

Mentoring and Research Misconduct: An Analysis of ORI Closed Cases

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Literature on Mentoring: Observations

- **The current body of literature on mentoring originates in the 1980s**
- **The 80s was the decade when celebrated cases of research misconduct came to national attention**
- **The bolus in this literature appeared in the years after the U. S. research misconduct regulations (NSF and PHS) took effect, 1989-1991.**

Motive To Mentor: Misconduct as Threat to Science

“The level of trust that has characterized science and its relationship with [U.S.] society has contributed to a period of unparalleled scientific productivity. But this trust will endure only if the scientific community devotes itself to exemplifying and transmitting the values associated with ethical scientific conduct.” (*On Being a Scientist*, NAS, 1995, preface).

Motive to Mentor, continued

“It is therefore incumbent on all scientists and scientific institutions to create and nurture a research environment that promotes high ethical standards, contributes to ongoing professional development, and preserves public confidence in the scientific enterprise.” *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct*, NAS, 2002

Further Observations on the Literature . . .

The literature on mentoring:

- **very general**
- **often filled with platitudes**
- **not specific about what mentors and their institutions should do to assure that trainees conduct research rigorously and ethically**

Reasons the Mentoring Literature is not more focused on RCR

- **Multiple Roles of The Mentor: e.g., *Advisor, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering*, NAS, 1997**
 - **Faculty Advisor - curriculum planning; thesis topics**
 - **Skills Consultant - training in approach to research, design, methods**
 - **Career Advisor - help with job market forecasting, contacts, recommendations**
 - **Role Model - Researcher/Administrator/Teacher**

Even When Focused on Research, Mentoring is Highly Complex

- **Developing technical competence**
- **Developing critical thinking skills**
- **Encouraging Intellectual initiative**
- **Socializing advisees into the culture of their disciplines**

Complexity, contin.

- **Articulating and modeling the ethical norms of responsible and rigorous research including appropriate use of human and animal subjects**
- **Citing appropriately source material and prior publication**
- **Allocating authorship fairly in joint publications**
- **Submission and review of publications ethically**
- **Recognizing and avoiding conflicts of interest**
- **Generation, recording, and using data responsibly**

From, Margaret King, *On the Right Track: A Manual for Research Mentors*, [U. S.] Council of Graduate Schools, 2003 p. 11.

The background of the slide is dark blue with several overlapping, lighter blue circles of varying sizes scattered across it. The text is centered and written in a white, serif font.

**Another Important Reason
Mentoring Literature is Not More
Focused on RCR**

We don't know *why* Misconduct Occurs

Why Does Research Misconduct Occur?

Theories:

- **Pressure for professional survival**
- **Sociopathology: 1-2% of every profession**
- **Ignorance of standards and ethical codes**
- **Failure of mentoring/supervision of trainees**

Still Another Important Reason Mentoring Literature is not more focused on RCR:

We don't know *if* or *how* RCR mentoring works

- **“No established measures for assessing integrity in the research environment exist.”**
- **“There is a lack of evidence to definitively support any one way to approach the problem of promoting and evaluating research integrity.”**

From “Conclusions,” *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct*, NAS, 2002

Origins of This Study

**Research on Research Misconduct Needed;
High personal, institutional, social costs of
misconduct make:**

- **Prevention - the necessary long term goal**
- **Learning RCR from the beginning
imperative: graduate students and post-
doc's as best audience**
- **Mentor-Trainee relationship the natural
focus**

Origins of this Study: Trainees are Especially At Risk

While rates of Misconduct are generally thought to be low, significant numbers of graduate and professional students (10% up) have or are willing to engage in unethical conduct but little is known about the consequences of this behavior or the need/ways to change it.

**This and the Next Slide from Prof. Nick Steneck, U of M / ORI Consultant,
*Defining Research Integrity, 2000***

Researchers in training

Undergraduates (McCabe, 1997)

Non-code schools

96%

business

90%

engineering

83%

natural science

83%

social science

Code schools

76%

68%

57%

61%

Medical school (Baldwin, 1996)

40.5 % cheated in high school

16.5% cheated in college

4.7% cheated in medical school

39% witnessed cheating

66.5% heard reports of cheating

(academic honesty)

Trainees (Kalichman, 1992)

15% select, omit, or fabricate
data to get grant or publish
paper

Postdoctoral (Eastwood, 1996)

27% select or omit data to improve grant

15% select or omit data to improve publication

32% add undeserving author to aid publication

Origins of this Study

- **In the past 5 years, Michigan State University has revoked or not granted 6 PhD/Master's degrees due to Research Misconduct.**
- **Led to University Taskforce on Research Mentoring**
 - **Research Integrity (2004), MSU, Volume 7, No. 2**
– <http://grad.msu.edu/integrity.htm>

ORI Findings over 10 Years*:

<u>Respondent</u>	<u>Misconduct</u>	<u>No Misconduct</u>	<u>Total</u>
Faculty	43	82	125
Non Faculty	89	46	135
Total	132	128	260

Chi-Square= 25.8, p<.001

Odds Ratio 3.7

***1993-2002**

The Research Question

- **Did inadequate mentoring contribute to/fail to prevent misconduct?**

What Would Constitute Inadequate Mentoring?

- **Failure to review trainee raw data at regular intervals for reasons including:**
 - **Absentee mentor due to other academic pressures**
 - **Mentor trust of trainee**

What Would Constitute Inadequate Mentoring?

- **Failure to Establish Clear Standards, for:**
 - **Keeping lab books**
 - **Managing and retaining data**
 - **Authorship**

What Would Constitute Inadequate Mentoring?

- **Failure to adequately support trainee career development**
 - **Unsupportive work environment for trainees**
 - **Undue pressure to produce results quickly**
 - **Unreasonable expectations as to productivity**

Authors' observations from 16 collective years of reviewing cases

The Importance of the Problem:

- **Trainees are more likely to be found guilty of misconduct if charged (ORI data).**
- **The consequence of a finding of misconduct by a trainee is severe.**
- **Trainees from abroad, especially those for whom English is a second language, appear to be at increased risk.**

Authors' Observations, continued

- **Trainees are more likely to commit misconduct when mentors are absent or unobservant**
- **Misconduct is more likely to occur when the trainee reports feeling “pressure” or “stress”.**

Authors' Observations, continued

- **Misconduct is most likely to occur at “critical moments” in a trainee’s career:**
 - **When a deadline looms**
 - **When results of an important earlier experiment can’t be replicated**
 - **When the trainee is preparing to leave the lab for another position**

Testing These and Other Observations As Hypotheses in a Nation-Wide Sample

- **44 closed ORI cases (total available N=59)**
- **Respondent is a graduate student, research fellow, or post-doc**
- **Cases from September 1990 to October 2003**

Data Limitations

- **All these cases involve PHS funding for biomedical or behavioral research.**
- **The data all come from cases where trainee misconduct was alleged, representing a tiny fraction of mentor-trainee relationships.**
- **Because of the regulatory requirement for reporting to ORI only when an investigation begins, findings of “no-misconduct” by trainees at the Assessment or Inquiry stage are often not captured in these data.**

Data Limitations

- **Case files will not always describe the post-doc's mentor.**
- **We have to infer the relationship from comments made during the investigations, or by ORI staff's judgment when they provide oversight on the case.**
- **Self-reports of "stress" and "pressure" by Respondents are post-hoc and perhaps justifications.**

Demographics

Sample (N=44)

- **Level of Education**
 - **65.1% PhD (28)**
 - **16.3% MD (7)**
 - **7% MD/PhD (3)**
 - **9.3% MS (4)**
 - **2.3% BS (1)**
- **Status When Allegation Filed**
 - **70.5% Post-docs (31)**
 - **6.8% Graduate Students (4)**
 - **13.6% Research Fellow (6)**
 - **9.1% Other Trainees (4)**

• **Misconduct Finding**

- **25% No Misconduct (11)**
- **75% Misconduct (33)**

Demographics

- **Average Time in Labs**
 - **PostDocs = 2.9 yrs.**
 - **Graduate Students: Mean = 3.5 yrs.**
- **Frequency of Misconduct**
 - **20.5% Fabrication (9)**
 - **43.2% Falsification (19)**
 - **29.5% Fabrication/Falsification (13)**
 - **2.3% Fabrication/Plagiarism (1)**
 - **4.5% Falsification/Plagiarism (2)**

Where were they trained?

United States	18	46.2%
Europe	3	7.7%
Asia	14	35.9%
Africa	1	2.6%
Other	3	7.7%
Unknown	5	11.4%
Total Foreign	12	53.9%

When is misconduct discovered?

Fail to reproduce results	35.7%
Data missing	9.5%
Fail to reproduce results and data missing	7.1%
Witnessed or became suspicious	35.7%
Not applicable	4.8%
Can't tell	7.1%

Examples of How discovered:

- “[Mentor] developed some concerns regarding the research data on [XXX] when his own experiments failed to show that the gene involved protected bacteria from exposure to [XXX], and when he critically reviewed results.”
- “[Respondent] stated that [Mentor] had confronted her in 1997 at [XXX] meeting, telling her they could not reproduce her data and asked whether she had withheld “vital information.”

A significant number of cases involve some sort of pressure on the trainee. (46%)

Types of Pressure

Grant, dissertation, or publication deadline	7.1%
New Job Waiting	4.8%
Internal Pressure	38.1%
Not Applicable (No pressure)	45.2%

Internal Pressure:

- **“The Respondent stated that he was a perfectionist to a fault and when he failed to obtain results that he expected, he altered the data to correspond with what he expected the results to be. . . . He felt pressure to achieve perfection in the lab environment. He commented that the pressure was primarily internal, although he felt some external pressure to perform because [mentor’s] lab was so well respected by other researchers.” “The Respondent stated that perhaps he was trying to find a way not to pursue research science. He felt that it was an intensely competitive and high-pressured field,” but he had done well and felt obligated to continue.**

Rush to leave the lab for another position:

- **Inquiry Transcript: “I just wanted out. I wanted to go. And finally, when I realized that I wasn’t going to get this to work, I, you know, made the wrong decision. I just said it worked and here’s what happened and everything. Hoping just to leave there and never do anything about this again, you know.”**
- **“Thus, it was in a desperate attempt to finish my project and leave the lab altogether that I made the greatest mistake in judgment of my career. . . I polished the trends of the last several experiments (that did appear to be present), thus biasing the data. To make matters worse, I misplaced the folder that had the raw data sheets for these experiments as well as several others (that were submitted as a separate abstract for an upcoming conference.)” Respondent letter to Associate Dean**

Indications of mentor shortcomings?

Did mentor fail to review raw data, lab books, etc.?

Yes	52.3%
No	31.8%
Can't Tell	15.9%

Did mentor rely on others to delegate responsibility to trainees or trainees to oversee their own research?

Yes	32.5%
No	45%
Can't Tell	22.5%

Mentors not reviewing raw data regularly:

- **“After R left the laboratory, M grew increasingly concerned because many reagents appeared to be missing, and a great deal of data that should have been in R’s notebooks was missing.”**
- **After a graduate student told him she couldn’t replicate R’s results, “M began examining the lab notebook in detail; he discovered numerous discrepancies between the raw scintillation counts and the counts on the corresponding spreadsheet. He also noted that there was no evidence in the notebook that a crucial part of the experiment . . . had ever been done.”**

- **PI was apparently unaware that the Respondent did not “routinely maintain laboratory notebooks of experimental procedures”**
- **“ . . . there appeared to have been a lack of oversight as evidenced from the selection of raw tracings appropriated for publication. [ORI] noted that the coauthors had the opportunity to review a total of six versions of the questioned manuscript; at no time did any one of them observe errors or mistakes in the raw tracings, even though some had far greater experience with the XX technique [than the R].”**

Summary: What have we learned about mentoring and misconduct?

- **Poor mentoring - 52%**
 - **During critical moments (pressures) in academic career**
 - **No regular review of trainee data by mentor**
- **High frequency of foreign trained - 54%**
 - **Cultural differences in expectations and pressures on young researchers?**
 - **Communication difficulties**

Evidence of Poor Mentor Supervision of Trainees

Investigative Committee Chair : “Several other feature compounded R’s situation. She felt very stressed, under a great deal of pressure to produce results rapidly. She often felt that her job was to find results that matched [Mentor’s] expectations.”

Comments of a Respondent Convicted of Fabricating Data about Unreasonable Demands

- **Respondent Testimony: “ The pressures put on me to complete the case report forms were constant and overwhelming. This protocol’s responsibilities were too numerous for one person. After I finished the lab two residents started the protocol and both of them quit. They told me that it was impossible to complete the entire protocol. I was subject to pressures that pushed me beyond my capabilities as a student.”**

**In Many Cases of Trainee
Misconduct, There Were Poor Data
Management Practices in Lab.**

**Investigative Committee Report: mentor
“should be informed to take corrective
actions to improve the interpersonal
relationships, communication and
oversight of research which existed in
the mentor’s lab.” Record keeping is
especially poor.**

Poor Data Management Practices

- **“M failed to establish proper practices for data management.”**
- **“ . . . it is also of significance that M did not begin the examination of the original data until after his return from the Neuroscience meeting [at which the data were presented in a poster] in spite of the fact that he had been warned on at least two occasions about potential problems with the quality of R’s data.”**

Are Important Experiments Replicated Before Publication?

- **In a number of cases we reviewed mentors appeared to publish trainee data without replicating key experiments:**
- **Example:**
 - **The Mentor had to withdraw the publication when, during the investigation, it became clear that the experiment had not been replicated and the original data could not be found.**

Additional Issues and Observations

- **Who is responsible for mentoring?**
 - **The dissertation director/lab director**
 - **Teaching Research Methods**
 - **Selecting Research Topics**
 - **Modeling Rigorous Research Procedures**
 - **Establishing Research Group Standards for Recording, Storing and Presenting data**
 - **Guidance on Preparing Grant Applicants and Manuscripts**

Observations, continued

- **Who is Responsible for Mentoring?**
 - **The Institution:**
 - **RCR Programming and Resources**
 - **Policies on**
 - **Research Data Management and Presentation**
 - **Authorship**
 - **Mentoring**

Mentoring More Challenging Today

- **Large, Interdisciplinary Research Groups**
 - **The mentor may not know all the areas of science and have to rely on others to teach and supervise trainees**
 - **The mentor may have to “farm out” to others part of the research which s/he cannot personally oversee**

Mentoring More Challenging

Technology-Driven Changes

- **The move to computer-stored research data and smart laboratory instruments may have lessened the emphasis on individual trainee responsibility for keeping lab notebooks and other rigorous records**
- **Computer-stored research data is comparatively easy to fabricate and to falsify**
- **Computer-generated summary data and analyses often substituted for review instead of raw data in discussions between mentor and trainee**

Mentoring More Challenging

- **Technology-Driven Changes, continued**
 - **Whereas once trainees had to show mentor raw data in the form of films to get authorization to take them to photography department for printing for reports, mss and grant applications; now trainees can do the same thing on desktop computers with programs like Photoshop. (John Krueger, ORI Investigating Scientist)**
 - **It is comparatively easy to fabricate and falsify images using these programs.**

Implications for Faculty and Institutions

- **Standard Procedures for review of trainee raw data at regular intervals and,**
- **Standard Procedures for replication of key trainee experiments before submitting data, and,**
- **Attentive supervision during periods of trainee stress . . .**

Might have prevented many instances of misconduct

Why Does Research Misconduct Occur?

Theories:

- **Pressure for professional survival**
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