that the specific structure and financing of this office should be jointly defined by the participating stakeholders and/or their representative committees. The Council sees it as the task of the organisations within the Alliance of Science Organisations to agree on further specific steps. The establishment of this platform shall also proof the commitment of the German science system to strengthen academic integrity.

B.IV   INFLUENTIAL FACTORS AND EVALUATION CRITERIA

Incentive systems, such as the assessment of research performance, influence important focal areas in science and can have also effects on the quality of research and on academic integrity. As described in section A. II. 3, assessment procedures, as for performance-related resource allocation, mainly use quantitative indicators that can have undesired negative effects. |[59] There is a dilemma of a competitive science system: competition should actually lead to more quality in science – however, excessive competition creates excessive pressure and acceleration within the system, which can result in a decline of quality and can endanger academic integrity.

The undesired side effects of the quantitative performance assessment have been identified repeatedly in guidelines on good scientific practice (cf. A. II. 3). Although various models have been developed that focus more strongly on quality and help to avoid negative effects, assessment practice has not yet changed fundamentally. The German Council of Science and Humanities reaffirms its position that the assessment of research performance (of both institutions and individual persons) should depend on quality criteria (such as originality, coherence, soundness and progress in terms of knowledge). The assessment of individual research performance should be based not only on citation indicators, but primarily on the contents of publications and on scientific progress and results. Additional criteria such as patents, awards, innovations, or invitations as a visiting researcher at relevant institutions as well as international activities can also provide valuable information about the quality of re-

research misconduct the agency will publish recommendations of what should be regarded as misconduct and how to detect and prevent it." – *http://www.oeawi.at as accessed on 26/3/2015.*

|[59] One example here is the consideration of the number of doctoral degrees, which can act as an incentive to take on a lot of doctoral students, which in turn can impair the quality of supervision and thus also makes scientific misconduct more likely. In Baden-Württemberg, this financial coupling has been repealed in the 2014 amendment of the State Higher Education Act. Other quantitatively focused incentives relate to the demonstration of a high number of publications in the acquisition of external funding, for example.

search (cf. B. II). Institutions should also be assessed not only based on the quantity of their output, but also on the quality of research and teaching and on effective structures.

Further systemic characteristics need to be taken into account to strengthen a culture of academic integrity in the long term. Career paths that are risky, difficult to plan or not transparent, problematic working conditions and employment on short-term contracts as well as dependencies can also be conducive to scientific misconduct as a result of the competitive pressure. |[60] Decisions for recruiting should consider the quality rather than the quantity of publications. Supervisors and employers are responsible for supporting the quality of scientific work with contracts of appropriate duration and sufficient time budgets. Good scientific practice is also encouraged by good working conditions in science.

In a competitive science system, attention must be paid to ensure that no undesired side effects occur that could endanger academic integrity (e.g. rewarding the supervision of many doctoral students or higher numbers of publications regardless of the content of the individual articles). Rules are required that reduce these side effects. Instead, competition should also be used to increase the visibility of particularly successful measures and instruments for the promotion of academic integrity as achievements of institutions. Honesty itself should not be rewarded by financial means – but instead it should be positively measured if institutions link their reputation and infrastructure to beneficial conditions and high quality standards. This should be implemented by taking into account measures for the strengthening of academic integrity in public and private external funding, in target agreements with Germany's federal states, in performance-related resource allocation and in system accreditation (cf. also B.III). |[61]

In addition, the German Council of Science and Humanities also encourages incentive systems such as quality initiatives as they have already been set up for other areas and which have improved these areas. |[62] These concepts can pro-

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|[60] In its recent publication *Empfehlungen zu Karrierezielen und -wegen an Universitäten (2014)*, the Council offered detailed suggestions for more attractive structuring of scientific career paths – e.g. the expansion of permanent positions for researchers and tenure track professorships.

|[61] In the area of sanctions, financial methods with an influential effect already exist at state level, e.g. by means of budget cuts in the case of insufficient structures for the safeguarding of good scientific practice. Measures to safeguard academic integrity and supporting framework conditions could be systematically specified in target agreements with the states.

|[62] Examples here include the *Qualitätszirkel Studienerfolg* or the *Lehrer-Initiative* of the German Donors' Association, which develop and reward specific measures and strategies for their respective areas in cooperation with universities.

mote an exchange about effective instruments, increase the visibility of efforts to promote academic integrity, and also serve to set a positive example. Voluntary obligations to implement certain measures could be publicised with a quality certification (e.g. as part of accreditation) and thus improve the reputation of institutions. The various management measures also serve as a significant prerequisite for the long-term safeguarding of high-quality research, alongside their inherent ethical purpose. Academic integrity affects the capacity for innovation and performance in the German science and research system. There is thus a genuine political interest in safeguarding academic integrity. |[63]

B.V   AREAS OF RESPONSIBILITY OF STAKEHOLDERS

Various stakeholders are responsible for the implementation of the recommendations made in this position paper for various areas. In order to identify these areas of responsibility and activity, they will be summarised below on the basis of the previous chapters.

V.1   Scientists and scholars

The recommended structural conditions should strengthen integrity as a personal attitude and promote honest behaviour on an individual basis. Every single scientist serves as a role model and must fulfil his or her responsibility to behave with integrity in their everyday research and teaching work. Depending on the researchers' roles and positions, this relates to various areas. As teachers, for example, they must impart the rules of good scientific practice, sophisticated and up-to-date methodological skills and ethical self-reflection, even if specific modules for these purposes do not (yet) exist in study courses. They are responsible for the supervision of students, including candidates for doctoral degrees, particularly within the context of theses. As superiors, they are also responsible for the working conditions of their employees and should ensure that contracts have an appropriate duration and that there are sufficient time budgets. It is also their task to facilitate an open culture of discourse about issues such as controversial and negative results within their teams. Alongside their own knowledge and application of subject-specific standards of good scientific practice, research groups (particularly in multinational teams) should agree upon these standards. In addition to methods that are based on international standards, this also includes rules for the listing of authors for publications as

|[63] For example, the avoidance of redundant research by also publishing negative results or the encouragement of the relevance and quality of scientific articles as opposed to their quantity.

well as transparency of their respective contributions. In peer-review processes, scientists should disclose any possible conflicts of interest and should refuse to review manuscripts accordingly. This also applies to cases where they do not have sufficient time or sufficient expertise to review a given research article. Independently of this, manuscripts that do not meet the minimum requirements in terms of methods and research design should not be accepted for peer reviewing in the first place. In cases where scientists publish scientific journals, the recommendations under B.V.6. are addressed at them. If they observe misconduct by colleagues, researchers should use the protected environment of an ombudsperson's office or impartial counsellor at all stages of their careers so that these suspicions can be investigated. A false understanding of courtesy among colleagues must not be allowed to damage academic integrity.

V.2　Universities and scientific institutions

V.2.a　Management/committees

The management of universities and scientific institutions is mainly responsible for well-functioning structures for the promotion of academic integrity. To this end, concepts must be established and conditions for their implementation must be created. First of all, norms – in the form of clear guidelines and procedural rules – must be put in place or else existing models must be adapted (such as those of the German Research Foundation and the German Rectors' Conference). The management of universities and scientific institutions should raise awareness of these norms and make sure that they are applied. The existence of rules is not sufficient in itself; a quality cycle needs to be introduced. Every scientific institution first requires information about the status of its internal implementation of guidelines and recommended measures on the strengthening of academic integrity and must also be aware of the reference papers that its own guidelines are based on. This is an important prerequisite for internal management and for fulfilling responsibilities and establishing higher-level standards. In order to achieve better transparency – also for the purpose of in-house monitoring at universities – it is necessary to collect data systematically on at least the most easily detectable aspects of good scientific practice (e.g. ombudsperson's office at universities, supervision agreements, rules on data archiving). Clear rules of procedure and defined responsibilities are essential for the investigation of suspected cases of scientific misconduct. Ombudsperson's offices should be provided with sufficient resources and administrative support so that they can provide advice to researchers and deal with disputes. Early stage researchers must be supported in their personal development and must be offered good working conditions (e.g. contracts with appropriate duration). In addition, the management of universities and scientific institutions has the long-term task of moving away from primarily quantitative evaluation criteria

in the performance assessment of departments and institutes – for example, in the case of internal performance-related resource allocation. The management of scientific institutions should exercise the greatest possible transparency as a matter of policy. Uncovered cases of misconduct are indicative of well-functioning investigation structures and high quality standards of the institution and should be reported openly.

V.2.b   Faculties and departments

In line with their respective disciplinary traditions, faculties and departments should establish rules based on university-wide guidelines on good scientific practice. The curricula for study courses should include good scientific practice as theory and training and should be tested in suitable scientific examination forms. Binding supervision agreements between doctoral candidates and supervisors should be introduced in the regulations for doctoral studies. Appointment procedures for professorships should be organised in a transparent manner and they should favour qualitative indicators to assess the applicants' performance. In addition, topics such as the teaching of good scientific practice or how candidates deal with negative results can be considered in this assessment. Academic integrity starts by setting a good example with one's own working practices. Accordingly, competitive situations between groups within faculties – for example, in the case of the acquisition of university or external funding – must be decided in a quality-led manner.

V.3   Politics

Public authorities need to be aware of the fact that performance assessment based solely on quantitative criteria can have side effects that may be conducive to scientific misconduct. For this reason, the German Federal Government and the states as providers of funding have a responsibility to keep these side effects to a minimum in the case of quantitative measurement of performance – in the case of performance-related resource allocation, for example. They should avoid research performance assessment based solely on numbers of publications and citation indicators, and should not base funding on the number of doctorates. The German Federal Government and the states should assess and foster structures and measures for the promotion of academic integrity as a part of the overall work of institutions (e.g. in target agreements). In their funding programmes, the Federal Government and the states should include transparent and effective structures for the strengthening of academic integrity (ombudsperson's offices, clear procedural rules and responsibilities) as criteria or prerequisites for the right of universities and institutions to submit applications

(cf. V.5). In addition, strategic concepts and guidelines on the issues of research data management or quality assurance in doctoral programmes are beneficial and recommended. |[64]

V.4   Research-funding bodies

Private and public institutions that award research funding have a responsibility to avoid undesired side effects in their funding activities that could be conducive to scientific misconduct. An upper limit on named publications should be introduced, as the German Research Foundation has done for its funding applications. Furthermore, the publication of negative results or replication studies should be assessed positively. Additional qualitative criteria for the assessment of research performance should be considered. When reviewers are being selected, their impartiality and active support should be provided in order to raise awareness for the problems that can occur in the assessment of research performance. Transparent and effective structures for dealing with disputes and scientific misconduct (clear procedural rules and responsibilities, ombudsperson's offices) and concepts for the archiving and accessibility of research data should be prerequisites for institutions to submit applications. The financing of the implementation of these measures must be ensured or supported. In case of international research collaborations, it should be specified that the same high standards and rules of good scientific practice have to be accepted and implemented by all participants. External funding by representatives of companies or lobbyists must not be dependent on the specification of desired research results.

V.5   Accrediting system and evaluation agencies

Stakeholders in the area of accreditation of universities and the evaluation of institutions (including accreditation and evaluation agencies and the German Accreditation Council) should consider the structures and measures described in V.2.a and V.2.b for the promotion of academic integrity at universities. These include transparent, effective structures and rules of procedure for dealing with disputes and scientific misconduct, ombudsperson's offices, as well as guidelines and rules for good scientific practice. These measures should be checked as part of the accreditation of entire universities and their quality management.

|[64] Examples include the state of Lower Saxony's *Leitlinien zur Qualitätssicherung in Promotionsverfahren. Gemeinsame Position der Landeshochschulkonferenz Niedersachsen und des Niedersächsischen Ministeriums für Wissenschaft und Kultur* or the policy paper of the Ministry of Science, Research and the Arts of Baden-Württemberg *E-Science – Wissenschaft unter neuen Rahmenbedingungen. Fachkonzept zur Weiterentwicklung der wissenschaftlichen Infrastruktur in Baden-Württemberg*, which contains suggestions on research data management.

The German Council of Science and Humanities will employ corresponding criteria in its own accreditation and evaluation processes.

V.6   Scientific publishers and journals

Publishers and the editors of scientific journals are responsible to adapt a publication practice that does not hinder academic integrity. It should be possible to publish negative results even in renowned journals – for example, as part of the main publication or in separate publications; the same applies to replication studies. Errata and corrigenda should be published systematically and, for example, linked with the original publication in order to prevent the distribution of false data. Online repositories with accessible primary research data are also an important measure to promote academic integrity. Submitted manuscripts should be checked for plagiarism and, in addition to plausibility checking, they should at least randomly be tested for data manipulation. Alongside suitability for the subject, the impartiality of reviewers should be ensured. Publishers of all scientific journals should agree on voluntary obligations and common guidelines in joint forums so as to maintain and update quality assurance and ethical publication standards on a continuous basis. A Membership of the international forum *COPE* (*Committee on Publication Ethics*) is recommended.

V.7   Outlook

With the present position paper, the German Council of Science and Humanities wants to motivate the identified stakeholders and the scientific community as a whole to strengthen academic integrity. The development of a culture of integrity is a continuous process in joint responsibility. Many of the recommended changes must be developed in detail and then implemented by the persons and institutions that are responsible in the various fields. With the overall goals of quality assurance and self-regulation, they all help to ensure the autonomy and functionality of the whole science system. It is particularly important to establish a central body for academic integrity in Germany that can support changes at individual universities and institutions. The German Council of Science and Humanities will provide accompanying support to the establishment of this platform in close exchange with other organisations. The Council will also monitor the implementation of the other recommendations in this paper. It might gather relevant data to obtain a better overview of the developments in Germany. The Council might consider other aspects of academic integrity at a later point in time. These aspects include conflicts of interest, the influence of private funders, and the prevention of corruption and ethical issues in connection with research subjects and topics.

With the concept of academic integrity as it is understood here, the Council aims to introduce a new approach into the debate about scientific honesty that

will reflect the influence of systemic conditions and structures on personal attitudes. This approach aims to further develop a science system that produces and encourages qualitatively excellent research in the long term, that is supported by the trust of society, and that assumes responsibility for the realisation of its own ethical standards.

Annexes

	WR[1]	DFG[2]	HRK[3]	AFT/DHV[4]
Quality assurance in doctoral studies				
Supervision	Doctoral committees for content-related accompaniment and advice during entire doctoral phase [2011/1, p. 16]. Responsible supervision relationships, supervision agreements at start of doctoral studies [2011/1, p. 19f]. Separation of supervision and reviewing [2011/1, p. 24f].	Alongside primary supervisor, two additional experienced researchers, where appropriate from other faculties/institutions for advice, preparation of a supervision concept at start of doctoral studies, primary contact persons for postdoctorates [p. 18].	Transparent, subject-specific supervision concepts (analogous with DFG recommendation).	Imparting of fundamental rules of good scientific practice by supervisor, possibility of (partial) delegation of supervision, for example in the case of interdisciplinary projects [2012, p. 5]. Supervision agreements, voluntary limitation of number of doctoral students, introduction of sworn declarations [2012, p. 6]. Doctoral commissions [2012, p. 8].
Evaluation	Separation of supervision and assessment, evaluation must be carried out by reviewers nominated by the doctoral committee, independent evaluations [2011/1, p. 24f]. Adaptation of grade scale (reduction to "bestanden (Passed)" and "mit Auszeichnung (With distinction)") [2011/1, p. 25].	–	Independence and impartiality of reviewers. Transparent qualitative parameters for performance evaluation criteria.	Retention of the unity of supervision and evaluation, where appropriate involvement of external examiners [2013, p. 8].
Institutional structures	Umbrella structures, e.g. graduate centres to involve all doctoral students – including external doctoral students – with advice and training services [2002, p. 53].	–	–	Establishment of a foundation chair for good scientific practice [2013, p. 11].
Imparting of good scientific practice				
General	Teaching by means of compulsory course elements during studies [2011/1, p. 23].	Integration of rules of good scientific practice into academic teaching and training of young scientists [p. 16],	–	Modification of study and examination regulations with implementation of teaching of good scientific practice into the subject curricula of courses [2013, p. 4].

	WR[1]	DFG[2]	HRK[3]	AFT/DHV[4]
Working with research data				
General	Teaching and testing of knowledge of correct manner of working with data before the doctoral phase, submission of documented primary data for dissertations, DFG guideline on ten-year obligation to archive data is supported [2011/1, p. 22f].	Ten-year archiving limit for primary research data, individual institutes must specify rules on recording, storing and access to data [p. 22].	Ten-year archiving of all data, provision of sufficient electronic data storage equipment at universities (financial support from universities for this).	–
Procedures in cases of scientific misconduct				
General	–	Universities and non-university research institutions should establish their own procedural rules and definitions for misconduct and specify forms of sanctions and responsibilities [p. 15, 23ff]. Recommendations on course of procedures in procedural rules (see below).	Initial investigation of suspected cases by ombudsperson's committees, forwarding to investigation commission. Specific suggestion on structuring of procedures in model procedural rules (see below).	Add precise procedures to regulations for doctoral studies that lead to the revoking of doctoral degrees. Limitation period analogous to the data archiving period of ten years recommended by the DFG [2013, p. 10].
Procedural rules	–	"Verfahrensordnung zum Umgang mit wissenschaftlichem Fehlverhalten" (DFG 2001/2011).	"Zum Umgang mit wissenschaftlichem Fehlverhalten in den Hochschulen" (HRK 1998).	–
Ombudsperson system	–	Set up neutral ombudsperson's offices or impartial counsellors at universities and non-university research institutions, create awareness and provide sufficient support for these [p. 19].	Ombudsperson committees consisting of at least three independent impartial counsellors for prevention and mediation.	Expand local ombudsperson services, clearly separate responsibilities (advice and mediation) in the university statutes from those of other committees with the authority to take decisions [2013, p. 5].

	WR [1]	DFG [2]	HRK [3]	AFT/DHV [4]
Publication process				
General	Promote quality instead of quantity of publications [2011/2, p. 34].	Guidelines on authorship (minimum scope of contribution for listing), clearly specified before the writing of individual publications, no second publications, disclosure of conflicts of interests by reviewers, replacement of these reviewers where necessary [p. 29 ff]. Checking and replication (where possible) of research results before publication [p. 21].	-	-
Incentive systems				
General	Move away from evaluation of solely quantitative indicators such as the amount of external funding acquired and number of doctoral students [2011/2, p. 42].	Move away from quantitative measures in the evaluation of research performance [p. 20].	Performance evaluation criteria must be based on qualitative parameters.	Criticism of the allocation of funding and rewarding of performance based on numbers of doctoral degrees, encouragement of voluntary limitation and publication of individual numbers of doctoral students [2013, p. 7].

1) Wissenschaftsrat: Anforderungen an die Qualitätssicherung der Promotion, Cologne 2011 [cited as: 2011/1]; Wissenschaftsrat: Empfehlungen zur Doktorandenausbildung und Förderung des Hochschullehrernachwuchses, Cologne 2002 [cited as: 2002]; Wissenschaftsrat: Empfehlungen zur Bewertung und Steuerung von Forschungsleistung, Cologne 2011 [cited as: 2011/2].

2) Deutsche Forschungsgemeinschaft: Sicherung guter wissenschaftlicher Praxis. Denkschrift (Empfehlungen der Kommission „Selbstkontrolle in der Wissenschaft"), Weinheim 2013 (expanded edition).

3) Gute wissenschaftliche Praxis an deutschen Hochschulen. Empfehlung der 14. HRK-Mitgliederversammlung vom 14. Mai 2013 [page citation not possible as document does not have page numbers].

4) Maßnahmenkatalog zur Gestaltung von Promotionsverfahren. Gemeinsames Positionspapier des Allgemeinen Fakultätentags (AFT), der Fakultätentage und des Deutschen Hochschulverbands (DHV) vom 21. Mai 2013 [cited as: 2013]; Gute wissenschaftliche Praxis für das Verfassen wissenschaftlicher Qualifikationsarbeiten. Gemeinsames Positionspapier des Allgemeinen Fakultätentags (AFT), der Fakultätentage und des Deutschen Hochschulverbands (DHV) vom 9. Juli 2012 [cited as: 2012].

		EU [1]	ESF [2]	IAP [3]	GSF [4]
Quality assurance in doctoral studies					
General		–	"The recent move towards a 'structured doctorate' model in many countries provides an excellent opportunity to lay the foundations for GRP at what must be seen as the entry point into a research career." [p. 23]	–	–
Supervision		Structured, regular relationship between researchers during their education phase and their supervisors and representatives of faculty/department, record-keeping of working progress and research findings, obtaining of feedback and implementation of this feedback, agreement of time plans, milestones, specify reporting requirements for (partial) results [2005, p. 8f]. Regard role as supervisors and mentors as a central task, ensure that they "have sufficient time, knowledge, experience, specialist expertise and commitment [...] to provide suitable support to the young researcher" before starting supervision of a research project. "Provide clear procedures for progress and monitoring as well as feedback mechanisms [2005, p. 12].	The education of young scientists and scholars requires binding standards for mentorship and supervision [p. 16]. "Research integrity should also be integral to research supervision and mentoring, requiring more senior researchers to become fully aware and supportive of the principles and practice of GRP." [p. 23]	–	–
Evaluation of doctoral studies		–	–	–	–
Inst. structures in the doctoral area		–	–	–	–

	EU[1]	ESF[2]	IAP[3]	GSF[4]
Imparting of good scientific practice				
General	–	Training in Good Research Practice should be an integral part of a research integrity governance framework [p. 23]. "Prevention, education and awareness raising should reach all stages of an academic and researcher's career – undergraduate, postgraduate and temporary or permanent employee responsible for research." [p. 23] Research integrity as an integral component of supervision and mentoring [p. 10].	All researchers and staff need to receive formal and informal training in responsible research practices [p. 22]. "Responsible conduct should be an element of all courses and research experiences so that it is seen as fundamental to the research enterprise and not as a separate component." [p. 29] "The fundamental values of research need to be practiced and emphasized as a matter of routine. Experienced researchers need to convey to students and younger colleagues the standards of research through teaching, through the examples they set, and through mentoring." [p. 29]	"Successful implementation should include the incorporation by all parties of instruction covering responsible conduct of research in curricula and in the training of academic (faculty), staff and technical personnel." [p. 4]
Research process / working with research data				
General	Joint ownership of data for research that has been carried out with supervisors and in research groups. Necessity for replication studies with transparency regarding the original data situation. (2005, p. 7) "The storing of research results is essential for ensuring the transparency and reproducibility of experiments." (2007, p. 7) "In principle, research data from research that has been funded solely from public funds should be accessible to all, [...]" (2007, p. 9)	"Good data practices: availability and access: – All primary and secondary data should be stored in asecure and accessible form. – Original scientific or scholarly research data should be documented and archived for a substantial period (at least 5 years, and preferably 10 years). – Research data should be placed at the disposal of colleagues who want to replicate the study or elaborate on its findings." [p. 18]	"All researchers are expected to keep clear, accurate, and secure records of their research data and corres-ponding primary material so that the work can be verified or replicated by others. They also are expected to share their data with others, including, where feasible, the research materials and software that enables them to draw their conclusions." [p. 16] "Researchers should be prepared to explain why data are not being released, and journals may require the provision of such explanations as a condition of publication. [...] Wherever possible, they should have their models independently validated." [p. 17]	–

Procedures in cases of scientific misconduct

	EU[1]	ESF[2]	IAP[3]	GSF[6]
General	–	"Academies of Sciences and other such bodies should adopt a code of conduct, with rules for handling alleged cases of misconduct, and expect members to abide by it." [p. 8] "The primary responsibility for handling research misconduct is in the hands of those who employ the researchers. Such institutions should have a standing or ad hoc committee(s) to deal with allegations of misconduct." [p. 8] "Institutes or organisations that fail to deal properly with such wrongdoing are also guilty of dereliction of duty. All allegations should be properly assessed, and credible allegations should be investigated fully, with corrective actions taken if allegations are confirmed." [p. 14] "Procedures for dealing with misconduct should be spelled out in sufficient detail so that the transparency of the process and uniformity within one domain of jurisdiction from one case to another is ensured." [p. 20] "Agreement not only on types of sanctions, but on who can recommend them and who has responsibility for enforcing them." [p. 25] Detailed Principles for Investigating Research Misconduct (see below)	"Primary responsibility for handling cases of misconduct should be in the hands of the employers of researchers. Each institution should have a standing committee that deals with misconduct, or it should establish an ad hoc committee when serious allegations of misconduct are made." [p. 22] "Research institutions need to establish clear, well-communicated rules that define irresponsible conduct and ensure that all researchers, research staff, and students are trained in the application of these rules to research. They should establish effective mechanisms for addressing allegations of research misconduct." [p. 30]	"An agreement for collaborative research involving parties from more than one country should address the promotion of good practice in research and describe the principles, standards and procedures for the investigation of allegations of research misconduct within the project." [p. 1] "The parties should agree on procedures for investigating research misconduct prior to taking part in the project. Where a party or parties to the agreement do not have such procedures in place, and for the purposes of the agreement, the parties may adopt an established procedure in accordance with the principles described" [p. 4] "Investigations should follow an agreed, standardised and clearly defined procedure and must be conducted with appropriate transparency and in accordance with the highest standards of: – Integrity; – Fairness; and – Confidentiality. And with a commitment to there being: – no Detriment; and – a Balanced approach." [p. 6]

	EU[1]	ESF[2]	IAP[3]	GSF[4]
Procedural rules	–	"Recommended Principles for Investigating Research Misconduct" [p. 20]	–	"Standard Procedures for Investigating Research Misconduct Allegations in International Collaborative Research Projects" [p. 8] "Clearly defined procedure for investigations and timeframes" [p. 11f]
Ombudsperson system	"Employers and research-funders should introduce suitable procedures in accordance with state rules and regulations – possibly in the form of an impartial person (in the nature of an ombudsperson) – to deal with complaints/objections from researchers, including those regarding conflicts between supervisors and young scientists. These procedures should provide confidential, informal support to all research personnel in the solution of work-related conflicts, disputes and complaints, with the aim of achieving fair and equal treatment within the institution and improving the overall quality of the working environment." [2005, p. 13]	–	"Ombudsmen generally do not have the power to initiate investigations, but should be able to require institutional or independent investigations of suspected irresponsible practices. In other cases, integrity officers at institutions serve as an independent point of contact for concerned researchers." [p. 29]	"All parties should designate an appropriately experienced and/or trained individual or office to receive concerns and/or allegations of misconduct. Such a contact point should be accessible to all those who might wish to raise a concern. All those responsible for procedures to investigate research misconduct (in national organisations or employers) should have received training in the application of the procedures and/or be experienced in their use." [p. 4]

	EU[1]	ESF[2]	IAP[3]	GSF[4]
Publication process				
General	"Co-authorship should be assessed positively by institutions when evaluating their employees, as it is evidence of a constructive approach to research work. For this reason, employers and/or research-funders should develop strategies, approaches and procedures that provide the necessary framework conditions to researchers – including those at the start of their research careers – so that they can benefit from their right to recognition, listing and/or citation for their actual contributions as co-authors of articles, patents, etc. or so that they can publish their own research findings independently of their supervisor(s)." [2005, p. 12]	"Results should be published in an open, transparent and accurate manner, at the earliest possible time, unless intellectual property considerations justify delay. All authors, unless otherwise specified, should be fully responsible for the content of publication. Guest authorship and ghost authorship are not acceptable. The criteria for establishing the sequence of authors should be agreed by all, ideally at the start of the project. Contributions by collaborators and assistants should be acknowledged, with their permission. All authors should declare any conflict of interest. Intellectual contributions of others should be acknowledged and correctly cited. [...] Financial and other support for research should be acknowledged." [p. 8] "An editor or reviewer with a potential conflict of interest should withdraw from involvement with a given publication or disclose the conflict to the readership. Reviewers should provide accurate, objective, substantiated and justifiable assessments, and maintain confidentiality. Reviewers should not, without permission, make use of material in submitted manuscripts. Reviewers who consider applications for funding, or applications by individuals for appointment or promotion or other recognition, should observe the same guidelines." [p. 8]	"Journals should use technological means to protect the integrity of the research literature. They should make retractions visible so that retracted papers are not used or cited. Both authors and journals should take steps to avoid duplicated publications that readers expect to be original and should refrain from citations designed only to boost the journal's impact factor." [p. 32] "The general order of authorship should be established along with agreements on how to share data, raw or otherwise, to guarantee scientific best practice." [p. 22] "Peer reviewers need to assess proposed publications fairly and promptly, with full disclosure of conflicts of interest or bias." [p. 25]	–

	EU[1]	ESF[2]	IAP[3]	GSF[4]
Incentive systems				
General	As regards evaluation procedures, general creativity in research and research findings, "for example, publications, patents, research management, teaching activity/lectures, supervision, mentoring, national and international cooperation projects, administrative duties, public relations work and mobility should be considered positively and contribute to promotion prospects." [2005, p. 13]	Funders should require from recipients of their funds that measures as training in Good Research Practice are in place. [p. 23]	"Public and private funding agencies should avoid policies that might lead to overemphasis of quantity over quality in the reward systems for researchers. They should provide support to researchers and research institutions at a level sufficient to ensure that research can be undertaken properly and responsibly, without compromising quality or integrity. Funding agencies should also support efforts of research institutions to develop education and training programs on responsible research conduct. They should require research institutions to have mechanisms in place to respond to irresponsible practices. When supporting international research collaborations, funding agencies should make sure that rules are clear and understood by all parties to the collaboration in advance." [p. 31]	–

1) EU Commission: Empfehlung der Kommission über die Europäische Charta für Forscher und einen Verhaltenskodex für die Einstellung von Forschern (Commission Recommendation on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers), Brussels 2005 [cited as: 2005]; EU Commission: Mitteilung der Kommission an das Europäische Parlament, den Rat und den Europäischen Wirtschafts- und Sozialausschuss über wissenschaftliche Informationen im Digitalzeitalter: Zugang, Verbreitung und Bewahrung (Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee on scientific information in the digital age: access, dissemination and preservation), Brussels 2007 [cited as: 2007].

2) European Science Foundation: Fostering Research Integrity in Europe. Final Report (including European Code of Conduct for Research Integrity), Dec. 2010.

3) InterAcademy Council/IAP: Responsible Conduct in the Global Research Enterprise: A Policy Report, Alkmaar 2012.

4) OECD Global Science Forum: Investigating Research Misconduct Allegations in International Collaborative Research Projects. A Practical Guide, April 2009.