

# Brett Graham PhD

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## EXPERIENCE

### Draft Product Development, Cambridge MA — *Consultant*

NOV 2020 - PRESENT

Regularly meet with clients to understand scientific needs, propose commercial and/or custom solutions, and aid in or lead the design, development, testing and deployment of novel software and hardware instrumentation for Neuroscience and Ecological research.

### Harvard University, Cambridge MA — *Neuroengineer*

AUG 2017 - PRESENT

Serve 40+ labs at the Center for Brain Science. Consult with scientists to understand instrument and analysis needs. Lead the development of custom software, hardware, mechanical, electronic and full-stack solutions. Train scientists on design, fabrication and analysis techniques. Examples include:

- Designed and built custom printed circuit board with embedded microcontroller and Python analysis software for tracking 200+ mice for 250+ days
- Wrote Python and Bash software for single board linux computers to capture and record 10+ terabytes of videos of 60 developing bumblebee colonies over 3 months

### Harvard Medical School, Boston MA — *Electron Microscopy Engineer*

AUG 2013 - AUG 2017

Developed instrumentation that accelerated collection of connectomics brain-circuit diagram datasets allowing for the first complete capture of a cortical column occupying over 1 cubic millimeter, imaged at 4 nanometer pixels producing a 2 petabyte image dataset acquired over 6 months

- Developed Python motor control and custom computer vision software for an automated closed-loop reel-to-reel UV laser marking machine
- Modified a commercial tissue slicing machine to allow automated closed-loop collection of thousands of consecutive 40 nanometer thin sections of brain tissue
- Invented, designed, machined parts for and wrote software to control an automated electron microscope with robotic sample exchange, computer vision for image quality assessment and network system to coordinate over 20+ Python processes running on 6 computers to acquire images at 160 MPix/s

### Rowland Institute, Cambridge MA — *Postdoctoral Researcher*

AUG 2009 - AUG 2013

Discovered object recognition neural signals in rodent cortex by developing and using novel methods. Wrote software to analyze and use 3D surgical scans for robotic placement of recording electrodes. Built custom electronics to use commercial audio recording hardware to record neural signals. Wrote custom Python signal processing software to analyze 10s of terabytes of neural time-series data.

## PROGRAMMING LANGUAGES

10+ years Python (2, 3)

Bash, C/C++, Javascript, R, Matlab

## SKILLS

Electrical engineering:  
PCB design (KiCad),  
embedded programming,  
test equipment use  
(oscilloscope, logic  
analyzer, DAQ)

Mechanical engineering:  
CAD (Fusion360,  
Solidworks), CAM  
(HSMWorks), CNC Mill  
and CNC Lathe operator

Realtime and offline  
image analysis: OpenCV,  
OpenCL, CUDA

Numeric signal analysis:  
NumPy, SciPy

Linux server, desktop  
and embedded systems  
administration

3D robotics and physics  
simulation: ROS,  
OpenGL, Bullet, Blender

## HOBBY PROJECTS

6+ year  
Somerville-Cambridge  
Elder Services Brown Bag  
Volunteer

4+ year Project Hexapod  
teammate:  
[projecthexapod.com](http://projecthexapod.com)

## EDUCATION

### **University of Delaware, Newark DE — PhD Neuroscience**

AUG 2004 - AUG 2009

Electrophysiology and computational modeling of fish vision for collision avoidance with applications to mobile robots and simulated unmanned aerial vehicles

### **Millersville University, Millersville PA — BA Psychology**

SEPT 2000 - MAY 2003

## SELECT PUBLICATIONS

Graham B\*, Phelps J\*, Hildebrand D\*, Kuan A, Thomas L, Nguyen T, Buhmann J, Azevedo A, Sustar A, Agrawal S, Liu M, Shanny B, Funke J, Tuthill J, Lee W (2021) Reconstruction of motor control circuits in adult *Drosophila* using automated transmission electron microscopy, *Cell*, 184(3) 759-774. (\* contributed equally)

Hildebrand D, Cicconet M, Torres R, Choi W, Quan T, Moon J, Wetzel A, Champion A, Graham B, Randlett O, Plummer G, Portuges R, Bianco I, Saalfeld S, Baden A, Lillaney K, Burns R, Vogelstein J, Schier A, Lee WC, Jeong WK, Lichtman J, Engert F (2017) Whole-brain serial-section electron microscopy in larval zebrafish. *Nature*, 545, 345-349.

Lee WC, Bonin V, Reed M, Graham B, Hood G, Glattfelder K & Reid RC (2016) Anatomy and function of an excitatory network in the visual cortex. *Nature*, 532(7599), 370-374.

## PATENTS

Hildebrand D, Graham B & Lee WC (2016) GridTape for Fast Nanoscale Imaging. US20200355583A1

## TEACHING AND MENTORSHIP

### **Harvard University, Instructor — Freshman Physics Seminar with Jene Golovchenko**

Spring & Fall 2017

### **Harvard Medical School, Instructor — Arduino Nanocourse**

Fall 2016, Spring & Fall 2017, Fall 2018, Fall 2019, Spring 2020, Spring 2022

### **Harvard Medical School, Manager — Mentored 4 scientific programmers**

AUG 2013 - AUG 2017

### **University of Delaware, Instructor — Sensation & Perception**

Fall 2007, Spring 2008

References and CV available by request