Good practices list in scientific research

"*To maximize the benefit to society, you need to not just do research but do it well.*"
Doug Altman

Purpose and context

This Guide has been designed to strengthen a healthy research culture, encourage good conduct in research, and help prevent mistakes and misconduct.

The guide is subject to the mission and objectives of the "Petru Poni" Institute of Macromolecular Chemistry in Iași (ICMPP) to ensure integrity, quality and excellence in research; therefore, the Guide provides, succinctly describes and exemplifies values, principles and general standards for good practices in research, applying both to ICMPP researchers at any career level (including PhD students) and to their partners interested in the production, transfer and dissemination of scientific research.

The content of this Guide has been developed on an extensive basis of normative documents in the field mentioned in the list of bibliographic references, with the idea of consistency with international regulations and trends for ensuring the quality of scientific research.

The guide is not comprehensive, does not aim to micromanage research, and cannot cover the nuances of all types of research, in all disciplines.

Values

The starting point of this Guide are the four fundamental, autonomous and interdependent values of academic integrity, which correspond to specific guidelines and types of good practices that allow the functioning of mechanisms for self-correction of research and avoidance of the negative consequences of deficient methodologies:

Honesty in obtaining, analyzing, reviewing, interpreting, reporting and communicating research data and results, in participating in research funding competitions, respectively evaluating the scientific products of other researchers, in a transparent, fair, complete and impartial manner. For honest research, it is recommended that researchers ensure:

- the concordance between the research conduct and its self-presentation in the public space;
- the concordance between one's own research practice, personal or institutional, and the positive expectations associated with scientific knowledge;
- the adoption of working procedures in accordance with the goals and norms valued by the majority-positive in the field of scientific research, during the period of application of the Guide, even when the public visibility of the actual practices is reduced.

Responsibility in research, from idea to publication, in its management and organization, in training, supervising and guiding researchers, in order to correctly assume and build the impact that research can have, directly or indirectly, at the level of the entire society. This involves:

- respect for the human subjects of scientific research or experiments;
- avoiding suffering for animals;
- protection of the natural environment;
- preserving the ecological balance;
- promoting social inclusion, democracy and sustainable development;
- protection of the material and cultural heritage.

Verifiability and reproducibility: the public presentation of the processes of obtaining, processing and interpreting data must be made in such a way that the research act can be understood by any other researcher and can be repeated with the achievement of the same results, regardless of whether a replication of the research is intended or not, in order to ensure credibility and cooperation in research. This involves:

- transparency of research methods;
- ensuring as far as possible access to the data obtained in the research carried out;
- testing the stability of the results by using alternative data or methods.

The validity of knowledge, so that the research results contribute to the effective progress of science, being obtained according to research objectives, questions or hypotheses and in the context of relating to:

- previous research and knowledge on the same topic;
- external criteria in relation to the given theme;
- theories in the field;
- all dimensions or aspects of the concept under research.

Research process

The research process has as starting points:

- explaining and justifying the objectives, questions, hypotheses and type of research so that their usefulness for fundamental or applied research can be determined;
- substantiation, in relation to studies and researches: (i) of major importance; (ii) recent; (iii) without making an excess of bibliographic references;
- elaboration of the study/project following a coherent and unitary structure well defined (purpose, objectives, bibliographic synthesis, methodology, analysis and interpretation of data, interrelated discussions and conclusions);
- acceptance only of research topics that can be carried out in accordance with the values and principles specified in this Guide, in national regulations or explicitly reducible to them;
- involvement only in research topics for which, directly or indirectly, research expertise is available;
- clearly defining the own, original contributions that will be brought to the project/study.

Honesty in research obliges us to:

- complete and accurate reporting of research results, regardless of whether they (i) support the working hypotheses of the research; (ii) whether or not they suit the interests of the research funders;
- respecting the public as an end-user of research, avoiding manipulation through poor design of research tools or by not presenting results inconsistent with those of the funders' interests;
- rejecting and preventing any form of intellectual theft (plagiarism) of text, ideas, data, methods of analysis or results of analysis;
- rejecting and preventing any form of fabricating data and presenting it as if it were real;
- rejecting and preventing any form of falsification or manipulation of data.

The verifiable and reproducible nature of any research process implies that:

- research reports or methodological sections of scientific publications specify in detail where, when and how research data were collected/produced;
- any transformations in the databases (elimination of extreme cases, replacement of missing values on certain variables, etc.) during the analyses should be mentioned, procedurally described, justified and evaluated by the initial research team;
- the reporting of the results of the quantitative analyses should be made with the specification of any procedures for weighting the data or for "smoothing" the frequency distributions for certain variables;
- the archiving of research data should be ensured by standard procedures, for specified periods of time and, as far as possible, accessible for specialized public use.

The validity of the research results is ensured by:

- specific tests, highlighting the consistency of new research results with results from previous research, with consolidated theoretical structures or objective evaluation criteria;
- applying multiple methods to analyze the same data or changes in method to see how robust the conclusions are in relation to such changes.

Ensuring transparency throughout the research process is a cumulative requirement arising from the requirements of honesty, verifiability, reproducibility and accountability and which involves:

- increased accessibility to research results and information on how to produce them;
- declaration of conflicts of interest;
- presenting their own research so that the entire research process can be reproduced.

Authorship of a scientific result

The authorship of a scientific result originates from the explicit recognition of the contributions that one or more researchers have to the achievement of a result presented in the public space.

Using a scientific article as an example, authorship implies that that person:

- has made a significant contribution to the reported article, in one of, in several or in all stages of conceptualization, study design, execution, data acquisition, analysis, validation, interpretation, and
- has drafted or written, substantially revised or critically evaluated the article, and
- agreed on the journal to which the article will be sent for publication, and
- reviewed and authorized all versions of the article prior to submitting, during the review, the final version accepted for publication and any significant changes made in the proofreading stage, and
- agrees to assume and share responsibility for the content of the article (including its conclusions) and the resolution of any questions or requests regarding the accuracy or integrity of the published work, etc.

Other people who contributed to the study should also be mentioned, for example in the Acknowledgments section, but not identified as authors.

The author who submits the manuscript:

- must make every effort to ensure that each author has reviewed the manuscript and authorized its submission;
- is responsible for coordinating the authors' group's responses to questions and requests that arise during the evaluation process;
- ensures that all authors have approved the manuscript as published.

The authorship is manifested by specifications related to:

- the order or marking by distinctive signs of the names in the series of authors;
- carrying out and/or coordinating the work within the team of authors;
- specifying the specific contributions for some of the authors, if applicable, in the body of the paper or on the publication platform.

At the same time, the quality of author is recognized by:

- explicit declaration of the use of texts previously published by the author to avoid self-plagiarism;
- respect for the joint ownership given by participation as a co-author in collective volumes or articles;
- explicit mention of the quality of author also for works made through contracts so that the beneficiary does not undeservedly assume a role in the team of authors.

The concepts of "free author", with the versions of "honorary author" and "gift author" (e.g.: the inclusion in the list of authors of a result of a person who has not made any intellectual contribution to that work, but has a privileged status in the research group/entity, high visibility, financial resources or from friendship, fear, tacit imposition, manipulation, to extinguish obligations, facilitate access to a particular journal, reciprocity, customary practices), "ghost author" (a person who has paid someone else, who does not appear as an

author, to actually carry out the research work and/or write the article) and derivatives thereof are not acceptable under any circumstances.

Data management and ownership

It is necessary that primary and collateral research data:

- be recorded in a form that allows access for analysis and review; it is recommended to use laboratory notebooks in physical format (or equivalent digital variants) containing signed and dated consecutive records; any attached materials (structures, graphics, printouts) should be signed, dated and permanently fixed on the pages of the notebook; for other situations, a separate signed entry in the notebook is required, indicating the date and place where the data are located;
- always be available within a reasonable time frame to scientific collaborators, supervisors or line managers for examination, subject to intellectual property law and authorship rules;
- be recorded in sufficient detail to allow for authentication, reproduction of results, confirmation and validation of conclusions, and resolution of requests and/or questions that may arise in the dissemination process;
- to be organized consistently (structure/stability/consistency of file formats) throughout the research process; Each file requires a descriptive name that uniquely identifies the content. quality assurance of data files should be carried out before sharing, reporting or publishing;
- be kept for a sufficient period to allow for further examination and analysis (depending on the sources of funding or the type of research carried out).

Any ICMPP researcher, collaborator, partner, student practitioner involved in research activities carried out within (funded by/carried out with the support of) ICMPP must comply with the internal rules regarding: (i) intellectual property; (ii) inventory, transfer and archiving of the acquired data

Training, guidance and supervision

Researchers in management positions, in supervisory and/or guiding positions, through decisions and personal example, support and promote the ethical values and professional and personal integrity of other researchers, which must reflect:

- transparency and probity in activity;
- professional competence;
- initiative by example;
- compliance with specific legislative provisions, regulations and norms;
- fair treatment and respect for collaborators, partners and citizens;
- approach in a professional manner to all the activities carried out.

It is recommended that researchers in these positions build a culture of mutual respect and cooperation, and promote an environment in which open discussion and critical analysis of research methods, results, and conclusions are accepted and welcomed.

They are responsible for disseminating to doctoral students, postdoctoral fellows and researchers in lower hierarchical positions some:

- appropriate standards of scientific conduct;
- policies and rules relating to authorship and other intellectual property issues currently used in their research group;
- expected practices and standards for recording, storing, backing up and archiving primary and collateral data, including laboratory notebooks and electronic information;
- guidelines applicable to specialized journals, for the preparation and presentation of figures when writing or submitting a paper for publication;
- decision-making process at organisational level and its results.

The process of leading, supervising and mentoring is preferable to be carried out by organizing regular and frequent meetings with the members of the guided group/researchers, to discuss the progress of their own research, the interpretation of the data, the concerns or problems that may arise, their resolution and any other issues that the two parties consider necessary to be addressed.

The doctoral supervisor has the responsibility to build an appropriate training environment, in which the doctoral student has the opportunity to acquire both the conceptual and technical skills of the field in which he or she operates.

The PhD supervisor and the selected advisors have the responsibility to provide doctoral students and postdoctoral fellows with a realistic evaluation of their performance and guidance regarding career development.

Regular, high-frequency meetings with PhD students are also required to address: (i) common expectations regarding the major elements of their professional interactions; (ii) any doubts regarding the doctoral internship, the research plan, the work they perform; (iii) the way in which the intended results are obtained and/or communicated; (iv) additional/alternative support possibilities and options.

Bibliographic references

- Law no. 206 of 27 May 2004 on good conduct in scientific research, technological development and innovation
- National Council for Ethics in Scientific Research, Technological Development and Innovation, National Code of Ethics for Scientific Research (2020)
- National Council for Ethics in Scientific Research, Technological Development and Innovation, Scientific Research Integrity Guide (2020)
- SCOSAAR, SCOSAAR's Code of Ethics and Professional Conduct
- Romanian Academy, Code of Ethics of the Romanian Academy

- ALLEA (ALL European Academies), The European code of conduct for research integrity (2017)
- Best practices in graduate student advising, Massachusetts Institute of Technology
- University of Cambridge, Guidelines on good research practice
- University of Oxford, Research integrity and the responsible conduct of research – Checklist for research students and their supervisors at the University of Oxford
- ARMA and UKRIO, Research ethics support and review in research organisations (2020), https://ukrio.org/ukrio-resources/publications/research-ethics-support-andreview/
- Committee on Publication Ethics (COPE) Guidelines, https://publicationethics.org/guidance/Guidelines
- Contributor Roles Taxonomy, CRediT. https://credit.niso.org/
- Methods Reporting with Initials for Transparency, MeRIT. https://www.merit.help/