BOOKS: NEUROSCIENCE

A Piece of Your Mind

Melvin Konner

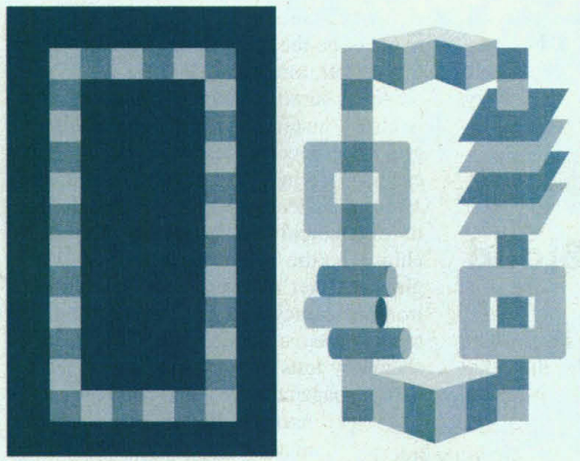
In *How the Mind Works* Steven Pinker, a leading psycholinguist and author of *The Language Instinct*, presents what appears to be two different books bound together. The first is a sophisticated, comprehensible review of how cognitive scientists think the mind works. Readers who follow the field of cognition will recognize such contributions as the connectionist models of James McClelland and David Rumelhart, Francis Crick's approach to the binding problem of consciousness, and various feature extraction and parallel processing views of the visual brain. There could scarcely be a more palatable yet still authoritative account of these theories.

How the Mind Works
by Steven Pinker
Norton, New York, 1997. 672 pp. $29.95, C$39.99. ISBN 0-393-04535-8.

But Pinker's efforts here share the drawbacks of the models he reviews: They attempt to explain a wide range of brain functions with only a few simple principles. They lack appropriate anatomical detail and are devoid of evolutionary knowledge. Whether viewing the neural elements from the perspective of linear feature extraction, of temporal synchronicity and binding, or of massively parallel processing, these models proceed (usually tacitly) with simplifying assumptions about uniformity in brain function. In other words, they mostly ignore anatomy.

Neuroanatomy in any species—but especially in a brain-ridden one like ours—is the product of a sloppy, opportunistic, half-billion year phylogenetic process that has pasted together, and only partly integrated, disparate organs that evolved in different animals, in different eras, and for very different purposes. Consideration of the medulla, the hypothalamus, the amygdala, the hippocampus, the superior colliculi, and the cerebellar cortex (to name only a few major structures) reveals immediately how limited theories are that treat the brain as if it were thousands of smoothly integrated modules, each resembling the visual neocortex. Of course, science is simplification, and we have to start somewhere. But perhaps by now our models should have left this starting point.

The second book between these covers is basically a popular account of sociobiology, which is appealingly billed as a solution to one of the main problems with the models mentioned above. Citing research by Robert Trivers, Napolean Chagnon, Leda Cosmides, John Tooby, and others who have applied Darwinian thinking to human behavior in interesting new ways, Pinker correctly concludes that—contrary to most current cognitive models—the brain cannot be any sort of general information processor, symmetrically repetitive iterator, or global learning machine. Any reasonable expectation informed by evolutionary biology requires domain-specific, functionally restrictive neural organs and circuits. One expects machinery honed for such purposes to be able to detect cheating in cooperative relationships, summon rage against sexual rivals, direct a killing bite at the neck of prey, parse a sentence, or retrieve a lost infant and facilitate its access to a milk-filled breast.



FROM *HOW THE MIND WORKS*

Not simply seeing. The apparent ring of light and dark tiles is actually an arrangement of objects viewed through a rectangular cutout in a dark cover. The illustration, devised by the psychologists Pawan Sinha and Edward Adelson, shows that the brain must identify three-dimensional objects by using both the patches of light on the retina and knowledge of which object each patch is a part of.

This is not to say that these behaviors share no circuits, nor that modifiability is unimportant in their normal function—just that there must be significant innateness and significant modularity across behaviors. Increasingly, developmental psychologists have come to accept both features in their accounts of behavioral growth. The smugly assumed isomorphism between development and learning that historically has marred research on behavior and mind is dying (and good riddance to it). Yet even enlightened attempts to discern the maturing modular circuits that underlie behavior remain neuroanatomically agnostic. This lack of anatomical detail simplifies the developmental models, but it also prevents them from answering many of the important questions.

Pinker makes little attempt to link the book about cognitive mechanism with the book about evolved behavioral modules. Research by Edmund Rolls on face-detection neurons, Thomas Insel on the neuroendocrinology of pair bonding, Leslie Brothers on the neurophysiology of monkey social dynamics, and Stephen Porges on the evolution of the autonomic nervous system would be relevant topics and effective in establishing continuity between the two books. But none of this work, nor anything like it, is cited by Pinker. So it is not surprising that he offers no thoughts on how evolutionary tendencies are realized in the brain, nor that in the end he suggests that "the mind of *Homo sapiens* lacks the cognitive equipment" to solve such puzzles as free will and sentience—a conclusion he calls "cognitive closure." Others may call it premature closure, and may feel frustrated that Pinker concedes so much before seriously trying to link the cognitive models he knows so well and the evolutionary models he passes over much more lightly.

Several years ago in *Nature*, Francis Crick co-authored a sort of cri de coeur bemoaning our lack of information about neuroanatomy, without which it seemed impossible to comprehend the mysteries of the mind. It no doubt took courage, after co-solving our century's greatest simple scientific problem, to face the complexities of mind and brain, where the same intellectual skills have not led to a solution. But it is not quite true that the information is not there; rather, the complexities are very difficult to master and even more difficult to think about clearly. Pinker has managed to write close to 600 pages about the mind while saying practically nothing about the brain. The pages are lively and informative, but with such an omission they cannot begin to answer the question posed by his title.

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Still, Pinker must be thanked for being one of the few cognitive scientists willing to try to take Darwin seriously. As long as cognitive science is ahistoric—treating the mind as if it had been born fully grown like Athena, out of the head of Zeus—it will continue to model minds made exceedingly slowly out of carbon less well than it models minds made by human hands from silicon. At least this book takes evolution seriously, which is more than can be said for almost all other books about cognition.

Pinker's intent to entertain interferes, at times, with his exposition and argument. He could (and should) write a better book: one that reflects some relevant anatomical study and a more serious reading of the literature on behavioral evolution. Since *How the Mind Works* is a fairly good book, asking for a better one is a major vote of confidence. Given his intellectual and literary power, Pinker's next book could explore a wider field, one in which students and practitioners take for granted that the study of the mind requires, in almost equal measure, cognitive science, neurobiology (at the gross anatomical and the cellular levels), evolutionary principles applied to brain and behavior, and the emerging science of how culture shapes mind. In a generation or two, this new field might produce the Watsons and Cricks of the knotty, but not unsolvable, puzzle—or rather, puzzles—of how the mind works.

BOOKS: MEDICINE

Boundaries in Blood

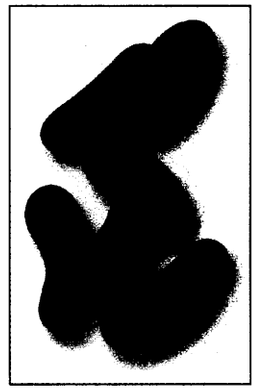
John T. Truman

The history of medicine is much more than the recitation of who did what first. Properly integrated within the context of the social milieu, evolving technology, the political system, economics, ethics, law, religion and literature, it tells a complex yet exhilarating story. This book by one of the young generation of able medical historians is a marvelous example of how many threads can be spun together to create a compelling narrative. It interweaves histories of disease over the past century, of technology, of hematology, and of medicine in the broadest sense.

Drawing Blood
Technology and Disease Identity in Twentieth-Century America
by Keith Wailoo

Johns Hopkins University Press, Baltimore, 1997. 304 pp. $39.95. ISBN 0-8018-5474-1.

The book's focus, as its title suggests, is on blood. For a history of disease this is much more interesting than one might imagine. Do you remember chlorosis, one of the more common diagnoses of the late Victorian era? Sufferers were mostly young working girls, and the treatment was removal from their home or working environment. Did the disease disappear because the treatment was so effective? Or did technology redefine the disease as iron-deficiency anemia, encouraging society to change its ideas of social control? Remember splenic anemia? Our grandparents were aware of it, and general surgeons did very well by removing the offending spleen. Did this illness vanish or did hospital-based physicians begin monitoring the diagnoses of swashbuckling surgeons? Wailoo recounts these histories, and those of aplastic anemia, pernicious anemia, and sickle-cell disease with insight and intelligence. He reminds us that the name of a disease reflects conventional social values and social roles, and that the pernicious anemia or sickle-cell disease of two generations ago may not be the same things as today or, for that matter, tomorrow.



As its subtitle indicates, *Drawing Blood* is also a history of technology. Technologies have become central to defining diseases, to giving them reality, to managing afflicted patients, and to defining the limits of medical specialties. In the case of chlorosis, the hemacytometer and hemoglobinometer allowed clear definition of iron deficiency and left little behind. For aplastic anemia, an increasing array of blood chemistry tests and transfusions moved patient management from the pathology laboratory to the bedside. With pernicious anemia, the technology born of research was translated into the pharmaceutical industry as "liver extract," which was used initially for treatment and later as a confirmatory diagnostic test. In the case of sickle-cell anemia, the advent of the "sickle prep" test in 1917 clarified the nature of sickle-cell disease as an affliction but also confused the issue by raising the question of "potential" disease. This appeared to endorse traditional prejudices about "negro blood." Electrophoresis in the postwar period put the focus on the hemoglobin molecule rather than the blood cell, and helped develop the understanding of autosomal recessive inheritance. As the author astutely points out, the history of splenic anemia was the mirror image of that of sickle-cell anemia. Splenic anemia vanished as various specialties claimed it and left little for surgeons, whereas sickle-cell anemia rose out of a variety of symptoms that different specialists assembled to fit a single disease.

Wailoo describes how a medical specialty originates, and how it changes its form. Hematology obtained legitimacy by its identification with diseases of the blood. It then expanded to include a wide variety of investigators from protein chemists and basic scientists to blood bankers, coagulationists, and, ultimately, oncologists. Leukemia and the other chemotherapy-sensitive cancers became the battlegrounds between hematologists and oncologists, whose disputes were settled by an uneasy truce linking the two in hematology-oncology. Subspecialties (such as my own, pediatric hematology-oncology) gained legitimacy by establishing their own journals and board examinations.

Lastly, this book provides a fine history of the practice of medicine. It shows how the Victorian solo practitioner gave way to the hospital-based specialist; how the pharmaceutical industry created a new class of physician and how industrial medicine itself developed to protect workers; how university-based research thrived as federal patronage became available after World War II; and how the Nixon administration's "war on cancer" gave rise to the field of oncology.

There are some minor clinical errors that the physician reviewer can point out to the non-physician author, but they do not in the least detract from the overall excellence of this book: Splenic anemia has not ceased to exist (witness hereditary spherocytosis, which is still treated by splenectomy). Sickle-cell disease and thalassemia are not clinically indistinguishable.

In all, this is a well-written and thought-provoking book. Wailoo is neither laudatory nor critical of hematologists. He tells their story on its own merits, though the warnings it contains are implicit. As practitioners we are often smug, fully aware of our triumphs. But we must be humble: today's diseases may not exist tomorrow because they have been reclassified rather than cured; today's specialty may not exist tomorrow because it has been divided among others; today's technology may be redundant tomorrow; today's cure may be tomorrow's disease. *Drawing Blood* is first-class history at many levels and can be read with profit and pleasure by the clinician, historian, non-medical scientist, and interested layperson.

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