Sherratt's personal entries in the two traditional sweepstakes in later European prehistory: "What caused Neolithic megaliths?" and "Who were the Indo-Europeans?".

The entire volume stands as an attempt to live up to Sherratt's general conclusion: "To succeed in his or her trade, the prehistorian must always be a generalist." In Sherratt's case, the effort is clearly successful. The scenarios are imaginative and have impressive depth, and the evidence is clearly marshalled. Even when disagreeing with the approach or conclusions, one can learn a tremendous amount. □

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No laughing matter

The Trembling Mountain: A Personal Account of Kuru, Cannibals and Mad Cow Disease
by Robert Klitzman
Plenum: 1998. Pp. 300. $27.95, £16.94

Colin L. Masters

The outbreak of kuru among the Fore people of Papua New Guinea that climaxed in the mid-1950s has many potential lessons for contemporary UK society, as it tries to understand the emergence of a new variant of Creutzfeldt–Jakob disease (CJD), linked with the recent outbreak of bovine spongiform encephalopathy (BSE, or 'mad cow disease').

Robert Klitzman's breezy narrative account of his fieldwork experiences in 1981 joins a growing list of monographs aimed at the wider community, notably *Fatal Protein: The Story of CJD, BSE and Other Prion Diseases* by Rosalind Ridley and Harry Baker (Oxford University Press, 1998). With varying degrees of success, these accounts convey the unprecedented effects of a devastating, infectious neurological illness, either in the setting of a Stone Age pre-scientific culture (the Fore) or in the technological sophistication of modern Europe (the British). With kuru, the Fore reacted with claims of sorcery, hysterical conversion reactions and retaliative armed conflict. With the emergence of BSE and new-variant CJD, the British went through phases of denials, cover-ups and trade embargoes while the daily tabloid newspapers conducted their contemporary versions of hysterical reportage.

Klitzman's retelling of the kuru saga lacks the authoritative analysis one would have expected from an academic psychiatrist. But at the time of his first visit to Papua New Guinea, he was a naive Jewish boy from Long Island, New York, trying to decide on a future career in medicine. As a young college graduate, he had fallen under the spell of Carleton Gajdusek at the US National Institutes of Health, and travelled to Papua New Guinea to work with Michael Alpers in recording the disappearance of this infectious disease.

Although the transmissibility of kuru through cannibalism had been well established, there remained many unanswered questions, particularly relating to the mechanisms of transmission (route and dose of inoculum) and the effects of genetic susceptibility. For example, were those who escaped infection participants at cannibalistic feasts at which they (the "natives"; Klitzman is very fond of this term) had eaten only the fingers and feet of the deceased? Klitzman searched and found examples of common point exposures with subsequent development of disease. He discovered the difficulties of doing fieldwork in kuru epidemiology where dirt roads were only just beginning to open up, most travel was on foot, and he was dependent on the cooperation of local guides whose senses of time and purpose were superficially different from those of a young New Yorker. ("The natives were skilled at getting what they wanted… They, too, were greedy, scheming, and deceptive when necessary.").

Seeking stability: in the language of the Fore people, the word *kuru* means 'to tremble'.

Themes of cultural diversity and evolution, the impact of western technology and the infusion of scientific endeavour into a rapidly changing Stone Age culture, which are clearly set out in the Gajdusek diaries and field notes (*Kuru: Early Letters and Field-Notes from the Collection of D. Carleton Gajdusek* by J. Farquhar and D. C. Gajdusek; Raven, 1981) fail to be conveyed by Klitzman's first-person narrative style. Although more compelling than the semi-fictitious recollections of Vincent Zigas in *Laughing Death: The Untold Story of Kuru* (Humana, 1990), Klitzman's account is aimed at his fellow New Yorkers, most of whom have never heard of kuru, CJD or BSE, let alone Papua New Guinea.

There are surprisingly few first-hand accounts of the kuru story. During the next decade, when the full implications of the BSE crisis in Britain become known, it will be possible to look back on the emergence and

Bamboozled by habitat loss

Deforestation leaves giant pandas isolated and with nowhere to go when bamboo, their staple diet, periodically dies. Renowned photographer Heather Angel visited China to capture these endangered animals on film. The results can be found in *Pandas* (Voyageur Press, $16.95).

disappearance of kuru as an important episode in our understanding of the risks associated with this type of infectious process. Informing the wider community of these risks may lead to a more helpful debate about the public health policies required to minimize the chances of another BSE epidemic. Books such as this are useful in this context. □

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The making of a biochemist

Otto Warburgs Beitrag zur Atmungstheorie: Das Problem der Sauerstoffaktivierung*
by Petra Werner
Basilisken-Presse: 1996. Pp. 390. DM136

Mikuláš Teich

The biochemist Otto Heinrich Warburg (1883–1970) was a name to conjure with in the days before molecular biology. In 1908 he began to investigate — in part with Otto Meyerhof — the respiratory activities of various materials, such as sea-urchin eggs, avian erythrocytes and liver tissue. His experimental results led him to surmise that cellular oxidation was linked to the catalytic activity of iron in cells.

After returning from the First World War, Warburg continued with his studies of respiration using cancerous tissue, and improved the manometric method of gas analysis. His starting point was that cellular respiration was a cyclic reaction. Oxygen combined with iron to produce higher-valency iron, which reacted with oxidizable organic material and in so doing returned to the bivalent state. Warburg might have obtained the idea of the cycle from Meyerhof, who in 1919 and 1920 studied chemical changes occurring in muscle in relation to the work done or the energy liberated as heat. Meyerhof visualized the breakdown of carbohydrate to lactic acid as the anaerobic phase, and the synthesis of carbohydrate as the aerobic phase, of a 'specific carbohydrate cycle'.

Warburg's investigations of artificial iron-containing systems, which were presumed to be analogous to reactions occurring in living cells, satisfied him that iron functions as the oxygen-transferring constituent of a ubiquitous cellular catalyst, which he named *Atmungsferment* ('respiratory ferment'). He was a most inventive experimenter. Among the artificial systems that he studied were the oxidation of amino acids by haemin charcoal, and the inhibition of oxygen uptake by cyanide and urethane.

**Otto Warburg's Contribution to Respiration Theory: The Problem of Oxygen Activation.*

In the late 1920s, he looked into the effect of light on the inhibition by carbon monoxide of respiration in living cells. This work encompassed considerations of photochemical processes in terms of quantum chemistry, and the use of the manometer, photoelectric cell and spectroscope. From the shape of the curve obtained by plotting the effectiveness of light against its wavelength, it was possible to deduce the resemblance between the respiratory ferment and haemins. Warburg was awarded the Nobel prize for physiology or medicine in 1931 for his recognition of the haemin-type nature of the respiratory ferment and its underlying principles.

The development of Warburg's theoretical thinking and experimental procedures are ably chronicled in Petra Werner's introductory essay. Her book is the first volume of an edition of Warburg's correspondence deposited in the Berlin–Brandenburg Academy of Sciences. Regrettably, the 143 published letters covering the period 1906 to 1939 include only 14 by Warburg, all of which were to Jacques Loeb. Warburg's early work was strongly influenced by Loeb's book, published in 1906, which dealt with artificial parthenogenesis and the nature of fertilization in thoroughly physicochemical, reductionist terms. Loeb immediately recognized in Warburg a kindred spirit, and was prepared to get him a grant from the Rockefeller Institute to work in his laboratory, and to help him settle in the United States. Before and after the First World War, Loeb — an early emigré from Germany as a result of his experiences of anti-Semitism in the academic world — befriended not only Warburg, but also Meyerhof and Leonor Michaelis, who contributed to the development of a mathematical theory of enzyme processes. This emerges from Loeb's letters to the two scientists, which are also included in the book.

Outstanding as Warburg was as a scientist, even his admiring Nobel prize-winning research students, Hans Krebs and Hugo Theorell, realized that he tended to pettiness. There can be little doubt that this fuelled his resentment of Meyerhof, who, with Archibald Vivian Hill, won the Nobel prize for physiology or medicine nine years before Warburg for work on muscle metabolism. Werner also refers to Warburg's selective approach to history in two retrospective monographs: "he cited only Nobel prize winners or widely known persons... and left others out; thus, later he never mentioned the name of Jacques Loeb. This retrospective account submerged historical reality beneath an embellished, teleological presentation."

The English version of Warburg's first publication appeared as *Heavy Metal Prosthetic Groups and Enzyme Action* (Oxford University Press, 1949) and was critically reviewed by David Keilin (*Nature* **165,** 4–5; 1950). In 1925, Keilin demonstrated the reversible oxidation and reduction of a pigment, which he named 'cytochrome', in the thoracic muscles of the adult fly *Gasterophilus intestinalis*. This was a crucial event in the history of biological oxidation and helped lead to the interpretation of cell respiration in terms of a sequence of reactions driven by oxidation and reduction (the 'respiratory chain'). That Keilin's achievement did not earn him a Nobel prize was, I think, a notable omission. It is unfortunate that his name crops up just once in the book.

That said, the book is an important source for studying the development of the chemistry of life from about 1900 to 1930. □

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Brilliant but flawed: Warburg tended to pettiness.

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