Book

Eve Marder: the world is her lobster

In the late 1960s, neuroscientists aiming to understand how the human brain worked were searching for a simpler network of neurons to study; one that reliably activated a stereotypical response, in which they would be able to identify the sensory nerve that detects the stimulus and the neural interchange that passes the message to a motor nerve. The stomatogastric ganglion (STG) of crustaceans fitted the bill particularly well as it is an independent network with a countable number of neurons (about thirty), a simple single input nerve, and an output to accessible stomach muscles. It is in this context of early scientific discovery that Charlotte Nassim explores the life of neuroscientist Eve Marder in her book, *Lessons from the Lobster: Eve Marder's Work in Neuroscience*. Apart from access to colleagues, whose recollections feature throughout, and Marder herself, Nassim also had access to her lab notebooks (all 896 of them) as she attempted to piece together the making of this neuroscience luminary.

The combination of an outstanding biology teacher in high school, a chance assignment in her senior year at Brandeis University (Waltham, MA, USA), luck, and good instincts led Marder (the self-described hippie chick) in the late 1960s to the lab of Allen Selverston, her eventual PhD supervisor at the University of California San Diego (San Diego, CA, USA). There, she ambitiously decided to enumerate definitively the neurotransmitters used in the STG of the lobster. It transpired that the thirty-odd neurons used only two neurotransmitters, acetylcholine and glutamate, although the work required to eliminate all others was no mean feat. However, it became clear that neurons were also influenced by other substances termed neuromodulators, and so started her career—so far spanning 40 years. After her postdoc work, she sought an informal research environment and relative freedom to work and, despite an offer from Cornell University (Ithaca, NY, USA), chose to return to Brandeis, where she remains to this day.

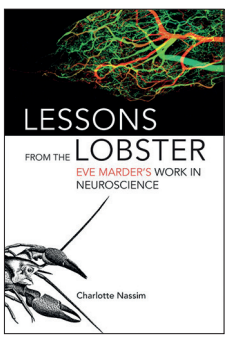
Starting from her formative early life and school years, *Lessons from the Lobster* traces Marder's career, beginning with her relatively simple question about neurotransmitters; each new finding about the STG seeming to raise more questions than it answered. Nassim describes the painstaking nature of the dissections and preparations, the skill needed to make the fine glass electrodes (an essential tool of the electrophysiologist), and the late nights toiling in the lab. Marder's approach was always multidisciplinary, almost before the word was first coined; as Nassim notes, she seems to have an ability to sniff out like-minded "smart people", and has a "talent for exciting people intellectually". During her career, she has collaborated with mathematicians, chemists, computer scientists, and perhaps most notably Larry Abbott, originally a particle physicist. Together they developed the dynamic clamp method, which allows observation of neurons responding to computer-calculated inputs using feedback from the neurons' responses, and which is now a ubiquitous tool in electrophysiology.

Eschewing the convention whereby hypotheses are formed and then experiments done to prove or disprove them, Marder does not construct elaborate theories. Instead, she relies on the data, which she believes contain the answer, or at least the next question; as she puts it, "let the data speak, let the data drive the questions". Marder's work on the lobster continues in light of new understanding of the genetic and molecular basis of cell organisation, optogenetics techniques, and developments in the processing power of computers; however, much work remains to be done linking the small lobster neural network to human neurology before clinical applications become possible. Nevertheless, Marder expects that understanding how network behaviour depends on specific cellular mechanisms will be relevant to neural circuits of all sizes.

Nassim's "best of compilation" of Marder's career, viewed collaboration by collaboration, along with the associated papers, as her ideas and career developed, is an effective approach, although one which could have been a little heavy-going. However, Nassim has skilfully translated the science for the non-specialist and it is worth persevering with the more technical passages; there are lessons here indeed and they are not all to do with lobsters. Nassim describes her book as a "thought biography", based around Marder's work. As such, it is both a detailed account of how science is (and was) done as well as, perhaps, a template for anyone interested in a career as a neuroscientist, electrophysiologist, biologist, or indeed, any type of scientist. Marder is a gifted example of all of these, but even she has had her fair share of frustrations, which might strike a chord with fellow scientists. For example, the all too common, chauvinistic attitude of male colleagues in the early days, the home-spun and often unreliable lab equipment in the precomputer era, a crucial proofreading error on a published paper, and the rejection of papers by top academic journals.

Today, an influential and respected neuroscientist, Marder is also an inspirational teacher and mentor. Directly addressing readers considering a career in science, particularly female readers, Marder signs off her Foreword with words that give insight into her motivation: "The thrill of seeing and understanding something, be it small or large, that no one has ever seen before is incomparable, and I wish it to all of you."

Chris Wortley



Published **Online**
October 8, 2018
http://dx.doi.org/10.1016/S1474-4422(18)30372-7

Lessons from the Lobster: Eve Marder's Work in Neuroscience
Charlotte Nassim
The MIT Press, Cambridge, MA, USA, 2018
Pp 244. £22.00
ISBN 978-0-262-03778-5