

faculty spotlight

Professor Jeff Lichtman, Center for Brain Science

By Katie Ransohoff and Susan De Wolf

From the microscope next to his desk to the myriad of textbooks aligning the walls, one immediately realizes upon entering his office that Professor Jeff Lichtman believes that science is a hands-on profession. This approach, he says, is something that comes innately from his curiosity about the mind and neurobiology: he confirmed that working in the lab and interacting directly with students is an absolutely necessary component—as well as the highlight—of his quotidian routine.

As an undergraduate at Bowdoin, Professor Lichtman recalls that neurobiology was just emerging as a distinct field. The first neurobiology department in the country, the Department of Neurobiology at Harvard Medical School, did not appear until the 1970s and the field remained significantly underpopulated throughout the world for quite some time. So what was it about neurobiology that drew Professor Lichtman in? “It was so deeply mysterious,” he said, with “so many unanswered basic questions,” leaving plenty of room for exploration and discovery. “The field grew up with me,” he said. He noted the key roles of his early mentor, Dale Purves, now Director of the Center for Cognitive Neuroscience at Duke University, in coalescing this new area of investigation. It was under the tutelage of Dr. Purves that Professor Lichtman began looking at the specificity of wiring in the nervous system, ideas that he says that still guides his work and thinking today.

The central question motivating Lichtman’s earliest research focused on the specificity of the wiring of the nervous system in early development. His first project analyzed how the precise pattern of neuronal connections in the rat submandibular ganglion is established in development. This is the region of the peripheral nervous system responsible for triggering the release of rodent saliva. He vividly recounts the thrill of this early success, the joy and awe of his first moments of scientific discovery—of seeing something no one else in the world had ever observed even though it was in a relatively unimportant and obscure part of the nervous system.

Lichtman’s particular interest in the flexibility, also called plasticity, of neural connections throughout early development stems from the fact that perhaps the most unique feature of homo sapiens as a species is our uniquely protracted childhood compared to other animals on

earth. This lengthy period of immaturity affords humans the unique opportunity to “take in information before we crystallize out,” explained Lichtman, enabling the development of complex cognitive adaptations that later allow for maximal functional success in a given generational context. Humans may be slow mature, but out extended developmental period is what engenders our tremendous complexity.

Professor Lichtman’s current research is unusual in two respects—firstly, he focuses on the peripheral nervous system, rather than the central nervous system. He finds that the peripheral nervous system presents a way to explore neural wiring in a less-complicated, though still wonderfully intricate, state, and that the knowledge gained from studying the peripheral nervous system can hopefully be extended to the understanding of the central nervous system. Secondly, Lichtman’s projects rely most on pure observations rather than specific experimental manipulations, enabling direct

examination of the innate properties of the undisturbed organism. On observation, he describes that if you “let the animal do the talking, it will tell you something you weren’t even looking for.” Observation affords

unparalleled opportunity for new discoveries because the search for new knowledge is based on the unexpected and uncharted. He says that this approach, while uncommon, has allowed some of his greatest discoveries to unfold.

Professor Lichtman emphasized that the most important message he has for budding scientists is that there is no worry of running out of amazing discoveries: the nascent field of neurobiology offers many large questions with as yet only glimmers of answers. Not only does our understanding of the brain remain primarily elusive, but the tools required for proper inquiry are barely existent.

There is no question to Professor Lichtman that the extraordinary ingenuity of humans—the only species that has discovered how to leave the planet or to shape artificially the genome of another organisms—lies in the human brain. Neurobiology is an area of investigation lying wide open for bold emerging scientists who have the potential to demystify the most miraculous and complicated of biological systems. ■

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