Continuing Exclusions

The Outer Circle. Women in the Scientific Community. HARRIET ZUCKERMAN, JONATHAN R. COLE, and JOHN T. BRUER, Eds. Norton, New York, 1991. 350 pp. $24.95.

Sandra Panem was a virologist who was turned down for tenure at the University of Chicago and is now a venture capitalist specializing in biotechnology. Chapter 5 in *The Outer Circle*, an interview in which Panem tells the story of her scientific career, provides a crash course for anyone interested in how exclusion operates for women in science. I was impressed with her wisdom, unfortunately only in retrospect, about the politics of tenure and the requirements for collaboration if one is to be successful in academic science. There are two other interviews in the book as well, one with geneticist Salome Waelsch and one with astronomer Andrea Dupree. These three interviews are probably the most engaging chapters in the book. They relate the triumph of talent and persistence in the face of continuing obstacles and downright hostility. I recommend them, especially to young women scientists, but also to anyone concerned with the future of scientific endeavor or the status of women.

In addition to the three interviews, the book contains nine papers from a series of symposia on women in science held at Stanford University between 1983 and 1986. Two of the editors, Jonathan Cole and Harriet Zuckerman, are highly respected sociologists of science; John Bruer was associated with the Macy Foundation, which sponsored the symposia. The book seeks to explain why women are in the outer circle in science and to contribute to a new research agenda on the subject.

There are at least three senses in which women are in the outer circle of the scientific community: low representation in the disciplines themselves; average publication rates that are lower than the average for men; and absence from the centers of power and clout. The book deals mostly with the second issue.

In many scientific fields the number of women is very small and the so-called pipeline is still not flowing very rapidly. For example, in 1988, women made up only about 7 percent of the doctorate recipients in engineering, about 10 percent in computer sciences, about 16 percent in the physical sciences and in mathematics, and about 20 percent in earth sciences. Only in the life sciences was women's representation among new Ph.D.'s relatively high, about 37 percent (*Statistical Abstract of the United States*, 1990, table 1004, p. 591).

What accounts for these low percentages? None of the authors focus on this issue, although several touch upon it. Theories about when and how occupations change their gender composition need to be brought into the discussion of the paucity of women in science. (See, for example, M. H. Strober and C. Arnold, "Integrated circuits/segregated labor: women in three computer-related occupations," in *Computer Chips and Paper Clips: Technology and Women's Employment*, vol. 2, H. Hartmann *et al.*, Eds. [National Academy Press, 1987], pp. 136–181).

The book is far stronger in surveying a variety of explanations for why men scientists have a higher average publication rate than women scientists. Cole and Zuckerman reproduce their 1987 article from *Scientific American* showing that marriage and motherhood do *not* explain these differential rates. Stephen Cole and Robert Fiorentine argue from a socialization perspective that "because there are normative alternatives open to women which are not open to men, there is substantially more pressure on men to be occupationally successful" (p. 222). But William Bielby and Mary Frank Fox, in separate chapters, suggest that such a supply-side explanation is inadequate to explain women's position in science. Rather, they propose that the difference in publication rates has a structural explanation stemming from differences in the treatment of women and men by their work organizations.

The chapter by Jonathan Cole and Burton Singer, which offers a theory of limited differences to explain why women publish less than men, is quite interesting. Cole and Singer present a mathematical model to show that even if there are only small differences between women and men in the amount of negative reinforcement they receive (for example, having a grant proposal or an article turned down) the cumulative effects of discouragement resulting from these negative experiences can be fairly large over a long period of time. Although Cole and Singer do not relate their work to that of Helen Astin, whose chapter appears earlier in the book, Astin's finding that women may be more sensitive to external validation than men adds strength to their argument.

The most thought-provoking chapter on the differential publication question is by Evelyn Fox Keller, who argues that all the fuss about number of papers produced by scientists is misplaced, that number of publications is not a measure either of productivity or of scientific merit or impact. Rather, she suggests, it is a reflection of the fact that men tend to have larger scientific laboratories than women and that the number of papers on which a principal investigator's name appears is directly related to the size of his or her operation.

Fox Keller also points out that in discussions about women and science the usual assumption is that scientific norms are "right" and that what we need to do is train women to fit them: get women to be more competitive so that they can get bigger grants, have bigger laboratories, and publish more papers. She suggests that maybe before we "retrain" women scientists we ought to examine this assumption more carefully and ask ourselves whether the current competitive norms in science are really necessary to good research, whether they really further the scientific enterprise.

The third sense in which women are in the outer circle is that even when they are highly productive, they are rarely offered positions of leadership or accepted as equals in the power elite. Cynthia Fuchs Epstein's chapter presents an excellent sociological analysis of this issue. She explains how various modes of social control limit women's recognition. She uses the case of Rosalind Franklin to illustrate some of her theories. The interview with Salome Waelsch, earlier in the book, also supports Epstein's analysis. I wish Epstein had been asked to comment directly on that interview.

The book deals with some important theories about women's position in science and presents some interesting research findings. The writing is clear, and in almost all cases the issues are dealt with in sophisticated fashion. For those who have not kept abreast in this field, the book is "must reading." However, because many chapters are based on work completed several years ago, neither their data nor their interpretations are up-to-date.

Also, the book falls short of its goal of providing an agenda for further research.

There is a very useful two-page research agenda at the end of chapter 1 by Zuckerman. But it is not integrated with the rest of the book. For the book to move us forward with respect to a research agenda, it would require inclusion of the latest thinking on many of these issues, a dialogue among the authors, and a concluding chapter detailing and integrating unresolved puzzles they raise.

I was particularly disappointed that there is only minimal discussion by the editors of the interview material. (Nor is there any indication of how these particular interviewees were chosen, why the interviews were included in a book of papers from a series of conferences, or when the interviews were conducted, a salient concern in fields that change rapidly.) I wish that some of the more theoretical papers in the volume had integrated material from the interviews. Such an integration would have contributed greatly to the book's goal of developing a research agenda in this field.

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What Children Know

Knowing Children. Experiments in Conversation and Cognition. MICHAEL SIEGAL. Erlbaum, Hillsdale, NJ, 1991. x, 154 pp., illus. $32.50.

"Anyone who knows children realizes that they have an understanding which often is not reflected in what they say and do." So begins the preface of *Knowing Children*, which makes two major points, both implied in its title: first, that much past and current research underestimates young children's abstract knowledge, and second, that it is important to discover the extent of young children's implicit knowledge because of possible implications for the teaching of academic skills.

The author blames researchers' reliance on inappropriate questioning techniques for findings that portray children's knowledge of the physical and social world as curiously simplistic. Specifically, he claims that these questioning techniques ignore differences in adults' and children's understanding of conversational rules, such that children may perceive adults' well-meaning questions to be ambiguous, irrelevant, pointless, insincere, or uninformative. Others, such as Donaldson (*Children's Minds*, Norton, 1979), have raised these points in the past, though they have not laid them out in as much detail as Siegal. Few, however, have asked what these new findings mean in terms of parental teaching and early childhood education.

In reviewing the literature on infant cognition, which cannot rely on language, Siegal highlights researchers' ingenuity in the use of nonverbal methods to uncover the rudiments of infants' abstract knowledge. He argues that similar ingenuity should be exercised when probing preschoolers' knowledge of implicit abstract concepts. Siegal thus takes a different position from Piaget, who attributed qualitatively different logical thought structures to children of different stages of development. In the rest of the book he reviews recent and classical Piagetian-inspired studies of just what children understand about such topics as number and measurement, classification, time, and causality. Siegal is adamant that repetitive questioning, especially the use of "trick" questions, may lead young children to give nonsensical answers ("Why would he ask me again? He must want me to change my mind."). Misunderstandings or boredom may similarly result in confabulated answers just to get the task over with.

What is the evidence supporting Siegal's claims? Citing his own and other researchers' attempts to uncover earlier forms of preschoolers' understandings of the physical and social world, he shows that findings change when questions change. For example, the accuracy of answers increases when young children are asked fewer questions per session, when the domain of study is about a content area meaningful to them (such as food), or when they do not have to formulate an answer themselves but are instead given an opportunity to choose between two hypothetical possibilities.

Siegal thus contends that, when studied in supportive contexts, young children's mastery of abstract concepts seems to be gradual rather than sudden. Therefore, he suggests, it is counterproductive for parents and educators to take a passive stance towards young children's capacity to learn. We should no longer match demands to children's supposed level of readiness. Rather, materials should be prepared in such a way as to pull children from current levels toward higher levels of understanding. In line with this argument, Siegal believes that parental involvement in *informal* instruction could play a key role in encouraging young children's mastery of the rudiments of number and literacy concepts, including, for example, an understanding of fractions. He is not calling for formal schooling for four-year-olds, but he finds the attitude that "it is better for a child to find and invent his own solutions rather than being taught" much too complacent. This attitude implies that there is little for teachers and parents to do except to await certain developments.

One curious omission in Siegal's essay is his failure to integrate Vygotskyan-inspired research into his thesis. According to Vygotsky all higher mental functions initially come into being through children's social interaction with more knowledgeable adults. In this view, adults are not the passive bystanders described by Piaget but are active guides who supportively induct children into culturally valued knowledge. Because Siegal, apart from one brief citation, ignores Vygotsky and Vygotskian-inspired research, the second part of his thesis, that children's implicit knowledge has important implications for the teaching of academic skills, seems much less developed than the first. Nevertheless, it is to his great credit that he focuses on the practical implications of new findings on children's understanding of physical and psychological causality, including their understanding of the distinction between reality and appearance and of spatial and social perspective-taking. Let us hope that this book will be read by early childhood educators, with a view to challenging traditional ideas on curriculum development.

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