A Modern Science in China

The Study of Change. Chemistry in China, 1840–1949. JAMES REARDON-ANDERSON. Cambridge University Press, New York, 1991. xx, 444 pp., illus. $59.50. Studies of the East Asian Institute, Columbia University.

Joseph Needham's *Science and Civilisation in China*, one of the wonders of the modern scholarly world, has revealed the riches of traditional Chinese science to Western readers. But the history of science and technology in modern China, though of obvious importance in China's modernization, has been strangely neglected by Western historians. In Western scholarship on modern China, as in Maoist parlance and practice, it often seems that "politics has taken command," much to the detriment of presenting a balanced picture of the last century and a half of Chinese history.

The Study of Change: Chemistry in China, 1840–1949 by James Reardon-Anderson is the first full-length study of the history of a modern science in China, though it by no means ignores politics. Indeed, the book might just as well be entitled "Science and the State in Modern China," particularly in that its most important and debatable points concern the relationships between political authorities and scientific enterprises. The political framework of Reardon-Anderson's study is highlighted in his periodization, which takes the major turning points in modern Chinese political history, 1840, 1895, 1927, 1937, and 1949, as the principal pivots in the history of science and technology as well.

Reardon-Anderson characterizes the interactions between science and the state in modern China by reference to Goldilocks's sampling the three bowls of porridge (pp. 10–11). In the late 19th century, and later in the Communist-controlled areas after 1942, the development of modern science in China was impeded by too much political authoritarianism and ideological constraint, eventually reaching the point that scientists were devoured by a "voracious political elite" (p. 375). On the other hand, the progress of science and technology during the early 20th century was hampered by too little political order, which left it with "no reliable source of funding and organization, no insulation of scholarship and industry against the winds of fate" (p. 10). It was only under Nationalist (Guomindang) rule during the Nanking decade (1927–37) that the "just right" balance between authority and freedom was struck, resulting in considerable advances in scientific research, education, and industry (though often not in those fields such as agricultural chemistry that would have most benefitted the Chinese people). Reardon-Anderson goes so far as to credit the Nationalist government's science policy for much of this success, a position that exposes him to attack from more politically correct scholars in the field for whom the Nationalist government under Chiang Kai-shek has long been the favorite whipping boy of modern Chinese history. On the other hand, it is hard to imagine many of these scholars, inebriated by the heady draughts of politics and ideology, sobering up for long enough to read a history of chemistry in modern China.

Although the most pervasive theme of this book concerns the relationships between science and the state in modern China, almost half of it deals with the history of chemistry and chemical technology, discussing very ably such varied topics as research on the seasoning monosodium glutamate and the creation of a modern Chinese chemical terminology. As Reardon-Anderson points out, chemistry in modern China grew almost wholly from Western transplants and was little affected by the great Chinese tradition in alchemy. This was the case with other sciences as well: the connections between their traditional and modern forms in China were quite "tenuous and fleeting" (p. 6). This opens up the ironic possibility that traditional Chinese science may have contributed more to the birth of modern science in Europe during the age of the Scientific Revolution (as assayed in Needham's "grand titration") than it did to the development of modern science in China during the past century and a half.

Another irony emerges from Reardon-Anderson's work that political authorities in various times and places might do well to ponder. Most major political leaders in modern China, from Sun Yat-sen to Deng Xiaoping, have been almost obsessively concerned with the quest for national wealth and power, "demanding obedience to a program that enriches and strengthens the state and does so in short order" (p. 374). But this drive for quick results, ignoring the advice of Western-trained scientists to be more patient and invest more in basic research, has helped to produce a state of scientific and technological stagnation, as well as economic setbacks. Thus the goal of wealth and power remains elusive for contemporary China and will probably stay so until China's leaders allow a larger measure of autonomy to science and other social enterprises.

JOHN B. HENDERSON
Department of History, Louisiana State University, Baton Rouge, LA 70803

Crustacean Mating Behavior

Crustacean Sexual Biology. RAYMOND T. BAUER and JOEL W. MARTIN, Eds. Columbia University Press, New York, 1991. xii, 355 pp., illus. $70. Based on a symposium, Dec. 1988.

Research on insects has made major contributions to the development of theoretical models of sexual systems. Crustaceans similarly offer a rich diversity of comparative material in aquatic habitats, yet knowledge of their mating systems lags behind that of insects. The goal of *Crustacean Sexual Biology* is to provide information that will serve as a foundation for theoretical advances. The book is loosely organized around three themes: mate attraction, mating behavior and mating systems, and structure and function associated with insemination. Eighteen papers present current information within taxa ranging from primitive Remipedia to brachyuran crabs, from parasitic rhizocephalan Cirripedia to pelagic copepods, and from diverse Amphipoda to cryptic stomatopods. The authors were asked to place research on their taxa into a broader evolutionary context.

The volume's greatest strength is its detailed review of functional morphology of reproductive structures for most major crustacean groups and for several interesting minor taxa. Three papers do a particularly admirable job of providing an ecological or evolutionary context for their work, integrating new data with those from previous studies, and proposing plausible evolutionary trends. These chapters, on precopulatory mate guarding in amphipods, the ecology and evolution of polygyny in isopods, and the evolution of sexual systems in rhizocephalans, include findings on such topics as the role of currents in amphipod pheromone detection, the influence of isopod female availability on male reproductive behavior and morphology, and the phylogenetic trend in rhizocephalans toward specialized female receptacles for male cyprids.

The book is a particularly valuable bibliographic and reference resource. It is attractively produced and generously illustrated. Blades-Eckelbarger, for example, provides striking scanning electron micrographs depicting morphology and transfer of spermatophores in calanoid copepods.

The volume suffers from two main problems. First, because most of the authors are morphologists, they often include only cursory information on behavior (mate choice, reproductive timing), population biology (sex ratios, size structure), and life-history characteristics (patterns of maturation, fecundity). With some notable exceptions (bioluminescent courtship displays in ostra-