

BOOK REVIEW

Portraits of the Mind: Visualizing the Brain from Antiquity to the 21st Century

By Carl Schoonover

2010 Basic Books, 240 pages

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If there were ever a television series on nerdy hoarding, I might be a candidate for an episode. For at least 15 years I have kept a manila folder in my office file cabinet titled, "cool brain images." That folder expands regularly as I stuff in more and more pages torn from journals depicting neurons imaged by various techniques. These images, mostly fluorescent micrographs, have been getting visually more spectacular over the years, facilitated by exciting technical advances in microscopy and fluorescent proteins. Within that same folder, I also stashed a handful of historical depictions of the brain, reproductions of hand drawings by scientists in previous centuries such as Gall's phrenology maps and several of Cajal's important anatomical interpretations of the neurons he saw through his microscope. I like to believe that the classic and contemporary neuroanatomists would be pleased to know their work was cohabitating.

In late 2010 when Carl Schoonover published *Portraits of the Mind* I was simultaneously disappointed and thrilled - disappointed that I had not been smart enough to create this book from my manila folder, yet thrilled to learn I was not the only hoarder of brain images. (In fact, Schoonover's collection included a stage far more portable and public than mine; he carried favorites in the plastic photo sleeves of his wallet, an impressive demonstration of admiration and affection for images of neurons.) It is easy to understand how Schoonover became enamored with images of neurons and brains because he was an eyewitness to an important moment in neuroanatomical history. As an undergraduate in Josh Sanes's lab at Harvard, he was one of the first few people on the planet to see and appreciate the unusually spectacular images of individually colored neurons produced by the Brainbow technique developed there and its power to reveal individual neurons within complex circuits. In this book, Schoonover also found meaningful ways to link classic drawings of brains from previous centuries with the modern imaging technologies in a product that is far more effective and comprehensive than my ragged folder.

In *Portraits of the Mind*, published while he was a graduate student, Schoonover masterfully curated a collection of many of the most stunning and important images created by neuroscientists over the centuries. While any practicing neuroscientist could suggest important images to augment the collection, its breadth in both time and technique is together coherent and impressive. Reader reviews have referred to *Portraits* as a coffee table book because the formatting unquestionably resembles a catalog highlighting examples from a very large and broad art collection. The nearly one hundred

images are maximized on the pages and each accompanied by a few paragraphs of explanatory text nearby. The book is organized partially chronologically and partially by technique with images representing important highlights of neuroanatomical research both past and present.

Portraits starts with a short chapter that includes the oldest known depiction of the visual system from Egypt then moves to classic anatomical drawings by da Vinci, Descartes, Vesalius, and Golgi. Not surprisingly, Santiago Ramón y Cajal's work earned him a solo chapter. Cajal's iconic drawings are familiar to many neuroscientists because these images founded much of our current understandings of cellular morphologies and circuitries in the nervous system. The chapter ends with an important photomicrograph of Cajal's raw data, a Golgi-stained tissue sample that helps the reader understand how these stained brain slices gave rise to his ink drawings. The next chapter is titled, "After Cajal" marking his pivotal before and after role in the history of neuroanatomy as well as the shift from drawings to photography in documentation methods. The majority of the book considers the brain in the post-Cajal period with one chapter flying through visualization techniques such as dyes, fluorescent proteins, immunostaining, and *in situ* hybridization, all born in the 20th and 21st centuries and widely deployed in contemporary neuroscience labs. The next chapter features microscopy techniques from transmission and scanning microscopy to confocal to recent developments in super resolution microscopy (which will undoubtedly justify more consideration in a second edition). Schoonover smartly broadens the term "portrait" beyond the obviously striking visual images to include a short chapter featuring data from physiological recordings of neural activity such as action potentials and EEGs. These images may not be as readily appreciated because they are not as visually charismatic as multi-color immunostainings, yet their importance in revealing brain function is unquestionable. The chapter includes a single example of optogenetics, another technique that will also need to expand considerably, given how powerfully optogenetics is permitting new functional analyses of signals, circuits, and behavior in the years since *Portraits* was published. Subsequent chapters examine brain circuitry and continue to mingle structure with function. These chapters include images gathered by a diverse array of approaches including connectomics, simulations, and medical imaging. In short, the contents ensure that the general reader will find some images captivating enough to read the explanatory text while at the same time neuroscientists will

undoubtedly find images that resonate with personal experience and interests.

The audience for this book appears to be a general reader who may not bring a scientific background. The colorful pages invite readers to flip through the diverse array of images at will, passing and stalling on specific “portraits” as their eyes dictate. The supporting text for each image is written in accessible language that includes modest explanations of the technique(s) and obvious credit to the scientist(s) who created each image. The book is likewise a delightful treat for a neuroscientist because the images are both beautiful and significant; the text for each image, while accessible, remains useful and informative even though it is not comprehensive. It is also important to note that Schoonover’s voice is not alone in this book. Most chapters include a short and lively introduction authored by an active neuroscientist. These introductions similarly avoid jargon and convey enthusiasm, explaining first-hand why seeing the brain from multiple perspectives is an important part of attempting to understanding the mind.

Portraits received tremendous attention from high profile publications such as the *New York Times*, *Science*, and *Nature* when it debuted. Moreover, there are several interviews and a 2012 TED talk by the author easily accessible online. Consequently, an additional review at this time in *JUNE* may seem trivial. I feel compelled, however, to comment on *Portraits* here not only for reasons articulated by previous reviewers, but because it is a book that is particularly amenable to undergraduate neuroscience education. As examples, I now use *Portraits* as an important resource in my Light Microscopy course because it serves as an accessible and engaging introduction to many of the techniques my undergraduates learn and perform. I frequently assign a page in *Portraits* that illustrates a striking example of a technique as an approachable and quick introductory reading to be followed by an article from a methods publication that is necessarily technical, but rarely friendly or inspiring. At the end of the semester I ask each student to create a curated (and sometimes themed) portfolio of the microscopy images that they generated throughout the course. For this capstone assignment, Schoonover’s book also provides an unusually rich, useful, appropriate, and accessible example of their goal that they have been enjoying all along. I particularly like to point out that the author was a graduate student only a few years beyond them when he published the book. I was tickled to learn that some of my students were posting images they created for their portfolios on Facebook, something akin to Schoonover’s wallet photos. On other informal fronts, I also recommend the book as a coffee table book for the lab – I have left my copy on the lab bench and found research students flipping through it when they have a few minutes between rinses. I have also used *Portraits* as a fitting gift for departing students or research technicians from our lab (sometimes augmenting or displacing Cajal’s *Advice for a Young Investigator*, my previous go-to book for such occasions).

I recognize that I am using Schoonover’s book as a text in an undergraduate course in ways that the author likely

never intended (though I suspect he would support). In this context, I do offer two small suggestions for making a subsequent edition more useful to young scientists without compromising its many strengths for other audiences. First, scale bars are entirely missing from the images, understandably omitted to encourage reader focus on the art of the image rather than the annotation of the science. Because the image collection traverses multiple scales of analysis, I find this lack of scale can make it difficult for a reader who is not familiar with the structures or techniques to get a sense of the magnification with which these images are portraying the brain. Second, selected references and suggested readings need to be included even if in footnotes. The book provides little specific direction for a curious reader who desires to understand the context of the research beyond what is presented in either techniques or research findings.

In summary, *Portraits of the Mind* is far more than a coffee table book – it works well on the lab bench and in the classroom as an enchanting way to engage both scientists and non-scientists in the beauty and wonder inherent in the quest to understand neurons, brains, and minds.

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