**FROM: RESPONSIBLE CONDUCT OF RESEARCH. Adil E. Shamoo and David B. Resnik**

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**CHAPTER 4**

**Mentoring**

Effective mentoring can play a key role in preventing misconduct and promoting research

integrity. This chapter explores various issues related to mentoring, including

such moral dimensions as proper training, setting an example, trust, accountability,

and collegiality. The chapter also addresses policies designed to promote effective

mentoring.

As we noted in chapter 2, effective mentoring can play a key role in

preventing misconduct and promoting research integrity. Mentoring

is important in helping students learn how to deal with most of the ethical

issues and concerns discussed in the book, ranging from data management

and authorship to publication and social responsibility. Mentors can

teach students about research norms and practices and can provide students

with examples of how to behave ethically in research. Mentors can

model different scientific virtues, such as honesty, openness, objectivity,

fairness, integrity, flexibility, conscientiousness, resourcefulness, and

social responsibility (Macrina 2013; National Academy of Sciences 1992;

Resnik 2012a; Swazey and Bird 1997; Weil and Arzbaecher 1997).

Mentoring traces its history back to ancient Greece. The word “mentor”

comes from the name of a man who was the adviser to King Odysseus

and the teacher to Telemachus in Homer’s Odyssey. Mentor provided education

and moral guidance to his students. Following this model, a

mentor was an older male teacher who had a close relationship with an

adolescent young man. Socrates, the father of philosophy, mentored

Plato and many other students in Athens. Plato created his own school

and mentored many students, including Aristotle, who made important contributions to physics, biology, philosophy, logic, politics, and literary

theory.

Today, mentoring is a very important component of the research

enterprise. In academic institutions, mentors not only transmit knowledge

and skills to students but also teach attitudes, traditions, values,

and other things that cannot be learned in formal courses. Mentors

serve as role models and teach their students by example.

Most people have different mentors at different times for different reasons.

A mentor could be a family member, a pastor, a coach, a friend, a

teacher, a business leader, a policeman, or anyone a student knows and

admires. In science, a mentor is usually a senior researcher who supervises

a number of different graduate students. Usually students’ graduate advisers

or thesis advisers are also their mentors, but many research students

obtain mentoring from senior researchers who have no formal advising

responsibilities (Weil and Arzbaecher 1997). Many students

consider more than one person to be their mentor, but, unfortunately,

some students have no one whom they would consider a mentor. Researchers

who can benefit from mentoring include undergraduate, graduate, and

postdoctoral students; technicians; and junior-level professors (National

Academy of Sciences 1992, 1997; National Institutes of Health 2002).

Mentors in science interact with their students in many ways. Some of

the most important activities include the following:

1. Teaching students how to do research: Mentors help students learn the

techniques, methods, and traditions of research. They show students

how to design and conduct experiments; formulate research questions

and hypotheses; collect, record, analyze, and interpret data; and write

up results. They help students understand important work in their discipline,

ongoing controversies, and areas of research that need further

study (Macrina 2013).

2. Critiquing and supporting students’ research and teaching: Mentors

read students’ lab notebooks, research protocols, and manuscripts, and

they scrutinize students’ research designs and data analyses. They may

attend classes that the students teach, read students’ evaluations of

teaching, and provide feedback on teaching style and technique. Although

it is very important for mentors to criticize students, they also

need to offer support and encouragement, and they need to carefully

tread the line between constructive and destructive criticism. Mentors

need to guard against discrimination, favoritism, and excessively high

(or low) expectations when critiquing students (Macrina 2013).

3. Promoting their students’ careers: Mentors help students form professional

contacts, look for jobs, and submit job applications; they write letters of recommendation; help students prepare for job interviews;

and provide career advice (Macrina 2013).

4. Helping students understand the ethical, legal, social, and financial aspects

of research: Mentors teach their students about research rules

and regulations, such as animal care and use regulations, human experimentation

regulations, and laboratory, biological, and radiation

safety rules and regulations. They also help students understand the

social structure of the research environment, including relationships

with colleagues, students, administrators, funding agencies, and the

public. They help students understand the funding of research, including

how to write grant applications and obtain scholarships and

fellowships.

5. Involvement in students’ personal lives: Although mentors should

maintain professional distance from their students, they should not

ignore their students’ personal lives. For example, if mentors are aware

of psychological, personal, medical, or legal problems that are affecting

their students’ work, they should help their students find the proper

resources or help. Mentors can listen to their students’ problems and

support them in difficult circumstances. Even though it is important

for mentors to be aware of their students’ personal lives, judgment and

discretion should be used so that the relationships remain professional

and do not become too personal. Mentors should avoid becoming too

involved in their students’ personal lives so that they can maintain a

measure of objectivity and fairness.

This list shows that mentors perform many important duties for their students.

Mentors are more than mere teachers: They are also advisers, counselors,

and often friends. Because students usually also work for mentors

as teaching or research assistants, mentors also serve as employers and

supervisors. These different roles may sometimes conflict. For instance,

mentors may give students so much work to do that they do not have adequate

time for their own research. In these cases, a mentor’s role of employer/

supervisor conflicts with the role of teacher. Or a mentor may believe

that it is in the student’s best interests to transfer to a different

university to work with someone who has more expertise in that student’s

chosen area of research but yet may hesitate to convey this advice to the

student if the mentor needs him as a research or teaching assistant.

Steiner et al. (2004) surveyed 139 primary care fellows of the National

Research Service Award from 1988 through 1997 regarding their subsequent

career development and research productivity. The fellows indicated

whether during the fellowship they had no sustained and influential mentorship, influential but not sustained mentorship, or influential and

sustained mentorship. Steiner et al. found that those with sustained and

influential mentorship were more engaged in research, were publishing

more often, were more likely to be the principal investigator on a grant,

and were more likely to provide good mentorship to others.

Because the mentoring relationship depends on mutual respect and

trust, students and mentors have ethical duties toward one another. Students

should listen to and appreciate the guidance and advice from the

mentors, ask for help when they need it, and work diligently on their research

projects. Mentors should provide guidance, advice, and other forms

of help to their students; protect their students from harm and exploitation;

and treat their students fairly. Both parties should communicate

honestly, maintain confidentiality concerning private matters, and respect

each other’s choices and values.

To better understand the ethical dimensions of the mentor–student relationship,

it is important to realize that mentors have more power, experience,

knowledge, and expertise than their students and that students

depend on their mentors for education, training, advice, and often employment

(Macrina 2013; Weil and Arzbaecher 1997). Given their minimal

power, experience, knowledge, and expertise and the high degree of

dependency, students are highly vulnerable. It is very easy for mentors to

manipulate, control, or exploit their students, because students often may

be unable to prevent or avoid such abuses of power. Thus, the mentor–student

relationship resembles other professional relationships where one

party is highly vulnerable, such as the doctor–patient relationship and the

lawyer–client relationship. These relationships are sometimes called fiduciary

relationships because the powerful party is entrusted with protecting

the interests of the vulnerable party. This is different from a contractual

relationship in which both parties need only look out for their own

interests (Bayles 1988).

Unfortunately, various forms of exploitation are fairly common in

mentoring. Mentors sometimes do not protect their students from harm

or treat them fairly. For instance, mentors often do not give students

proper credit for their work. They may fail to give students acknowledgments

in papers or include them as coauthors (Banoub-Baddour and Gien

1991). They may fail to list students as first authors when students make

the most important contribution to the research. In some of the more

egregious cases, mentors have stolen ideas from their students without

giving them any credit at all (Dreyfuss 2000; Marshall 1999a, 2000). One

well-known case of this type of exploitation involved the famous scientist

Robert Millikan (discussed in chapter 3) and his student Harvey Fletcher.

Millikan began his experiment by trying to measure the electric charge on

water droplets. When the experiment was not working well, Fletcher suggested

that Millikan use oil droplets instead. Millikan took this advice but

did not acknowledge Fletcher’s contribution in his paper describing these

experiments (Holton 1978). A more recent case involved Carolyn Phinney

and her former mentor, Marion Perlmutter, a University of Michigan professor.

Phinney had developed an instrument to measure psychological

effects when she worked as a research assistant for Perlmutter. Perlmutter

incorporated Phinney’s work into a grant application and began claiming

the instrument as her own. She also refused to return Phinney’s laboratory

notebooks. In 1997, Phinney won a $1.67 million lawsuit against

Perlmutter and the University of Michigan (Grossman 1997).

Mentors may also overwork their students by assigning them too many

experiments to run, too many papers to grade, too many undergraduate

students to tutor, and so on. If students are assigned too much work, they

will not have enough time for their own education and research. In recent

years, graduate students have formed unions to deal with poor working

conditions. Postdoctoral students often face especially demanding and

exploitative working conditions. They are usually nontenured researchers

who are paid through “soft money,” that is, money from research grants.

Postdoctoral students are paid much less than regular faculty members

even though they have doctoral degrees and often do just as much research

or teaching. They also do not receive the usual benefits package

(e.g., health insurance), and they have little job security (Barinaga 2000).

Although some postdoctoral students enjoy their work, others feel mistreated

or exploited. Given their vulnerability, it is very hard for these

students to complain about working conditions or about their mentors,

because they face the real threat of retaliation. For example, a mentor

could refuse to work with the student any longer, recommend that the student

be expelled from the program, or encourage his colleagues not to

work with the student.

Other examples of ways in which mentors may mistreat their students

include the following:

• Giving students misinformation or poor advice

• Intimidating or harassing students

• Discriminating against students

• Showing favoritism to one or more students

• Failing to help students advance their careers

• Not recognizing when students are having psychological troubles that

require counseling

Given the importance of the mentor–student relationship for scientific research,

and the kinds of problems that routinely arise, many universities

and professional organizations have developed programs and policies aimed

at improving mentoring (National Academy of Sciences 1997; National Institutes

of Health 2002). Some of these policies include the following:

1. **Train researchers how to be good mentors** (Pfund et al 2006).

2. **Reward researchers for effective mentoring**: Most universities do not

emphasize or even consider mentoring skills when they review faculty

for hiring and promotion, but this needs to change if we want to improve

mentoring (Djerassi 1999).

3. **Provide mentors with enough time for mentoring**: Professors who do

not have adequate time for mentoring will do a poor job of mentoring.

Professors who have heavy mentoring responsibilities should be released

from other administrative or teaching obligations.

4. **Develop clear rules concerning workloads, teaching duties, research**

**opportunities, authorship, time commitments, and intellectual property**:

Many of the problems that occur in mentoring are due to poor

communication. Communication can be improved by clearly defining

expectations and obligations (Macrina 2013).

5. **Establish procedures and channels for evaluating mentoring** and for

allowing students and mentors to voice their grievances.

6. **Ensure that students who “blow the whistle” on mentors are protected**:

A whistleblower is someone who reports unethical or illegal conduct.

Whistleblowers often face retaliation. To avoid this, whistleblowers

must be protected. (See the discussion of whistleblowing in chapter 2.)

7. **Promote a psychologically safe work environment**: Students and mentors

both need to have an environment that is free from sexual, religious,

ethnic, and other forms of harassment (National Academy of

Sciences 1992). Sexual harassment is unethical and can also be illegal.

Although most researchers agree on the need to protect students and

others from sexual harassment, there are disputes about the definition

of sexual harassment as well as the proper response to sexual harassment

(Swisher 1995). For further discussion, see Resnik (1998b).

8. **Promote a nondiscriminatory work environment**: Racial, ethnic,

sexual, religious, and other types of discrimination are also unethical

and often illegal. Women have for many years labored under the yoke

of sex discrimination in science. Although women have made significant

gains in some sciences, such as anthropology, biology, and medicine,

women are still vastly underrepresented in engineering and physical

science. Racial and ethnic discrimination continue to be a problem in science as more minorities enter the workplace (Johnson 1993; Manning

1998). Although African Americans have historically been the

most frequent victims of discrimination, Asian Americans also experience

discrimination (Lawler 2000). Scientists should be judged by the

quality of their research, education, and character, not by the color of

their skin, their national origin, their religious views, or their gender.

Effective mentoring cannot take place when discrimination affects the

laboratory (for further discussion, see Resnik 1998b).

9. **Promote a diverse workforce**: Because mentors serve as role models as

well as advisers and friends, one could argue that it is important to promote

diversity in science in order to enhance mentoring and education.

Science students have different gender, racial, ethnic, and religious

characteristics. The scientific workforce should reflect this diversity so

that students can benefit from having role models with whom they can

identify (Holden 2000; Mervis 1999). An excellent way to promote the

effective mentoring of women in science is to hire and promote more

women scientists (Etkowitz et al. 1994), which will also encourage

more women to study science. This same “diversity” argument also applies

to racial and ethnic diversity, which raises the question of affirmative

action in science: Should hiring and promotion of scientists be

decided based on a person’s racial or ethnic features? This is a complex

legal, moral, and political question that we do not explore in depth

here. We favor a weak form of affirmative action that increases the diversity

of the workforce without compromising quality. Racial, ethnic,

and gender considerations should be treated as one factor among many

that can enhance diversity. Other factors might include geography, socioeconomic

status, and life experiences. Affirmative action should not

be used to promote incompetence or tokenism (Resnik 2005).

**QUESTIONS FOR DISCUSSION**

1. What do mentors do for students?

2. What are the qualities of a good mentor? A good student?

3. Can you describe how you are being mentored? Do you think you are

being treated well? Would you like your mentor to treat you differently?

4. What types of problems can arise when the same person is a supervisor

and a mentor?

5. Is the mentor–student relationship like a physician–patient

relationship?

6. How can universities encourage good mentoring?

**CASES FOR DISCUSSION**

**CASE 1**

A postdoctoral fellow got into a severe conflict with her mentor. Her mentor provided

her salary from his grant resources, and she was working on one of his primary projects.

She found another job and took all three laboratory notebooks with her when

she left. The mentor was very angry when he found out. He asked her to return the

lab notebooks immediately or she would be accused of theft. He claimed the lab notebooks

belonged to him and to the university, but he invited her to copy the books for

her use. She returned the notebooks after making copies. Two years later, the mentor

learned that she had published a paper without mentioning his name anywhere, but

his grant was acknowledged.

• What should the mentor do?

**CASE 2**

A graduate student worked for a year with an adviser on replicating a new small protein.

He spent part of the year developing the methodology before conducting the

replications. However, the graduate student did not like his adviser and moved to a

different adviser within the same department, who happened to be the director of

the graduate program in that department. The student’s new research program was

in a different area from the previous work. A year later, the student learned that a

subsequent student of his former mentor had used his method for replicating the

protein in subsequent research and that they were writing a paper without listing

him as a coauthor. He protested but was told that the new graduate student had to do

the whole thing all over again and that they were not using his data. The student

argued that the new technique used to collect the data was a novel technique developed

by him and not available in the open literature. The student’s former adviser,

after meeting with everyone including the director, reluctantly agreed to publish at

a later date a small technical paper on the technique, naming the student as a coauthor.

The first paper will still appear, much sooner, and without his name. The student

agreed, under protest, but he knew his life would be difficult if he insisted on a

different outcome.

• Should the student have been listed as an author on the paper?

• What would you have done under these circumstances?

• Should the first adviser have done what he did?

• What should the new student have done, and what should he do now?

**CASE 3**

Dr. Trotter is a molecular geneticist who applies Darwin’s principle “survival of the

fittest” to his laboratory environment. Each year, he hires two new postdoctoral students

for one year. He assigns them both to work on the same experiment. Whoever

finishes the work first, with reproducible results, will get to be an author on a paper;

the loser will not. He runs several such contests during the year. At the end of the

year, the postdoctoral student who has the best results will be hired for a three-year

position, and the loser will be terminated.

• What do you think about Dr. Trotter’s policy?

• Is it ethical?

**CASE 4**

Sarah Parker is a doctoral student in entomology. Her mentor, Dr. Russell, is one of

the world’s experts on fire ants. He is very busy, as he supervises five students and

often gives invited lectures. He also provides advice for agricultural groups on controlling

fire ants. He rarely meets with Ms. Parker in person and provides most of his

comments on her thesis by email. He encourages students to work independently so

they will learn how to deal with problems on their own. Ms. Parker’s thesis defense is

next week. One of the members of the committee says that he cannot approve her

thesis because she does not have enough data pertaining to one of her studies of fireant

mating. Ms. Parker is very upset when she learns about this, because Dr. Russell

had assured her that she was ready to defend. It will take her several months to collect

the additional data, which will put her career plans on hold.

• Do you see any problems with Dr. Russell’s mentoring approach?

• How could this problem have been prevented?

• Should Ms. Parker have requested that Dr. Russell provide her with more help?

How should she have gone about this?

**CASE 5**

Dr. Feldman is a professor of history at Page University. He specializes in the U.S.

Civil War. Brad Cooper was a graduate student who had been working with Dr. Feldman

for three years. He completed his master’s degree with Dr. Cooper. He was planning

to write a doctoral thesis, under Dr. Parker’s direction, on surgical techniques

developed in the Civil War, but then he decided he would like to go to medical school.

Dr. Feldman was disappointed that Mr. Cooper made this decision, because he felt

that Mr. Cooper had some promise as a historian. Mr. Cooper had extensive discussions

with Dr. Feldman about a potential doctoral thesis on surgical antiseptic techniques.

Unbeknownst to Mr. Cooper, Dr. Feldman began working on the ideas that

they had discussed, and she did extensive historical research on surgical antiseptic

techniques used in the Civil War. Mr. Cooper received a magazine in the mail from

Page University that featured Dr. Feldman’s research and mentioned an article she

had recently published on surgical antiseptic techniques used in the Civil War. He

looks up the article and finds that he is not mentioned in the acknowledgments. Mr.

Cooper is very upset about this because he thinks he should have received some

credit for his ideas.

• Did Dr. Feldman do anything wrong?

• Did she commit plagiarism? What additional information would you need to

make this determination?

• What can Mr. Cooper do at this point?

• Would it be difficult to prove a plagiarism case against Dr. Feldman?

• How could this unfortunate turn of events have been avoided?

**CASE 6**

Ms. Holloway was a psychology graduate student working under the direction of Dr.

Truman at a large research university. During her second year in the program, Ms.

Holloway suffered from a bout of severe depression and withdrew from the university

for a semester. After resuming her studies, Ms. Holloway was doing well and

seemed to be making good progress on her thesis. However, Ms. Holloway’s work

degraded during her second semester back at the university. She missed several

meetings of the research group and was late for some of her teaching sessions with

the Introduction to Psychology students. Other students noticed that she kept to

herself and seemed distant and emotionally detached. Dr. Truman sent Ms. Holloway

an email warning her that her performance was not acceptable and that she

needed to make a better effort on her research and teaching or she could lose her

position. The next day, Ms. Holloway committed suicide.

• Did Dr. Truman act unethically?

• Was he a bad mentor?

• What could he have done to help prevent Ms. Holloway’s suicide?

• Did he have a responsibility to be aware of her personal problems?

**CASE 7**

Dr. Fitzgerald is a professor of geology at a large public university. He supervises

three graduate students: Tom Turpin, Wendy Price, and Melissa Macintyre. Dr.

Fitzgerald has known Mr. Turpin since he was a young boy because Mr. Turpin’s

father is a friend and colleague at the university. Dr. Fitzgerald took an instant liking

to Mr. Turpin and they have gone on several fishing trips with Mr. Turpin’s father in

the last year. Ms. Price and Ms. Macintyre have begun to resent this relationship and

they feel that Dr. Fitzgerald is showing favoritism to Mr. Turpin. They have noticed

that Dr. Fitzgerald is eager to introduce Mr. Turpin to colleagues at professional

meetings. They also believe that Dr. Fitzgerald has assigned Mr. Turpin research projects

that are more exciting and fulfilling than the projects they have been asked to

work on. Dr. Fitzgerald also recommended Mr. Turpin for a graduate student award

but did not recommend them.

• Is Dr. Fitzgerald showing favoritism to Mr. Turpin?

• Is Dr. Fitzgerald acting unethically?

• What can Ms. Price and Ms. Macintyre do about this situation?

• How could these problems have been avoided?

**CASE 8**

Mr. Goldman is a toxicology graduate student in Dr. Miller’s laboratory. He is conducting

experiments that involve exposing cells to a nanomaterial thought to be

toxic because it has chemical and physical properties similar to asbestos. Mr. Goldman

weighs the material in powder form and mixes it with a solution. When the

material is in a powder form, it may become airborne and could be breathed in. For

his protection, Mr. Goldman wears a mask and gloves and uses a negative pressure

hood to prepare the solution. However, Mr. Goldman has done some reading about

safety procedures related to the preparation of this material, and most laboratories

use a glove box for preparation, as this greatly reduces the risk of inhalation. Mr.

Goldman asks Dr. Miller if he can obtain a glove box to use in preparing the material.

Dr. Miller responds that this is unnecessary and that he will be adequately protected

if he follows the procedures they are using. He also says that he does not have enough

money in his grant to pay for a glove box.

• Is Dr. Miller acting unethically?

• What should Mr. Goldman do about this situation?