book reviews

Life at the extremes: the science of survival

by Frances Ashcroft. London: HarperCollins, 2000. 326pp. £17.99.

This book is fascinating. It is a work of science which explains how man and animals cope with extreme physiological stress – the former sometimes adding technology to remarkably broad capacities, the latter using nature alone. From an initial training in zoology, the author has progressed to a Chair in physiology at Oxford, and Fellowship of the Royal Society. Now, she uses the expertise that she has gained en route to great effect, to guide us through the physiological responses to the entire breadth of different environments. Starting with altitude, she describes the mechanisms that allow mankind to climb Everest. Then she moves to depth and diving medicine and on to heat and cold. The journey then deviates slightly from the environmental theme to address the physiological issues that underlie athletic performance – speed, power and endurance. Then it is out into the truly difficult environment of space before a final chapter arguably visits more hostile places still – the extraordinary settings of organisms such as tube worms that live in boiling, pressurised sea water and which sustain life through novel chemical reactions. She even tells the tale of an organism that has taken up residence in battery-strength acid – our now old friend H pylori.

Her accounts of basic physiological mechanisms are marvellous. The style is light and reader-friendly and provides evidence of a rare beast – the professor of science who can write plain English. This simplifies understanding complex integrative functions, a far cry from the struggle that many of us remember from medical school. But the real delight of the book is not the formal descriptive science but the pages filled with unexpected anecdotes, facts, and snippets of information. These illuminate both the history of physiological investigation and the personalities who led the work. In many cases they also include descriptions of extraordinary experiments in which these workers acted as their own guinea-pigs to move science forward. In 1620 a Dutch alchemist living in London, Cornelius van Drebbel, travelled submerged from Westminster to Greenwich in the world's first submarine. To do so, he probably utilised heated potassium nitrate as a source of oxygen. At the end of the eighteenth century, the Secretary of the Royal Society decided that he should sit in a room heated to 105°C for 15 minutes whilst the steak and eggs that he took in with him were cooked to a crisp. And then there are tales of expeditions and survival situations which have sometimes illustrated our remarkable physiology by accident, my own crossing of Antarctica on foot amongst them. Finally, there are some thought-provoking insights. It had never even occurred to me that the reason for the ancients' belief that Gods lived up big mountains might have been that as they ascended they became inexplicably breathless. Ashcroft suggests they had a straightforward explanation – they assumed that they were being poisoned to prevent pressures on the deities from unwelcome visitors.

She uses serious writing mixed with the 'bran-tub' approach when addressing the physiological capacity of animals. Fascinating facts are interspersed with careful description; some of the facts are frankly staggering. How does a flea generate accelerations of more than 200*G*, and why do sperm whales never get the bends? There is even an account of a species of wayward spider which lives under water by weaving a dense, air-tight, web. It then fills this diving bell with air that it ferries from the surface, swimming down with bubbles beneath its back legs.

I did wonder at whom the book is aimed, but it scarcely matters. Whether you are relatively expert in the field (myself on heat, cold and exercise) or know little about the topic (myself on many others) Ashcroft's meaning is always clear. The book can be enjoyed by scientists and general readers, and I would particularly recommend it to blasé teenagers. Everyone who takes it up will enjoy it and learn. They will also find themselves dipping in and out, reading a line, a paragraph or a page, and will almost invariably seek someone to share it with. It is that much of a delight.

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The matter of motion and Galvani's frogs

by B Innes Williams. Bletchington: Gava, 2000. With Foreword by A Rupert Hall and Preface by Peter Williams. 298pp. £25.00.

There is no full-scale biography of Luigi Galvani, an individual known not just to scientists and historians who remember him for giving his name to the 'galvanometer', but also to the general public who are familiar with the word 'galvanise'. His own *magnus opus* was *De viribus electricatis in motu musculari commentarius*, published in his native Bologna in 1791. Scholars seeking further information about him might consult JL Alibert's eulogy published in Paris in 1806, and during the 20th century there were writers such as H E Hoff who have analysed his contributions to electrophysiology, Giulio Pupilli who wrote an introduction to an edition in English of *Commentarius* and J F Fulton and Harvey Cushing who produced a bibliographic study of animal electricity. Dr B Innes Williams' *The matter of motion and Galvani's frogs* therefore fills an important lacuna in the literature of medical history for whilst it is in no way a formal biography, it is the only study in English which examines in detail the work of Galvani.

The book is in two parts. The first nine chapters are derived from notes made by Dr Williams on ideas of motion from the ancient Greeks, who sought to distinguish motion in man and animals from the motive power of the wind or of streams seeking the sea. Whilst this section of the work is interesting and well referenced, it is in no way comparable to the second part, which deals with Galvani himself, the state of knowledge when he began his experiments in Bologna in the eighteenth century and his own experimental work. There is an excellent assessment of what biochemists such as John Mayow, or anatomists represented by Thomas Willis, thought in the years that preceded Galvani's work. The significance of Newton's ideas and particularly those of the American philosopher and sage, Benjamin Franklin, on electricity are carefully set out. But it is the assessment of how Galvani came to study how electric impulses influenced muscular contraction that is the great strength of this book. Dr Williams quotes from sources in at least five different languages, illustrating an unusual intellectual facility in one who was brought up as a physician, became an eye doctor and only came to medical history in her forties. A particularly interesting feature of her work is her repetition in the laboratory of Galvani's exact experiments, an approach which may owe something to the influence of one of her PhD supervisors, the late Dr Edwin Clarke, who thought it important to repeat experimental work of the past using similar instruments to those of that era.

Dr Williams has produced a remarkable book which has been prepared for the press by her husband, Peter Williams, lately Director of the Wellcome Trust. He writes in his preface that he wanted to have a number of copies published privately for deposit in libraries for the possible use of future scholars. He is too modest. This book should have a wider readership.

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