

source allows it to live in larger and more cohesive groups than can humans or *P. troglodytes*.

Furthermore, *P. paniscus* has not yet been observed to hunt monkeys, a behaviour found in *P. troglodytes*. Could it be, the authors ask, that the suppression of personal violence also suppresses predatory aggression? They conclude that "murder and hunting may be more closely tied together than we are used to thinking". In recalling Raymond Dart's emphasis on the predatory habit as "the mark of Cain" separating man from ape, the authors bring us full circle to recurring themes: connecting hunting and eating meat with aggression and war, and vegetarianism and eating herbs with a placid and peaceful nature. The theme was sounded in the story of Cain and Abel and in Robert Ardrey's best-selling *African Genesis* (1961), which introduced a generation of readers to meat-eating 'killer apes' — *Australopithecus africanus* preying on their herbivorous contemporaries, *A. robustus*. Before that we had H. G. Wells's *Time Machine*, in which demonic Morlocks of the distant future dine on the dumb but happy flower-eating Eloi.

In evolutionary science, there are no demons or angels. The capacity for aggression and violence, like the capacity for friendship and peaceful coexistence, exists in most individuals and human cultures, as it does in the apes and other mammals. The authors argue that both species of chimpanzee and humans descended from a violent common ancestor, but it could as easily be argued that both species of chimpanzee descended from a peaceable ancestor such as *P. paniscus*. In either case, our two closest living relatives together express a wider range of behaviours than either taken alone and offer a broader platform for speculating about the early history of our own multiplex genus and species. □

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Also on the dark side

Why is human violence so prevalent in the United States, especially among young single men? In *Violent Land: Single Men and Social Disorder from the Frontier to the Inner City* (Harvard University Press, \$29.95, £19.95), David Courtwright takes the long view of his subject, examining the interplay of biological, social and historical forces. Richard E. Nisbett and Dov Cohen, in *Culture of Honor: The Psychology of Violence in the South* (Westview, \$59.95, £44.50 (hbk), \$12.95, £8.95 (pbk)), conclude that the higher rate of homicide among whites in the southern United States is due to the traditional 'culture of honour', in which a man's reputation is seen as central to his economic survival.

Myths about a polymath

Bernadette Bensaude-Vincent

Arrhenius: From Ionic Theory to the Greenhouse Effect. By Elisabeth Crawford. *Science History Publications: 1996. Pp. 320. \$49.95.*

To many students of chemistry, Arrhenius is just a name attached to an equation. Elisabeth Crawford's biography of the Swedish scientist unveils the face behind the name, and reveals a human being living, loving and fighting against his colleagues. Svante August Arrhenius (1859–1927) is recognized as one of the founders of physical chemistry, but until now there has been no complete biography, and all the published sketches repeat standard accounts of his work formulated by Arrhenius and his brother-in-law.

IMAGE
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REASONS

Arrhenius: expert at promoting myths about himself.

Crawford enjoys a high reputation for her historical studies of the Nobel Institute and of international relations in science. Her familiarity with the Swedish language and culture allowed her to research this new view of the life of Arrhenius the scientist. Crawford provides a fine analysis of Arrhenius's work on electrolytic dissociation and immunochemistry, based on archival material in the Arrhenius Collection at the Royal Swedish Academy. She reconstructs his investigative pathway in some detail, making the technical aspects accessible to lay readers through careful definitions of the terms.

The mythical image of Arrhenius's early career, which he built up after becoming famous for winning the Nobel prize for chemistry in 1903, is subjected to careful scrutiny. In speeches, Arrhenius portrayed himself as a young creative discoverer who became the victim of narrow-minded and conservative colleagues. This was motivated by a key event in his life, the humiliation he felt because he did not receive the highest grade for his doctoral dissertation

— the usual opening to an academic career. (He was awarded only a fourth class, the lowest possible pass.) He then became resentful towards the Uppsala physicists who condemned all attempts at theoretical interpretations.

But in fact Arrhenius's 1884 doctoral dissertation, aimed at determining molecular weights by conductivity measurements, did not contain his theory of electrolytic dissociation and his famous equation, which were established only in 1887. One of the most valuable chapters in the book examines the influence exerted on the development of Arrhenius's theory by Jacobus van't Hoff's memoirs on the law of chemical equilibrium, published in 1886. A popular myth is that the theory of the 'ionists' first met hostility in the scientific community and generated great controversy. Crawford counteracts this with evidence of a contrast between a handful of opponents and the great mobilization of Friedrich Wilhelm Ostwald and the "army of ionists" who, through an active campaign, worked for a wide circulation and rapid acceptance of the notion of permanent ions.

The most original feature of the book is its emphasis on local context and its influence on Arrhenius's scientific style. As a postdoctoral fellow, he travelled in Germany and Austria where he was able to collaborate with Ostwald, Walter Nernst and Ludwig Boltzmann. Although Arrhenius gained an international reputation, he decided to make a career in his native Sweden, which was then on the periphery of the major scientific powers. He succeeded Anders Jonas Ångström at the Royal Institute of Technology in Stockholm where teaching duties were light and laboratory facilities were not up to the usual standards of an academic institution.

In this niche, Arrhenius defined a style of his own. Like Louis Pasteur, he continually changed his field of research. After his trail-blazing contribution to the beginnings of physical chemistry, he moved to cosmic physics where he became interested in cyclical phenomena. He predicted the influence of carbon dioxide in the atmosphere on climate changes — later known as the greenhouse effect — and ventured that this could explain the ice ages. In the 1890s, he tried to apply physical chemistry to the study of the reactions between toxins and antitoxins, became involved in a long controversy with Paul Ehrlich over Ehrlich's theory that certain antibodies had side chains that could bind specific toxin molecules, and eventually positioned himself as the founder of 'immunochemistry'.

Arrhenius became acquainted with new fields of research through informal com-