Best Practices for Responsible Conduct of Research – Life Sciences

PURDUE UNIVERSITY | Office of the Executive Vice President for Research and Partnerships

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Abstract

Responsible Conduct of Research (RCR) is the practice of scientific investigation with integrity. It involves the awareness and application of established professional norms and ethical principles in the performance of all activities related to scientific research (NIH/ORI). According to the Retraction Watch Database, the majority of retracted scientific articles are linked to detrimental research practices and research misconduct; these may lead to wasted investment and career and reputational damage to those who engage in unethical conduct. RCR education provides the knowledge, skills, and resources needed to conduct science with integrity and prevent misconduct and detrimental research practices. Purdue is committed to fostering a culture of research integrity and implemented an RCR Standard (S20) that requires all faculty, staff, trainees, graduate and undergraduate students who design and conduct research and/or report and publish research outcomes to complete RCR training. Purdue has also developed RCR training resources, including a template for Lab Expectations – Life Sciences to facilitate researcher involvement in lab based plans for fostering research integrity and creating a safe, ethical, secure and productive research environment.

RCR Core Values and Guiding Norms

Honesty Convey information truthfully and honor commitments	**Accountability** Be responsible for and stand behind the work, statements, actions, and roles in the conduct of your work	**Stewardship** Ensure the long-term and sustainable care of research data and materials, from study design to data collection, analysis, storage, and sharing
Objectivity Let the facts speak for themselves and avoid improper bias	**Transparency** Declare interests and report all methods and data behind an analysis	**Fairness/Mentorship** Treat everyone fairly and with respect. Be responsible for the professional development of research trainees

Definitions

Research Integrity: The use of honest and verifiable methods in proposing, performing, and evaluating research; reporting research results with particular attention to adherence to rules, regulations, and guidelines; and following commonly accepted professional codes or norms.

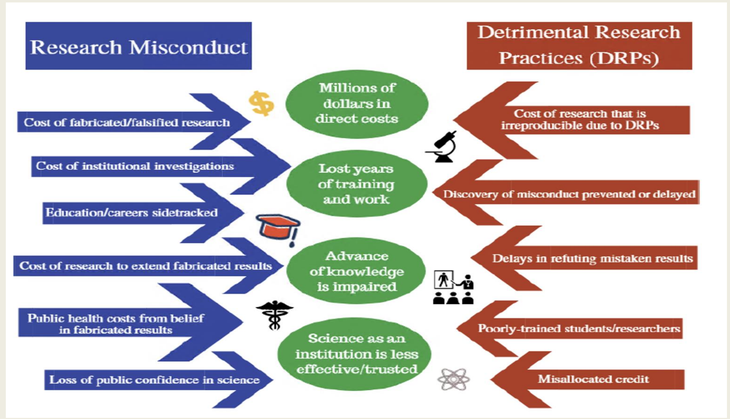
Detrimental Research Practices (DRPs): Actions that may threaten the integrity of research/researcher

- **misrepresentation of data**, e.g., suppression of relevant findings and/or data, or knowingly presenting a flawed interpretation of data
- **undisclosed duplication of publication**, including undisclosed duplicate submission of manuscripts for publication
- **misrepresentation of interests**, including failure to declare conflicts of interests either of the researcher or of the funders of the research
- **misrepresentation of qualifications and/or experience**, including claiming or implying qualifications or experience which are not held
- **misrepresentation of involvement**, such as inappropriate claims to authorship and/or attribution of work where there has been no significant contribution, or the denial of authorship where an author has made a significant contribution (NASEM, p. 69-70).
- **breach of duty care** (researcher negligence), **improper dealing of allegations** (institutional negligence) and **neglectful and exploitive mentoring** (mentoring malpractice)

Research Misconduct: Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.

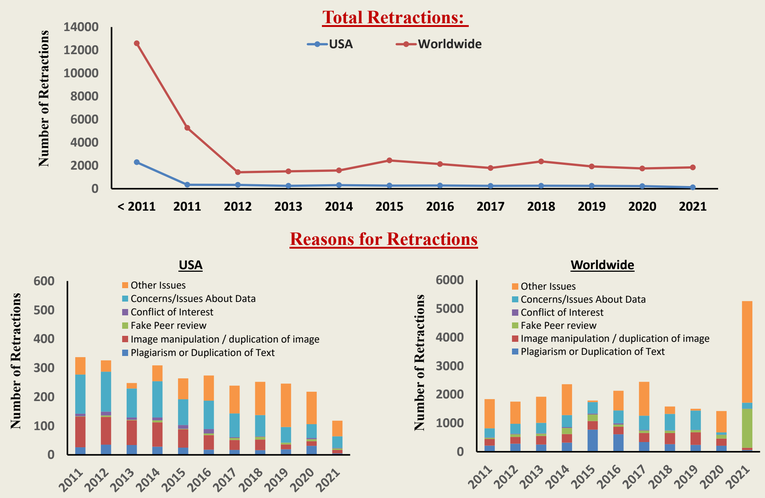
- **Fabrication** is making up data or results and recording or reporting them
- **Falsification** is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record
- **Plagiarism** is the appropriation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

Consequences of Research Misconduct and Detrimental Research Practices



Source: Fostering Integrity in Research - NASEM

Retraction Trends: Number of Retractions by Year of Publication



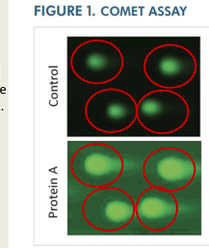
The **Retraction Watch** database (RW DB) is the source of data for the figures above. It contains more than 36,500 retracted papers, conference abstracts, and dissertations/theses from around the world (published from January 1940 to December 2021); 14% of these are based on research conducted in the US.

A review of 5,122 research articles published in the US between 2011 and 2021 and listed as retracted in the RW DB revealed that data concerns accounted for 40% of retractions, image manipulation/duplication - 24%, and plagiarism - 8%; for the 36,608 retracted articles worldwide for the same time period, data concerns accounted for 20%, image manipulation/duplication - 12%, and plagiarism - 8%.

Data source: RW DB

Examples of Image Manipulation

Fig. 1: The control image was cropped and relabeled as the image for Protein A. It was also intentionally lightened to make the "tails" appear longer.



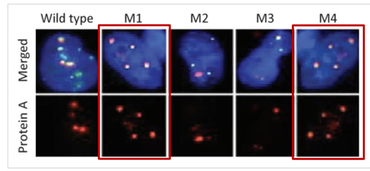
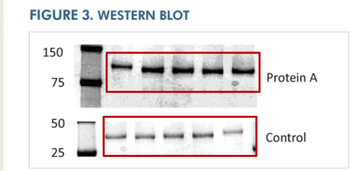


Fig. 2: M1 and M4 are the same image but Flipped vertically.

Fig. 3: The top panel and bottom panel of Figure 3 are from the same source image. The Protein A blot image has been flipped horizontally and represented as the control blot image.



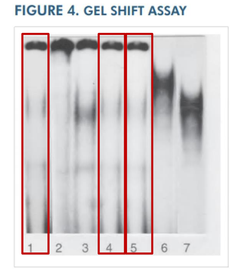


Fig. 4: Lanes 1, 4, and 5 are from the same image source and were relabeled and reused to represent different experimental conditions.

Source: ORI

RCR Education and Resources at Purdue

Purdue is committed to the highest standards of research integrity and implemented the **Responsible Conduct of research (RCR) Standard (S20)** in 2020. It **requires all researchers** (faculty, staff, trainees/post docs, graduate and undergraduate students) who design and conduct research and/or report and publish research outcomes to complete RCR training tailored to their career stage and research field/area and has two components:

- **General RCR training** offered through the CITI online program
- **Field-specific RCR training** includes formal and informal PI- and Peer- led research group discussions, RCR workshops at the departmental and college level, case studies and ethics courses that are specific to the research field/area.

Resources

- OEVPRP RCR website: https://www.purdue.edu/research/oevprp/regulatory-affairs/responsible-conduct.php
- Lab Expectations – Life Sciences template: https://www.purdue.edu/research/oevprp/regulatory-affairs/docs/Lab%20Expectations%20-%20Life%20Sciences%20Template_March2022.pdf

Conclusions

- **Research misconduct** and **DRPs** jeopardize research integrity and public trust in the research enterprise
- Researchers must strive for the **highest levels of ethics, honesty, and accuracy**
- The **biggest impact** on research integrity is achieved through sustained **improvements in day-to-day research practices** — better **record-keeping**, **vetting experimental designs, techniques to reduce bias, rewards for rigorous work, and incentives for sharing data, code and protocols** . *Nature* 570, 5 (2019)
- **RCR education** ensures that researchers have the knowledge, skills, and necessary resources to conduct science in a healthy, safe, ethical and secure research environment
- To ensure a **safe, ethical, secure and productive research environment,** each laboratory should maintain and periodically update a Lab Expectations document or online resource that outlines responsibilities of researchers for the specific research portfolio and lab rules for authorship, mentorship, and stewardship.