

## **Athena Unbound**

### **The Advancement of Women in Science and Technology**

Why are there so few women scientists? Persisting differences between women's and men's experiences in science make this question as relevant today as it ever was. This book sets out to answer this question, and to propose solutions for the future.

Based on extensive research, it emphasizes that science is an intensely social activity. Despite the scientific ethos of universalism and inclusion, scientists and their institutions are not immune to the prejudices of society as a whole. By presenting women's experiences at all key career stages—from childhood to retirement—the authors reveal the hidden barriers, subtle exclusions and unwritten rules of the scientific workplace, and the effects, both professional and personal, that these have on the female scientist.

This important book should be read by all scientists—both male and female—and sociologists, as well as women thinking of embarking on a scientific career.

**HENRY ETZKOWITZ** is Director of the Science Policy Institute and Associate Professor of Sociology at the State University of New York at Purchase.

**CAROL KEMELGOR** is a psychotherapist and psychoanalyst in private practice in Westchester County, New York, and Director of the Center for Women in Science, at the Science Policy Institute, State University of New York at Purchase.

**BRIAN UZZI** is Associate Professor of Business and Sociology at the Kellogg Graduate School of Management at Northwestern University.

To my mother  
MARY MIRIAM LIFSHITZ ETZKOWITZ  
*BA Hunter College 1933*

Magna Cum Laude, Geology

H.E.

For LARRY

C.K.

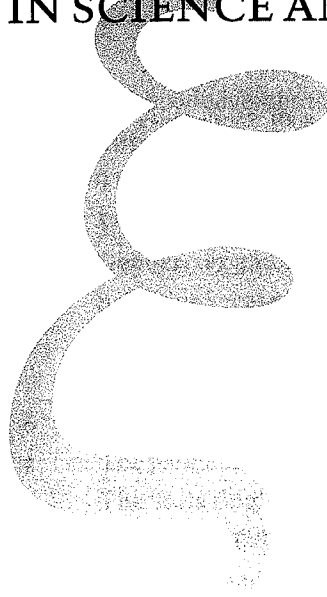
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**HENRY ETZKOWITZ**

Science Policy Institute,  
State University of New York at Purchase

**CAROL KEMELGOR**

Science Policy Institute,  
State University of New York at Purchase

**BRIAN UZZI**

Kellogg School, Northwestern University

With:

MICHAEL NEUSCHATZ, *American Institute of Physics*

ELAINE SEYMOUR, *University of Colorado*

LYNN MULKEY, *University of South Carolina*

JOSEPH ALONZO, *Rockefeller University*

Author  
**HENRY ETZKOWITZ**  
Editor  
George 1933

Editor  
de, Geology

H.E.

Editor  
RY

C.K.

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## Introduction

### Women in science: Why so few?

Why are there still so few women scientists, especially at the upper levels of the scientific professions? Persisting differences between women's and men's experience in science make this question as relevant today as when sociologist Alice Rossi posed it more than three decades ago at a conference on women in science at the Massachusetts Institute of Technology (Rossi, 1965).

The years since Rossi's groundbreaking analysis have witnessed the revival of the feminist movement and the increased entry of women into many professions. Women have become lawyers and doctors in significant numbers, albeit unevenly distributed into high and low status subfields of these professions. Despite significant advances, there is a continuing disproportionate lack of women in most scientific and engineering disciplines, especially at the upper reaches of the professions.

One such scientist, Leslie Barber, a female Ph.D. in molecular biology, decided to end her career as a research scientist shortly after being awarded the doctorate. She reflected upon the mixed experience of her male and female peers in a recent article (Barber, 1995). On the positive side, she found widespread evidence of encouragement for girls and women to pursue scientific professions from the media and from parents and teachers.

On the negative side, in comparing the career trajectories of the ten members of her graduate research group, equally divided into five men and five women, Barber noted significant differences. Whether or not the men had done well in their graduate careers, they had forged ahead in their professional lives. Among the women, three 'have left research altogether, while the other two languish in post-doctoral positions,

apparently unable to settle on a next step.' Barber was initially surprised that, despite the unique story that each woman offered to explain her situation, the traditional pattern of relative exclusion of females from the scientific professions had been reproduced in her graduate cohort.

A guarded professional prognosis for both men and women could well be advised for a field such as physics, where the potential numbers of qualified applicants, vastly overwhelm traditional occupational demand (Linowitz, 1996). Certainly there has been a shift away from nuclear weapons and power plants, as well as from 'big science' projects such as the cancelled Superconducting Super Collider, which once gave virtually automatic multiple choices of employment to Ph.D. physicists. Although not unemployed, young physicists can often be found utilizing their quantitative and analytical skills in the back rooms of Wall Street or even in their own financial firms.

But how can the male-female divide in following scientific research careers, as identified by Barber, be explained for molecular biology, given the proliferation of biotechnology firms with research positions in recent years? Why has the increase in women entering graduate school not been fully translated into female scientists occupying higher positions in the field? Why has science lagged other professions in its inclusion of women? The answers to these questions, and the responsibility for repairing a less than optimal outcome, can be found primarily within science and secondarily in the larger society (National Research Council, 1940; Fox, 1994).

#### A LIFE COURSE ANALYSIS OF WOMEN IN SCIENCE

The thesis of this book is that women face a special series of gender related barriers to entry and success in scientific careers that persist, despite recent advances. Indeed, while some of their male contemporaries view female scientists as 'honorary men', others see them as 'flawed women' for attempting to participate in a traditional male realm (Longino, 1987; Stolte-Heiskanen, 1987; Barinaga, 1993).



next step.' Barber was initially surprised by the story that each woman offered to her. The general pattern of relative exclusion of women from science had been reproduced in her own experience.

Options for both men and women could be found in physics, where the potential numbers are large. However, to overwhelm traditional occupational patterns, there has been a shift away from physics, as well as from 'big science' projects such as conducting Super Collider, which offers multiple choices of employment to women. Unemployed, young physicists can use their quantitative and analytical skills in the private sector or their own financial firms.

Options in following scientific research fields are explained for molecular biology, physics, and biology firms with research positions. The relative ease in women entering graduate school and into female scientists occupying research positions in science lagged other professions. Answers to these questions, and the implications for an optimal outcome, can be found in the following study (Stolte-Heiskanen, 1987; Stolte-Heiskanen, 1987; Stolte-Heiskanen, 1994).

#### WOMEN IN SCIENCE

Women face a special series of challenges in attaining success in scientific careers. Indeed, while some of their colleagues are regarded as 'honorary men', others are discouraged from attempting to participate in a field. (Stolte-Heiskanen, 1987; Stolte-Heiskanen, 1987; Stolte-Heiskanen, 1994).

Female scientists have been at odds over how to respond to these invidious distinctions. Should they insist that as scientists they are not different from men? On the other hand, given that science has historically been a male-dominated profession, should not women claim that they must have their needs taken into account in how the field is organized?

We focus the greater part of this book on the quality of women's experience in academic science, on the grounds that the university serves as a gateway into the larger scientific community. Our analysis is based on extensive systematic fieldwork that focuses both on the personal accounts of female and male graduate students and faculty members, and on the statistical analysis of aggregate demographic data and survey data on person-to-person ties in departments. In interviews with us, they discussed their experience in research groups and departments as well as their interaction with male and female peers and mentors.

*Athena Unbound* provides a life-course analysis of women in science from early childhood interest, through university, graduate school and the academic workplace. The book is based on several studies: (1) fifty in-depth interviews with female graduate students and faculty members in five science and engineering disciplines at two universities; (2) four hundred in-depth interviews and focus groups with female and male graduate students and faculty members in five science and engineering disciplines at eleven universities; (3) follow-up interviews with a sub-sample of graduate students and post-doctoral fellows interviewed in the previous study; (4) a quantitative survey of female graduate students and faculty members in five science and engineering disciplines at one university, focusing on publication experiences; and (5) interviews with very young children on their image of the scientist as a gender-related role.

In the following chapter we will begin to address the question raised in this introduction: why so few women in science? We will present quantitative evidence documenting how women's entry into and leakage from the ranks of graduate school education and university

departments differ from men's. As society becomes more knowledge-intensive, ending any exclusion of women from science and technology becomes more pressing.