Presences and Absences

The Mind Has No Sex? Women in the Origins of Modern Science. LONDA SCHIEBINGER. Harvard University Press, Cambridge, MA, 1989. xii, 355 pp., illus. $29.50.

Nature may be uniform for all times, peoples, and places, but for most of their history the sciences of nature have been pursued only by a select few. In a book remarkable for its scope and sophistication, historian Londa Schiebinger investigates the nature, extent, and consequences of the strictures that have so long barred women from full participation in the sciences since the Renaissance. Although the work is organized chronologically, Schiebinger presents not a comprehensive survey but rather selected episodes in the history of women's involvement in European science from the Renaissance until the mid-19th century. Her story weaves back and forth between women as the subjects and women as the objects of science, between detailed *vitae* of individuals and the social milieux that eased or blocked their achievements.

Beginning in the late 16th century, in the same cultivated Renaissance courts that provided Galileo with his several aristocratic patrons, Schiebinger situates women like the Grand Duchess Christina, to whom Galileo addressed his reflections on the proper relations of science and theology, within courtly conversation circles in which women of rank participated and even dominated. This aristocratic salon setting in the loftiest reaches of high culture was one in which privileged women could learn, discuss, and pursue the new mathematics and natural philosophy, as the careers of Margaret Cavendish and Emilie du Châtelet bear witness. But there were also low-culture points of entry into science in the 17th and early 18th centuries. Because of the close ties between empirical sciences and the artisan's workshop during this period, the wives and daughters of skilled craftsmen might also do research alongside their male kin, just as the potter's or candlemaker's womenfolk would have assisted in those shops. With luck and pluck, such women might occasionally step out of the shadow of their male mentors. Schiebinger revives two such cases in fascinating detail: the astronomer Maria Winkelmann, who collaborated with her husband Gottfried Kirch, and the naturalist Maria Sibylla Merian, trained in sketching by her artist stepfather Jacob Marell.

Valuable as these neglected cases are as counterexamples to hasty generalizations about the absence of women in early modern science, neither aristocratic salon nor artisan's workshop produced more than a handful of prominent women scientists. Although Schiebinger makes much of the relative freedom early modern women both high and low enjoyed before their confinement to the private sphere of home and hearth, her own evidence reveals considerable conflict between these scientific careers and contemporary expectations of womanly domesticity and retiring modesty. However, she is surely correct to indict learned institutions, first the universities and then the scientific academies, as the chief culprits in the exclusion and hindrance of women scientists during this period. With access neither to training nor to recognition and remuneration, even the most talented women could not hope to go far in mainstream science. (Conversely, women made most headway where native wit counted most and formal training least: Schiebinger rightly remarks the strong feminine presence in 18th-century Parisian salons, but this had less to do with the peculiarly feminine stamp of Enlightenment intellectual life than with rampant autodidacticism, from which provincials and parvenus profited as much as women.)

It would be a mistake to ascribe the closed-door policy of universities and academies of the late 17th and 18th centuries solely or even primarily to a belief in the inferiority of the female intellect. Schiebinger documents the compelling theoretical grounds Cartesians and others had for granting women equal intellectual status and shows that only in the late 18th and early 19th centuries did anatomists oblige misogynist writers with theories of sexuality so thoroughgoing that not even the bones, much less the brain, could escape telltale feminine markings. In the earlier period, however, the grounds for exclusion were largely social rather than intellectual. Women scientists might correspond with male colleagues and win academic honors and prizes in absentia, but their physical presence within a male confraternity was intolerable. Intellectual recognition by no means implied social (and therefore professional) integration.

Schiebinger argues that social and political factors ultimately conspired at the turn of the 19th century to banish even the exceptional aristocrat or artisan woman from science, however discreetly practiced in private studies and back rooms. On her account, many writers followed Rousseau in countering political briefs in favor of women's equality with a vision of men and women as complementary in both intellectual and physical endowments and (therefore) in social roles: men's strong bodies and abstract intelligences suited their roustabout public lives; women's wide-hipped frames and concrete intelligences destined them to child-rearing and domesticity at home. Here Schiebinger's stories about women as subjects and as objects of science intersect, for she concludes that it was scientific theories about the nature of women, most notably the sexualization of the skeleton in late-18th-century anatomy, that justified the exclusion of women from public participation in science. Henceforth women would figure in the history of science only as invisible partners to fathers, husbands, and brothers, their service in the laboratory or observatory no more in the public eye than the other hidden, homely duties of helpmeet.

From semi-public independence to private dependence; from recognition to exclusion; from intellectual equality to intellectual complementarity—these are the broad outlines of Schiebinger's story. The evidence and arguments mustered in support of this story are of uneven quality. Schiebinger is at her best in two detailed case studies based on extensive research in primary sources: Maria Winkelmann's vexed relations with the Berlin Academy of Sciences pinpoint the moment when the new institutions for the new science slipped back into the social conservatism of the old institutions for the old learning; the putting asunder of male and female human anatomy shows not only that but also how ideology can infiltrate science without any conscious motive to deceive. Both tales of injustice carry conviction not because Schiebinger affects a cool neutrality, but rather because they are thoroughly researched and tightly argued and demonstrate beyond reasonable doubt that women's marginal status in science was a contingent rather than necessary fact, one grounded in social conditions rather than intellectual differences.

Unfortunately, some chapters fall short of this high standard, most glaringly when Schiebinger attempts to link the plight of women in early modern science with cosmologies and styles of thought of the same period. Here superficial and selective readings mar the considerable interest of both topic and analysis. Schiebinger's claim that Christian neo-Platonism was the source of the iconographic tradition that represented science, philosophy, truth, and indeed almost all abstract nouns as women is difficult

to square with several facts: (i) The feminine depiction of such qualities as truth and virtue antedates not only Christian neo-Platonism but even Plato—Wisdom already appears to Parmenides as a woman, as do of course the nine muses to poets since Homer. (ii) Whatever the favored place enjoyed by women in the Renaissance court, they were conspicuously absent in the avowedly neo-Platonist academies in the early modern period. And (iii) other, non-feminine neo-Platonist imagery rarely surfaces in the iconography Schiebinger discusses. In short, neo-Platonism and the feminine personification of science do not correlate in symbol or practice. It is equally dubious to make Kant bear witness to the decline of the feminine icon on the strength of a passage that is rather an instance of its survival—outcast metaphysics likened to mourning Hecuba—and moreover to make misogyny responsible for this decline when all emblems, not just female ones, were fast disappearing from frontispieces of learned works. A similar lack of attention to text and context plagues Schiebinger's attempts to align cosmology and gender. Given the subtlety and originality of the questions she poses, the reader is doubly disappointed by such unpersuasive answers.

The moral Schiebinger draws from her tale of women let into (and booted out of) early modern science is that scientific impartiality is incompatible with partial representation in science. On her account, a science that excludes women is also one that willy-nilly excludes certain topics and approaches, and, still worse, tricks out misogyny in scientific dress. The failure of universalism in science therefore, claims Schiebinger, carries with it a failure of objectivity. There is an undeniable kernel of truth in this view about the dismal inevitability of ideology when the balance of power is badly askew, and Schiebinger presents a good deal of damning evidence to this effect for her period. Yet because this evidence testifies to false consciousness as well as to ideology, it is not clear that the presence of more women in science would by itself remedy distorted science about women: the most egregiously feminized skeleton of 18th-century anatomy was the work of the Frenchwoman Marie Thiroux d'Arconville, and conversely, the most radical and outspoken defenders of women's intellectual rights were M. J. A. N. Condorcet and John Stuart Mill. We need a far more nuanced view of the relationships between power, interest, and knowledge, not to mention gender, in order to unravel their tangled history in modern science. But Schiebinger is no doubt on the right track when she makes specific lives and events speak, parable-fashion, for general themes, instead of ascending prematurely into grand, synthetic theory that can instruct by precept but not by example.

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Hörstadius and Beyond

The Neural Crest. Including a Facsimile Reprint of *The Neural Crest* by Sven Hörstadius. BRIAN K. HALL. Oxford University Press, New York, 1988. viii, 303 pp., illus. $60.

This book is in essence a chimera comprising a facsimile reprint of a seminal text published 39 years ago onto the front of which has been grafted an overview putting that original monograph into the context of current developmental biology. The host in this operation is Sven Hörstadius's *The Neural Crest: Its Properties and Derivatives in the Light of Experimental Research*. On publication in 1950 it constituted the first major scholarly work on the neural crest—a transient cell population in vertebrate embryos that gives rise to, or contributes to, a number of unique features (for example, the entire autonomic nervous system and much of the craniofacial skeleton and connective tissue, including that of the gill-branchial arches). Research interest in this structure has increased almost exponentially since the '50s, to a considerable extent because of Hörstadius's text. Talking with embryologists who were active at that time, one soon begins to appreciate the impact its publication must have had. The original version has long been out of print (my own much-valued copy was a gift from a colleague upon his retirement), and this reappearance is to be welcomed. Hörstadius's own work, whether on the vertebrate neural crest or on echinoderm embryology (his other area of achievement), was characterized by dexterous experimental manipulation and rigorous experimental design; his writing is characterized by carefully wrought argument and analysis. Consequently, his book is a joy to read, and some of the questions raised are as pertinent now as in 1950.

How does the graft itself fare in this chimera? Brian Hall has taken on the demanding task of updating Hörstadius's text by reviewing the neural crest literature published since 1950. As a researcher with active interests in both developmental biology and evolution, Hall is well positioned to provide such an overview. Clearly one of the major changes is the much wider appreciation of the pivotal role of the neural crest in vertebrate evolution. The dramatic increase in interest in this area has focused on the construction of evolutionary scenarios and on the identification of neural crest origins in protochordate forms (a topic of research activity still in its infancy). Hall's overview is excellent in covering this ground and that of the "neurocristopathies"—a collective term for those tumors and dysmorphologies arising in neural-crest–derived tissues or within organ systems with a contribution from the neural crest. There is, however, a curious bias in Hall's overview in that he does not give in-depth coverage of melanogenesis, gliogenosis, and neurogenesis. This is not an oversight but the author's stated intention (see p. 6 for a justification), and it is disappointing given the parallel exciting developments in the analysis of pigment-cell, glial, and neural differentiation and the current ideas on lineage within the autonomic and peripheral nervous systems.

This criticism, however, should be put into perspective. As an overview of the neural crest spanning evolution, developmental biology, comparative embryology, oncology, and syndromology, the book is unique. Although it remains slightly flawed in its developmental coverage, it is nevertheless an exciting read—ambitious in scale, with some fascinating anecdotal material (for instance, of the 38-year delay in the publication of J. P. Hill's analysis of the marsupial neural crest due to his reluctance to depart from strict adherence to the germ layer theory). The juxtaposition of the old and the new, the Hörstadius and the Hall, does in fact work remarkably well.

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All About Some Algae

The *Chlamydomonas* Sourcebook. A Comprehensive Guide to Biology and Laboratory Use. ELIZABETH H. HARRIS. Academic Press, San Diego, CA, 1989. xiv, 780 pp., illus. $145.

Few books are awaited as eagerly, particularly among its particular audience, as Harris's *Sourcebook*. For those who work with or are interested in *Chlamydomonas* the finished product is worth the wait. Every aspect of work on *Chlamydomonas* since research on these algae became popular in the early 1950s is reviewed. Mentioned also are earlier studies, including the initial discovery of these organisms over 200 years ago and the eventual naming of the genus by Ehrenberg in 1833.

The genus *Chlamydomonas* includes at least 459 species of single-celled, flagellated al-