

Digesting evolution

The Evolution of Obesity

by Michael L. Power and Jay Schulkin
Johns Hopkins University Press: 2009.
408 pp. \$40, £21

The Evolution of Obesity is a fusion cuisine that brings together proximate explanations of weight-regulation mechanisms and the evolutionary reasons for why these can fail. The result is a rich meal that is memorable, if slightly hard to digest. The book is one of the first to use an evolutionary framework to analyse a major body of neuroendocrine knowledge about a specific condition.

By considering the adaptive functions of the physiological mechanisms of weight regulation, Michael Power and Jay Schulkin construct this framework to try to make sense of a huge amount of disconnected knowledge. They are in the vanguard of those who recognize a disturbing fundamental principle: natural selection shapes systems that are nearly indescribably complex. After millions of years of selection and genetic drift, the mechanisms responsible for a particular biological function are so intertwined and multifunctional that no simple description can be accurate.

Attributing one function to a hormone is attractive, but often wrong. For example, the strong correlation of leptin levels with body-fat mass seems to suggest that leptin exists mainly to limit body weight. But its role is not so clear: administering it to people who are obese does not reduce appetite or weight. Low leptin levels signal the need to seek food, but leptin is only one part of the complex system that regulates eating. Power and Schulkin provide the real story: leptin's functions depend "on the tissue, the state of the organism, especially the expression of other information molecules such as insulin, glucocorticoids, and CRH, and also on the age of the organism. Leptin has many functions, which change with time, tissue, and circumstances."

The authors come to similar conclusions for dozens of information molecules that are involved in feeding regulation — including the hormones ghrelin, corticotropin-releasing hormone and cholecystokinin. Although their conclusion about the complexity of systems shaped by selection will distress readers who want a simple story, it is profound beyond the realm of weight regulation. Power and Schulkin argue that a full understanding will come only from "integrating the reductionist methodology into a more all-inclusive approach".

The book covers nearly all the main issues in

obesity research. Geneticist James Neel's theory of the 'thrifty genotype' — shaped to store fat to cope with food scarcity — receives a full critique. Similarly detailed is the authors' treatment of new suggestions that thrifty phenotypes might be induced in developing embryos whose calorie intake is limited. They discuss adipose tissue, where fat is stored, as an endocrine organ that secretes at least ten information molecules, and describe the role of cytokines as mediators of the tissue damage associated with abdominal obesity.

The epidemiology of the recent obesity epidemic — manifesting as a threefold increase in obesity in the United States in just 50 years — is covered well. In an insightful section, Power and Schulkin ask why humans eat meals instead of feeding continuously. They eruditely connect explanations from behavioural ecology with the brain mechanisms responsible and with the social functions of sharing meals. Changes in diet since the Palaeolithic era are reviewed carefully, as are the interactions between meat eating and brain evolution.

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Most books on obesity are heavy on opinion and light on facts. *The Evolution of Obesity* is the reverse. I wanted to hear the authors' considered views on the relative contributions of fructose-based beverages, exercise and other factors to the obesity epidemic. They might also have discussed in more depth how mechanisms that limit body weight are shaped by selection forces. The authors mention the increased rates of predation for heavy, slow individuals, but they do not analyse other trade-offs, such as

the risks associated with increased foraging time, the caloric costs of maintaining extra weight or the costs of those calories not being available to kin.

The ingredients in *The Evolution of Obesity* are somewhat unbalanced, favouring proximate over evolutionary causes. Yet the book goes far beyond anything else that is available on obesity. Power and Schulkin deserve much credit for their bold attempt to combine evolutionary and reductionist explanations, and for their unflinching acknowledgement of complexity. ■

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Mathematical memories

The Housekeeper and the Professor

by Yoko Ogawa. Translated by Stephen Snyder
Harvill Secker/Picador: 2009. 192 pp.
£11.99/\$14

The Housekeeper and the Professor does for number theory what Jostein Gaarder's best-seller *Sophie's World* (Aschehoug, 1991) did for the history of philosophy, but with a far lighter touch. The narrator, ignorant of mathematics, becomes a surrogate for the average reader as the recipient of a great deal of detailed information. It is indisputably a novel, but it is unapologetically educational.

The Professor is an elderly mathematician whose memory lasts only 80 minutes, as a result of a head injury in a car accident in 1975. Everything that happened before his injury, including his vast grasp of number theory, remains in his mind, but every 80 minutes he has to start all over again.

With his amnesia being understandably hard on the people around him, the Professor is stashed in a cottage on his sister-in-law's

property. He has gone through nine frustrated housekeepers by the time the eponymous one is called into service. The Professor's suit is blanketed with hand-written notes to help him navigate the world, the most crucial of which says "My memory lasts only 80 minutes." Soon, a sketch of the new housekeeper joins the hundreds of other attached scraps, proving useful when she has to introduce herself every morning. Within minutes of their first meeting, the Professor starts to share his love of mathematics with her, and then with her son who joins them after school.

The Housekeeper, who like the Professor remains unnamed throughout the novel, is no ordinary servant. Possessed of intelligence, a keen curiosity and tremendous empathy, she is soon fascinated by her charge and surprisingly receptive to the Professor's lessons, as is her son. It helps that the Professor is an eloquent and skilled teacher. In one memorable scene, he likens the search for very large prime numbers to a quest through the desert wastelands. The Housekeeper has a vivid imagination and personifies the concepts: primes, in resisting division by any number other than