same time, as Kraut, an American University historian, shows, Americans' xenophobic tendencies (never too deeply buried) were stirred up by contemporary beliefs about the origins of disease. According to the dominant theory of the late 19th century, infections and epidemics were caused by decaying organic matter that provided a hospitable environment for disease-causing "contagia." By popular logic, the damp, filthy tenements where immigrants lived offered a perfect environment for the contagia to flourish. Branding immigrants agents of disease, Americans cried out for measures to protect the public health.

States responded with various quarantine measures, which further stigmatized newcomers as a menace to the national welfare. By the 1890s, American concern over disease-carrying foreigners had reached such a pitch that Congress passed an act requiring immigrants to have physical examinations before departing from their native countries and after arriving in the United States. Those who failed were barred from entry.

The collision of cultures only began at Ellis Island, where an authority-cowed immigrant could be rejected as a mental defective for displaying anxiety in front of the uniformed Public Health Service physicians. Misunderstandings and distrust continued thereafter. American health professionals and reformers tried to preach the gospel of sanitation to immigrants living in overcrowded, unsanitary conditions. But many foreigners chafed at the exhortations of intrusive Americans asking them to abandon their traditions. Preferring to rely on amulets and herbal remedies to cure disease, many immigrants distrusted hospitals ("a place you go to die") and organized American medicine in general ("cold and impersonal").

Yet, as Kraut relates, the history of immigration and public health has some bright spots. The swell of immigration from the 1880s to the 1920s brought improvements in health care for all Americans. Hospital construction boomed. The institution of the "school nurse" came as a boon to all children who were not receiving proper medical attention at home. Yearly physical and eye examinations for schoolchildren became mandatory. And, finally, the infusion of foreigners into the labor force, often in dangerous jobs, forced lawmakers to pass legislation protecting the health of all U.S. workers.

The story that Kraut tells is not completely behind us. The government's classification of Haitians during the 1980s as a high-risk category because of AIDS and more recent worries about foreigners infected with tuberculosis show that some things remain the same.

UNCOMMON SENSE: The Heretical Nature of Science. *By Alan Cromer. Oxford. 240 pp. $23*

The primary stumbling block to scientific progress, says Cromer, has always been the human mind: It cannot naturally perform feats of logical thought. This explains the persistence of belief in animism, spiritualism, and UFOs, and also why, in Cromer's experience, American college students "don't have the critical thinking skills needed to distinguish the fanciful claims of astrology from the extraordinary claims of astronomy."

According to Cromer, a professor of physics at Northeastern University, the unnaturalness of logical thought also explains why science has not experienced a steady progression from the discovery of fire to the unlocking of the atom. Instead, it has followed the bumpy course described by Thomas Kuhn in *The Structure of Scientific Revolutions* (1962): "a succession of tradition-bound periods punctuated by non-cumulative breaks." The ideas of Copernicus, Galileo, and Isaac Newton displaced existing notions precisely because such thinkers came up with revolutionary ways of viewing the universe.

Cromer says that the reason science first appeared in ancient Greece, and that so many advances occurred during the Renaissance, was that people at both times developed the unusual ability to break through "the barrier of egocentricism" that characterizes most human thought. Greek culture, with its emphasis on assembly and a "maritime economy that prevented isolation and parochialism," gave the Greeks an opportunity to test new ideas and discard ones that were useless. Renaissance thinkers, rediscovering Greek ideas through medieval texts, adopted Greek-style methods of learning and thus were able to lay the groundwork for

their own scientific discoveries.

Why is scientific thinking so difficult? Cromer accepts the view of Swiss psychologist Jean Piaget that only people who advance through the four developmental stages—sensorimotor, preoperational, concrete operational, and formal operational—are equipped to handle the complexities of physics or advanced mathematics. In an ideal progression, an individual will have reached the formal operational level—capable of solving several problems simultaneously, able to theorize, and so forth—by adolescence.

Unfortunately, as Piaget himself noted, the only way for people to advance from one stage to the next is through the "accumulation of relevant experiences"—learning the ins and outs of word problems, for instance, or understanding the basis of mathematical proofs. By almost any measure, current American educational methods are not providing these experiences. Cromer's suggestions for countering this deficiency—compressing public education after grade seven into an intensive, two-year "academy" that would develop reasoning skills, and then, after further optional study, admitting the most promising students into college at age 16—are provocative, if full of practical pitfalls.

In the course of *Uncommon Sense*, Cromer demolishes many popular science myths, including the notion that extraterrestrials will visit or attempt to contact Earthlings, or that humankind, given the known laws of physics, will ever develop the capability for interstellar travel. (A moment of silence, please, for the Trekkies in our audience.) Real science, Cromer concludes, will likely find its new frontiers much closer to home: "It is from the fields of molecular biology, brain research, and computer technology that the epochal discoveries of tomorrow will come."

THE ASTONISHING HYPOTHESIS: The Scientific Search for the Soul. *By Francis Crick. Scribner's. 336 pp. $25*

The title is teasing. Has Francis Crick found religion in his old age? The thought is quickly dispelled. His "astonishing hypothesis" is simply that what we call self, consciousness, the psyche, the ego, or the soul can be explored by ordinary scientific means—through brain anatomy, nerve morphology, and the physiology of nerve function. It is "astonishing," Crick maintains, because so few psychologists, neurologists, or neurobiologists have attempted to study consciousness by scientific means, and because the history of religion, philosophy, and popular belief has long separated mind from body in a comfortable dualism.

Crick, who with James Watson discovered the structure of DNA in 1953, is not deterred by the huge gaps in our knowledge. He wants scientists to penetrate the black box we call the mind by considering hereditary pathologies, strokes, brain injuries, single-nerve stimulations, histological analysis of the cortical and thalamic regions of the visual system, and especially experiments using primates and other mammals. How do the neurons in different regions of the brain transmit information to each other? How is the information stored and processed so that we can construct a symbol of the external reality that we then recognize as our reality? Focusing on visual perception, Crick shows that the final representation of how we see the world is the product of much "unconscious" analysis.

Crick's rallying cry for psychologists, neurologists, neurobiologists, and molecular biologists to turn serious attention to the "search for the soul" is much like Erwin Schrödinger's attempt to bring physicists to genetics in his influential *What Is Life?* (1946). While the scientific benefits of this enterprise are indisputable, the further demystification of such qualitative experiences as awe and love does produce twinges of regret. As Crick writes, " 'You,' your joys and your sorrows, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules."