

UC Riverside RCR Primer for Undergraduates Participating in NSF-Funded Research

Background

Section 7009 of the America COMPETES Act of 2007 (*America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science*) directed that the National Science Foundation require that each institution that applies for financial assistance from the Foundation for science and engineering research or education certify that the institution has a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF. While training plans are not required to be included in proposals submitted to NSF, institutions are advised that they are subject to review upon request.

In responding to this requirement, the NSF published a revision to its NSF Proposal & Award Policies and Procedures Guide requiring that beginning January 4, 2010, institutions must certify, at the time of proposal submission, the institution has a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students, and postdoctoral researchers who participate in NSF funded projects.

Purpose

This document is developed to provide an introduction to Responsible and Ethical Conduct of research (RCR) for undergraduates who are engaged in research activities that are supported by NSF. It is intended to satisfy the *minimum* requirements of Section 7009 of the America COMPETES Act of 2007. All UCR undergraduates participating in research or training programs supported by NSF, are required to review this document and certify that they understand it. Additionally, some departments or principal investigators might require further training for undergraduates, depending on the nature of the specific NSF supported project. The signed certification form at the end of this document should be returned to the student's research supervisor.

Introduction

Research and scholarly activities within major universities are a critical part of advancing knowledge and introducing the benefits of this knowledge for the betterment of the society.

According to the Association of American Universities report entitled *University Research- the Role of Government funding* (May, 2006): "*University research is a vital building block of the nation's R&D enterprise. While universities perform 14 percent of total national R&D, they perform 54 percent of the nation's basic research. Along with creating new knowledge and the foundation for new products and processes, U.S. universities use their research activities to*

educate students who will become the next generation's scientists, teachers, and leaders in government and industry”.

“Because there is broad consensus that university research is a long-term, national investment in the future, the federal government supports 62 percent of the research performed at universities. In 2004, federal research support to universities was \$26.1 billion: \$20.6 billion in basic research, \$4.9 billion in applied research, and \$543 million in development”. This number has increased significantly over the past few years, especially with the infusion of the American Recovery and Reinvestment Act (ARRA) of 2009 which provide over \$15 billion in additional research funding for the National Institutes of Health (NIH) and National Science Foundation (NSF) alone. UCR receives well over \$60 million per year in Federal research funding.

It is therefore extremely critical that the research enterprise conducts its activities in a responsible manner and with the highest ethical standards if it is to preserve the public and governmental trust.

In its introduction to the requirements for RCR training the NSF has stated *“The responsible and ethical conduct of research (RCR) is critical for excellence, as well as public trust, in science and engineering. Consequently, education in RCR is considered essential in the preparation of future scientists and engineers.”*

This has been further amplified in the [Introduction to the Responsible Conduct of Research](#) handbook published by the U.S. Department of Health and Human Services Office of Research Integrity (ORI) which states *“Responsible conduct of research is simply good citizenship applied to professional life. Researchers who report their work honestly, accurately, efficiently, and objectively are on the right road when it comes to responsible conduct.”*

In summary, it is our obligation to maintain the highest standards of ethics and responsibility when conducting our research in order to continue enjoying the trust of the public and the funding agencies.

What is Ethical and Responsible Conduct of Research (RCR)?

RCR is not a method that can be followed; it is an overall philosophy of creating and maintaining an environment for research that conforms to the highest ethical principles, fosters intellectual honesty and integrity, and encourages scientific advances of the highest quality. These concepts must be incorporated into every aspect of research and scholarly activity.

The ORI describes this best by stating that: *“There is no one best way to undertake research, no universal method that applies to all scientific investigations. Accepted practices for the*

responsible conduct of research can and do vary from discipline to discipline and even from laboratory to laboratory. There are, however, some important shared values for the responsible conduct of research that bind all researchers together, such as:

- *HONESTY — conveying information truthfully and honoring commitments,*
- *ACCURACY— reporting findings precisely and taking care to avoid errors,*
- *EFFICIENCY— using resources wisely and avoiding waste, and*
- *OBJECTIVITY— letting the facts speak for themselves and avoiding improper bias.”*

Any action that violates these principles is not responsible conduct and will result in loss of the trust of society in the research enterprise. At a more practical level, it can result in the termination of a research project, dismissal of a researcher found to have acted irresponsibly, and, in extreme cases, debarment of the institution from receiving Federal research funds.

What are the RCR Content Areas?

While NSF has not specified what should be covered in meeting its requirements, a researcher should understand how the following concepts apply to research activity:

- Collaborative Science
- Conflict of Interest and Conflict of Commitment
- Data Acquisition, Management, Sharing and Ownership
- Mentor/Trainee Responsibilities
- Peer Review
- Publication Practices and Responsible Authorship
- Research Misconduct
- Research Involving Animals (see <http://or.ucr.edu/RI/IACUC.aspx>)
- Research Involving Human Subjects (see <http://or.ucr.edu/RI/HRRB.aspx>)

What You Need to Know

While your specific research activity may not include activities that require all of the areas covered, it is strongly suggested that you review all of the content so that you are familiar with the broader requirements as your career in research progresses. An overview of these topics is provided below. You are encouraged to study these topics further and to discuss them with your research supervisor and your fellow researchers.

A. Collaborative Science

Today's research environment increasingly includes collaboration with colleagues both across the University and external to the University. By nature, collaborations have the potential for dilemmas such as complex roles and relationships, divergent interests, dissimilar management styles and differing disciplinary and cultural interpretations.

Clear communication is the key to effective collaborations.

Collaborative projects should have effective management plans; the teams should meet and reach agreements on key areas prior to commencement of a project. The agreement should cover areas such as:

- Financial issues;
- Authorship;
- Intellectual property;
- Training and supervision; and
- Compliance with all regulatory matters relevant to the project.

Each team member needs to clearly understand what the collaborative arrangements are.

Ask your Principal Investigator to provide you with the requirements for your project before you start your work. For example, you will want to be sure to understand what work you are funded to perform, and what work will not be funded, and how and when to report your results. Make sure you understand them and adhere to those provisions.

B. Conflict of Commitment

In today's complex research environment individuals often have multiple commitments to various research projects and at times to external activities. It is your obligation to act in the best interest of the University and in furtherance of the University's mission, and you must not let outside activities or outside financial interests interfere with those obligations. Funding agencies expect that the amount of your effort charged to the project is an accurate reflection of the actual effort you have spent on the project.

C. Conflict of Interest

To protect against bias or the appearance of bias, every investigator at UCR must disclose whether they, their spouse, or registered domestic partner or their dependent children have a significant financial interest that could reasonably appear to be affected by the design, conduct, or reporting of covered research. Disclosures are reviewed in accordance with the [UC Conflict of Interest Policy](#).

Become familiar with the Policy and ensure that you have submitted any disclosure of significant personal financial interest that is applicable to your involvement in the research project. The UCR Conflict of Interest Committee reviews financial disclosures for both privately and federally sponsored projects and situations where a potential, perceived, or real conflict of interest exists by virtue of financial interest. It establishes management strategies to eliminate, manage or reduce conflicts of interest. It determines which strategies are appropriate and is responsible for ensuring their implementation and provides an oversight role and endeavors to safeguard the interests of the University and the individual, and ensure compliance with state and federal government mandates.

D. Data Acquisition, Management, Sharing and Ownership

The integrity of research data and the usefulness of the research it supports depend on careful attention to detail, from initial planning through final publication. While different disciplines and types of research may differ in data management practices, there are generally accepted standards that the University community should be aware of and adhere to relative to data ownership, data collection, data protection and data sharing. Key considerations for data collection include using the appropriate method, providing attention to detail, obtaining the appropriate permissions for use of certain categories of data and the accurate and secure recording of data. Data should be maintained and secured in such a way to allow it to confirm research findings, establish priority, and be reanalyzed by other researchers. Data should be stored in such a way as to protect confidentiality, be secure from physical and electronic damage, destruction and theft, and be maintained for the appropriate time frame dictated by sponsor and University policies. Conditions imposed by sponsors, the University, and data sources may affect data acquisition, management, sharing and ownership.

E. Mentor/Trainee Responsibilities

Mentor-trainee relationships begin when an experienced and an less experienced researcher agree to work together. The experienced researcher has knowledge and skills that the inexperienced researcher needs to learn.

When mentors accept trainees, they assume responsibility for assuring that the persons under their supervision are appropriately and properly trained. Generally the expectations are that:

- At least one faculty member should supervise all individuals in a laboratory who are not acknowledged independent investigators.

- Mentors should commit themselves to spend the time required for adequate supervision
- The ratio of trainees to available mentors should be small enough to encourage close and frequent interactions concerning all aspects of research undertaken by a trainee or junior investigator, including the planning and design, data interpretation and preparation of reports.
- Trainees have both the right and responsibility to be certain that they are adequately supervised during their research training and that the research itself is performed in a manner which reflects high standards for the responsible conduct of science.

F. Peer Review

Peer review refers to the evaluation of your work by colleagues with similar knowledge and experience. This is an essential component of academe and research, and nearly all scholarly journals subject submitted papers to such reviews.

The integrity of the peer review process depends on analysis that is:

- Timely;
- Thorough;
- Constructive;
- Free from personal bias or conflict of interest and commitment; and
- Respectful of the need for confidentiality.

If you are asked by your colleagues, journals and external sponsors to judge manuscripts and sponsored project applications, you must make sure that your opinions are fair and unbiased. You almost certainly will be asked to sign a non-disclosure agreement before serving as a reviewer; this certification binds *you personally* to protect the confidentiality of the information you are asked to review.

G. Publication Practices and Responsible Authorship

Research involves the dissemination of knowledge gained by means of publication which in today's research environment often includes the contributions of many individuals. As collaboration grows in all areas of academe, questions concerning who should be named as an author for a journal article, conference presentation, or grant proposal become more complex. The basic principle is that authors should make meaningful intellectual contributions to a project, but it can be difficult to apply because of the many different possible roles in a project.

Key ethical issues surrounding the submission and review of manuscripts and grant proposals include:

- How to appropriately acknowledge contributions on joint projects
- What is expected of authors, and
- What is expected of reviewers.

The appropriate reporting of research results entails a full and fair description of the work undertaken, an accurate report of the results, and an honest and open assessment of the findings. Many scientific journals have begun listing the areas of contribution of different authors and require a signed document verifying various contributions.

Another important question is whose names should not be on a paper. Because authorship entails rights and responsibilities, contributors should not be named as authors without their knowledge or unless they review manuscripts.

H. Research Misconduct

The U.S. Department of Health and Human Services Office of Research Integrity (ORI) that oversees all NIH research defines research misconduct as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.

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

Research misconduct does not include honest error or differences of opinion. The UCR policy for responding to allegations of research misconduct is available at <http://or.ucr.edu/Policies/Policies.aspx>.

Acknowledgement

This document is modeled on one generously shared with UCR by the Office of Research Compliance at Boston University.

Certificate of Completion

I certify that I have read and reviewed the “UC Riverside RCR Primer for Undergraduates Participating in NSF-Funded Research”.

(SIGNATURE)

(PRINTED NAME)

(Date)

(Principal Investigator Signature)

(Date)

The Principal Investigator should retain this signed certificate as documentation that the undergraduate researcher has satisfied this NSF requirement.