

Women and Science

11:776:296 (3 credits)
SEBS General Honors Program
Fall Semester (odd years)

CONTACT INFORMATION

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COURSE DESCRIPTION

In the English language, the word “science” is derived from the Latin word *scientia*, meaning knowledge. Scientific knowledge is considered to be a body of reliable knowledge that can be logically explained, bolstered by experimental data, and is testable using hypotheses about the behavior of the natural world. Science has roots in agricultural, metallurgical and other technologies that go back for millennia, but the modern concept of science developed in Europe in the 17th century. Often the natural sciences are divided into biology, chemistry, geology and physics. Social sciences are traditionally divided into anthropology, economics, psychology and sociology. Mathematics is usually put into a category of its own. When the scientific fields are classified into applied areas, major categories are agriculture, engineering and medicine. In an important perspective by Karl R. Popper (1902-1994), *The Logic of Scientific Discovery*, science is viewed not as a “body of knowledge,” but rather as a system of hypotheses, or as a system of guesses with which we work as long as they stand up to tests, and of which we are never justified in saying that they are “true,” i.e. scientific hypotheses cannot be proven, only falsified.

In the 21st century, with the exception of some of the social sciences, scientific disciplines are populated largely by male practitioners. This course will examine some of the unique characteristics of the sciences and mathematics, and the reasons that men have continued to dominate the scientific, engineering, and medical professions despite women’s access to education in the 21st century. The course will also address some of the epistemological analyses that have been put forth to understand the reasons that women are so underrepresented.

There have always been women in science, engineering, medicine, and mathematics, just not very many of them. The course introduces individual women who were exceptions in their time such as Dorothy Crowfoot Hodgkin (x ray crystallographer, Nobel prize winner in Chemistry), Barbara McClintock (cytogeneticist, discoverer of mobile genetic elements, Nobel Prize in Medicine or Physiology), Lise Meitner (physicist and discoverer of nuclear fission), Rosalind Franklin, (X ray crystallographer), and Jocelyn Bell Burnell (astrophysicist and co-discoverer of pulsars) (the 1974 Nobel Prize in physics went to her mentor, Anthony Hewish, for the discovery of pulsars).

Nowadays, there is a disparity in the representation of men and women in science, engineering, mathematics and medicine. The under representation of women is not uniform cross all disciplines, nor it is consistent for all stages in the career path or for women of different racial and ethnic groups. For example, women are near parity in educational achievement at the undergraduate and graduate levels in the life science, but make up fewer than 25 percent of the

bachelor's and doctoral degree recipients in engineering and computer science. We will examine the context and unique cultures of the difference science, including a discussion of the practical challenges women face in these disciplines.

Finally, we will cover the work of feminist philosophers such as Sandra Harding and Ruth Hubbard on gendered and "embodied" epistemology, and use the critiques of modern scientific thinking and methods including the work of Evelyn Fox Keller, Mary Hawkesworth, Sue Rosser, and Banu Subramaiam (among others) to examine concepts of nature and objectivity, including examples of research in physics, biology, and psychology.

COURSE WEBSITE, RESOURCES AND MATERIALS

- Course website: Canvas
- Readings, other supplemental materials, and links to on-line resources (including illustrative materials from popular media) are posted to Canvas or placed on reserve at Chang Library.

PREREQUISITE

None.

COURSE LEARNING GOALS

By the end of this course, the student will be able to:

1. Apply basic principles and concepts in the natural sciences, including relationships among assumptions, method, evidence, argument, and theory in scientific analysis, and the role of data in establishing "fact"
2. Identify and critically assess gender issues in science, while analyzing how forms of human difference, specifically those related to being a woman, shape personal experiences and perspective on the scientific enterprise
3. Communicate an understanding of how science, technology, and gender impact contemporary social issues

ASSIGNMENTS/RESPONSIBILITIES AND ASSESSMENT

Assignments: Readings in assigned texts and handouts, papers, student-led case studies, and group projects.

Grading:

Class attendance and participation	20%
Group-based special project	20%
Two-page treatments of contemporary topics (2)	10%
Final paper	25%
Comprehensive final exam	25%

Scale: 90-100 = A; 80-89 = B; 70-79 = C; 60-69 = D

Learning goals assessment: Specific questions on the final exam are used to assess student knowledge of all learning goals. Student ability to communicate and place course material in context (course learning goals 2 and 3) are assessed in student-led class discussions, written assignments, and the group project. The percentage score on

these assessments will determine the level of mastery: >90% outstanding; 80-89% good; 70-70% satisfactory; <69% unsatisfactory.

PARTICIPATION GRADE AND ABSENCE POLICY

Attendance is mandatory. Students unable to attend may contact the instructor via e-mail prior to the missed class or may use the University absence reporting website (<https://sims.rutgers.edu/ssra/>) to indicate the date and reason for the absence. An e-mail is automatically sent to the instructor.

COURSE SCHEDULE

Lecture	Topic
Introduction	
1	Introduction, course syllabus
Philosophy of Science	
2	What is science?
3	Experiments and the scientific method
4	Logic and empiricism
5	Induction and confirmation
6	Popper: Conjecture and refutation
7	Objectivity, bias, and the evolution of the double blind experiment
8	What is a "fact"? Are there alternative facts?
Women in Science: Case Studies	
9	Overview of the status of women in science
10	Science before modern times
11	Case studies: Early women in medicine and nursing (Elisabeth Blackwell, Florence Nightingale, Sophia Jex-Blake)
12	Case studies: Women in chemistry (Marie Cure, Dorothy Crowford)
13	Case studies: Women in the physical sciences (Lise Meitner, Maria Mayer, Jocelyn Bell Burnell)
14	Case studies: Women in biological sciences (Barbara McClintock)
15	Case studies: Women in ecology and agriculture (Rachel Carson, Mary-Dell Chilton)
16	Why is Rosalind Franklin a feminist icon?
17	Case studies: Women in the social sciences
18	Case studies: student led discussion
19	Case studies: student led discussion
The theory of science vs. the practice of science. Feminist Epistemology	
20	Reflections on gender and the sciences
21	Reflections on gender and sciences (continued)
22	What to do? I am a woman and I want to be a scientist
Thanksgiving recess	
23	Presentation of student projects
24	Presentation of student projects
25	Presentation of student projects
26	Review
Final exam (comprehensive): date to be determined	

FINAL EXAM/PAPER DATE AND TIME

The Online Final exam Schedule: <http://finalexams.rutgers.edu/>

READINGS

- Deboleena, R. (2004). Asking Different Questions: Feminist Practices for the Natural Sciences, in *Women Science and Technology*.
- Genova, J. (1989). Women and the Mismeasure of Thought. In Tuana (Ed.) *Feminism and Science*.
- Godfrey-Smith, P. (2003). *Theory and Reality: An Introduction to the Philosophy of Science*. Chicago: University of Chicago Press. Ch. 1,2,3,4.
- Jahren, H. (2016). *Lab Girl*. New York: Alfred A. Knopf.
- Keller, E.F. (1985). Gender and Science. In *Reflections on Gender and Science*.
- Keller, E.F. (1999). The Gender/Science System. In M. Biagioli (Ed.) *The Science Studies Reader*. New York: Routledge.
- Kourany, Janet A. 2010. *Philosophy of Science after Feminism*. Oxford University Press (last chapter).
- Maddox, B. (2003). The double helix and the “wronged heroine”. *Nature*, 421, xxx.
- Rossiter, M. (1982). *Women Scientists in America*. Baltimore, MD: Johns Hopkins University Press. Ch. 10.
- Schiebinger, L. (1999). *Has Feminism Changed Science?*
- Wylie, A. (1999). The engendering of Archaeology: Refiguring Feminist Science Studies. In M. Biagioli (Ed.) *The Science Studies Reader*. New York: Routledge.

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/>

The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that:

- Everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- All student work is fairly evaluated and no student has an inappropriate advantage over others.
- The academic and ethical development of all students is fostered.

- The reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

STUDENT WELLNESS SERVICES

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.