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Turkel, William J., *Spark from the Deep: How Shocking Experiments with Strongly Electric Fish Powered Scientific Discovery*. Baltimore: Johns Hopkins University Press, 2013. Pp. xi + 287. ISBN 978-1-4214-0981-8. £22.50 (hardback).

What does electricity look like? In all but the most extreme contexts (lightning, for example), this might appear to be something of a meaningless question. The benign electricity of the modern, western world does not really look like anything; we experience its effects in a domestic setting in the sights and sounds of appliances, yet these audio-visual phenomena are best described as the effects of electricity at least once removed. They are also, as William J. Turkel notes in his introduction to *Spark from the Deep*, ubiquitous; electricity is the constant, unchanging force underpinning and stabilising human existence. While much excellent scholarship to date has concentrated on electricity in its domestically tamed form from the mid-nineteenth century onwards, such as Graeme Gooday's *Domesticating Electricity*, it is refreshing to explore a book which takes seriously ancient encounters with manifestations of natural electricity as precursors to more recent innovations. Indeed, Turkel attempts to make a still stronger argument: that the histories of humans and strongly electric fish owe much to one another.

Fittingly, *Spark from the Deep* takes as its basis the ecology of 'strongly electric fish' – a phrase which reappears throughout the book as a reminder that we are reading about a powerful force – starting with the strongly electric African catfish. Turkel places a great deal of importance on the physiological and anatomical features of fish, and they are a key driving force throughout the narrative. We are taken across continents, civilisations and medico-scientific ideologies, and at every turn our attention is focused towards encounters between humans and strongly electric fish, whether in the rivers of South America or the

regulated laboratory conditions of Emil Du Bois-Reymond's Berlin-based Physiological Institute.

Early investigations into the apparently unique ability of strongly electric fish to shock people with whom they came into contact centred on two major questions: what was the nature of such shocks and what features of the fish in question enabled them to produce these? Observations about the circumstances under which fish shocked (through direct or mediated contact) or did not (when cooked and eaten) led to various hypotheses for the mechanism of action and the nature of electricity as substance or force. These encounters in the wild, Turkel notes, were relatively sparse until the nineteenth century, when systematic expeditions set out to investigate the habits and physiology of strongly electric fish in a more co-ordinated manner. The practical difficulties which attended such endeavours, however, were numerous: sensitive equipment was far from suited to the natural habitat of the objects of study, and these animals also presented hazards to those who sought to demystify their electrical powers. Individuals such as Du Bois Reymond and, earlier, Michael Faraday appropriated strongly electric fish for the purposes of laboratory research, actively putting researchers into contact with their experimental subjects to 'gauge the intensity of the shock' (p.146). Experiments such as these led not just to practical improvements in apparatus such as the galvanometer, but also the strengthening of metaphorical ties between activity within the human body and that of non-human animals.

The advent of increasingly electrical understandings of the human body – and here Turkel echoes the intriguing electrophilic scientists of the early twentieth century by claiming that 'all life is electric in the sense of being held together by electromagnetic forces, powered by electrons, and sensitive to electric fields and electromagnetic radiation' (p.209) – gave our relationship with animals which exhibited such properties spontaneously new

meaning. Experimental research tools – themselves inspired in a large part by encounters with strongly electric fish and their potential as laboratory subjects – were further refined in the twentieth century, unlocking diverse potential areas of research by using electrocytes (electricity-generating cells) to treat a range of conditions which display neurological or muscular defects.

Spark from the Deep is a beautifully-written account of our historical relationship as humans with strongly (and, less significantly perhaps, weakly) electric fish. Turkel is successful in linking together our attempts to elucidate the mechanism of action and potential applicability of these natural sources of electricity, and reminds us that the electric world which we now inhabit has been greatly influenced by natural encounters. His claim, stated early in the book, that the fascination with electricity in nature led us to attempt various forms of imitation – biomimicry – is rather less persuasive in this strong form. Whilst the fascination with strongly electric fish has certainly informed our priorities of investigation, we have sought to understand and harness, rather than understand and recreate. In this sense, the transformation of knowledge gleaned from strongly electric fish into the electrical systems on which we are now reliant is the key contribution which this highly engaging and chronologically broad book brings to the history of science. For Turkel, electricity looks like the multiple historical experiences of humans when encountering strongly electric fish: a powerful and transformational occurrence which has stimulated new ways of thinking about both the natural and the man-made world.

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