by simply pointing out that the origin of species or symbolic language (or the majority of the subjects worth of investigating in biology and other disciplines) cannot be explained by the laws of physics or chemistry.

Sagan might state a conviction that such reductionism (of, say, the laws of biology to the laws of physics) will be accomplished in the future. But this is a statement of faith. The late philosopher Karl Popper argued that complete epistemological reduction of a discipline to another is impossible in principle. Sagan asks rhetorically: "Why should some religious people oppose the reductionist program in science, except out of some misplaced love of mysticism?" Popper's opposition to the (epistemological) reductionist program in science was certainly not religiously motivated, nor was he particularly appreciative of mysticism.

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Vignettes: Identity Crisis

The myth of human exceptionality has been supplanted of late by the myth of biological continuity. Recent research efforts in the social and natural sciences seem determined to prove—indeed, presume to have already proved—that there is no essential, irreducible distinction between humans and animals. Each one of our prized facilities—language, cognition, megalothymia—is shown to appertain in one degree or another to other species. Precisely at the moment when we have overcome the earth and become unearthly in our modes of dwelling, precisely when we are on the verge of becoming cyborgs, we insist on our kinship with the animal world. We suffer these days from a new form of collective anxiety: species loneliness.

—*Robert P. Harrison*, in *Uncommon Ground: Toward Reinventing Nature* (William Cronon, Ed.; Norton)

Thinking in terms of bits has allowed us to develop the field of computer science, in which we learn how to represent the world with patterns of information. So successful are our endeavors that some physicists and computer scientists believe that perhaps information is not a human invention but something as real, as physical, as matter and energy. And now a handful of researchers have come to believe that information may be the most real of all. Simulated creatures would have no way of knowing they are simulations, the argument goes. And, for that matter, how do we know that we are not simulations ourselves, running on a computer in some other universe?

Nature, it seems, has honed us into informavores so voracious that some can persuade themselves that there is nothing but information.

—*George Johnson*, in *Fire in the Mind: Science, Faith, and the Search for Order* (Knopf)

The Gender Front

The Equity Equation. Fostering the Advancement of Women in the Sciences, Mathematics, and Engineering. CINDA-SUE DAVIS, ANGELA B. GINORIO, CAROL S. HOLLENSHEAD, BARBARA B. LAZARUS, PAULA M. RAYMAN, and associates. Jossey-Bass, San Francisco, CA, 1996. xxx, 353 pp., illus. $36.95. Jossey-Bass Higher and Adult Education.

Much attention has been paid to women's underrepresentation in the sciences, mathematics, and engineering (SME) in the past decade. Those who have a long-standing interest in the subject will find *The Equity Equation* a good update. For readers who are new to the subject, the book serves well as an entry point.

The Equity Equation is a collection of papers that were originally prepared for a 1994 conference sponsored by the Cross University Research in Engineering and Science group on women and gender, with the support of the Alfred P. Sloan Foundation. The book consists of nine substantive chapters and a summary chapter. The substantive chapters follow a consistent format: a literature review followed by the authors' view of needed research and policy interventions in the future. The authors have long been concerned with gender equity in SME, and their past contributions to the subject are cited in the book. In the first chapter, Daryl E. Chubin and Shirley M. Malcom propose structural remedies that they believe will promote women in science. Betty M. Vetter provides an overview of gender differences in SME. Three separate chapters are devoted to science education: Jane Butler Kahle focuses on the elementary and secondary levels, Helen S. Astin and Linda J. Sax on the undergraduate level, and Carol S. Hollenshead, Stacy A. Wenzel, Barbara B. Lazarus, and Indira Nair on the graduate level. Beatriz Chu Clewell and Angela B. Ginorio's chapter is concerned with the intersection of gender and other dimensions of diversity, with an emphasis on race. Cinda-Sue Davis and Sue V. Rosser review program and curricular interventions. Mary Frank Fox's and Paula M. Rayman and Jennifer S. Jackson's chapters cover women scientists in academia and in industry respectively.

The book's principal value lies in its summary and critique of the literature on women in SME. However, the book does not stop here. It also aims to set the future research and policy agenda, and this aim is fully explicated in the final chapter, by Hollenshead, Wenzel, Margaret N. Dykens, Davis, Ginorio, Lazarus, and Rayman. The authors recommend five research areas requiring future attention: "collection and dissemination of disaggregated data, examining of nonacademic careers, evaluation of intervention programs, development of an institutional perspective, and examination of true entry points or gateways into science careers" (pp. 322–23). These are important areas, and I am particularly sympathetic with the last two concerns. The authors' explication of them is less than satisfactory, however. For example, their definition of "an institutional perspective" exclusively focuses on employers in local settings. A broad institutional perspective should incorporate rules and norms operating at the societal level. In addition, in discussing evaluation research, the authors overlook methodological pitfalls that are well recognized in statistics, economics, and sociology: the nonexperimental nature of intervention programs renders observed data, quantitative or qualitative, prone to selection biases and subject to alternative interpretations. Finally, the authors' call for the collection of new data is not fully justified, given the vast amounts of existing unit-record data that have not been fully explored for the study of women in SME, either by the authors or by other researchers. Such data sets include the

Public Use Microdata Sample from decennial censuses, the National Survey of Experienced Scientists and Engineers, High School and Beyond, the Longitudinal Study of American Youth, the New Entrants Surveys, the National Educational Longitudinal Survey (NELS), the National Longitudinal Study of the High School Class of 1972, and the National Survey of Postsecondary Faculty. What is most needed is more methodical and more definitive analyses, not more data.

The book's overall lack of concern with "methodological correctness" is also reflected in its eagerness to embrace assertions that have not been proven scientifically. For example, Vetter cites a finding from an unpublished report: "it is interesting that women who choose engineering as a career are likely to have no brothers" (p. 32). This finding is invoked to support the idea that parents "discriminate against their daughters." Though the number of siblings is well known to affect achievement, the sex composition of siblings has not been proven to have much relevance. Puzzled by Vetter's citation, I contacted William LeBold at Purdue University, to whom the finding is attributed, and also, with the help of Kimberlee Akin, computed statistics from the 1994 wave of NELS. LeBold in response to my query said he had no direct evidence bearing on the issue, and our own results also clearly rejected the claim: the percentage of female students with brothers was 70.3 among 58 engineering students versus 72.3 among 2654 non-engineering students, a statistically insignificant difference. It is ironic that a myth is created in a section of the book on "myths and realities." Let us hope that it will not be spread further.

Though the book documents rather rapid progress in women's participation in SME since the 1950s, it gives no proven causal explanations for the increase. Although the future can be quite different from the past, understanding the recent past is a very helpful, if not the most helpful, aid in predicting the future. Because the book does not establish causal explanations for past experience, the merit of its policy recommendations is difficult to evaluate. It appears that the authors' recommendations were drawn mainly from their personal experiences, intuitions, and political convictions.

In sum, this book contains many interesting but unproven ideas and provides a good reference to many studies, some of which are of questionable scientific merit.

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