CURRICULUM VITAE

de Bivort, Benjamin Lovegren

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POSITION TITLE
Thomas D. Cabot Associate Professor of Organismic and Evolutionary Biology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Duke University, Durham NC	B.S.	1998 – 2002	Biology & Mathematics
Harvard University, Cambridge MA	Ph.D.	2002 – 2007	Neuroscience

Positions and employment

2017 –   Thomas D. Cabot Associate Professor, Harvard University
2013 – 2017   Assistant Professor, Harvard University
                    Department of Organismic & Evolutionary Biology
                    Center for Brain Science

2008 – 2013   Junior Fellow (Principal Investigator), Rowland Institute at Harvard
                    Evolution of Behavior Group

2007 – 2008   Postdoctoral Fellow, Harvard University
                    Giribet Laboratory, Department of Organismic & Evolutionary Biology

Honors

2019   Member of winning research team, Star-Friedman Challenge
2018 – 2020   Smith Family Odyssey Award
2017 – 2020   Klingenstein-Simons Fellowship Award in Neurosciences
2014 – 2018   Sloan Research Fellowship
2014   Kavli Fellow
2008   Lewis-Sigler Fellowship, Princeton University (declined)
2008   Miller Research Fellowship, UC Berkeley (declined)
2005 – 2007   Merck-Wiley Graduate Fellowship
2004   Ernie Peralta Prize (best departmental candidacy exam)
2003   Derek Bok Teaching Award (based on student evaluations)

2002 – 2005   National Science Foundation Graduate Research Fellowship

2001 – 2002   PRUV Fellow, Duke Univ. Mathematics Dept. (supports summer math research)

1998 – 2002   Angier B. Duke Memorial Scholarship to Duke (pays all tuition)

I. RESEARCH

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* indicates de Bivort Lab undergraduate coauthors

Publications in preparation

1. Kanwal J, **de Bivort B**, Samuel A. Early Integration of Multimodal Chemosensory Stimuli in the *Drosophila* larva. In preparation.

2. Elya C, Wang J, **de Bivort B**, St Leger R. Screening substantial variation in resistance to the specific fly pathogen *Entomophthora muscae* 'Berkeley' using the *Drosophila melanogaster* Genetic Reference Panel (DGRP). In preparation.

3. Akhund-Zade J, Yoon D, Soloshenko A*, Bangerter A & Polizos N, Campbell M, Zhang T, Wice E, Albright A, Narayanan A, Schmidt P, Saltz J, Ayroles J, Klein M, Bergland A, **de Bivort B**. Wild flies hedge their thermal preference bets in response to seasonal fluctuations. In preparation.

4. Akhund-Zade J, Gajda A, Yoon D, **de Bivort B**. Genetic basis of a tradeoff between fecundity and body mass in *Drosophila melanogaster*. In preparation.

Submitted publications

5. Skutt-Kakaria K, Reimers P*, Currier T, Werkhoven Z, **de Bivort B**. A neural circuit basis for context-modulation of individual locomotor behavior. *bioRxiv.* (2019). doi.org/10.1101/797126.

6. Werkhoven Z, Bravin A*, Skutt-Kakaria K, Reimers P*, Pallares L, Ayroles J, **de Bivort B**. The structure of behavioral variation within a genotype. *bioRxiv.* (2019). doi.org/10.1101/779363.

7. Versace E, Caffini M, Werkhoven Z, **de Bivort B**. Individual, but not population asymmetries, are modulated by social environment and genotype in *Drosophila melanogaster*. *bioRxiv.* (2019). doi.org/10.1101/694901.

Peer-reviewed publications

8. Werkhoven Z, Rohrsen C, Qin C*, Brembs B, **de Bivort B**. MARGO (Massively Automated Real-time GUI for Object-tracking), a platform for high-throughput ethology. In press, *PLOS ONE.* (2019). preprint: doi.org/10.1101/593046.

9. Honegger K & Smith M, Churgin M, Turner G, **de Bivort B**. Idiosyncratic neural coding and neuromodulation of olfactory individuality in *Drosophila*. *Proceedings of the National Academy of Sciences USA.* (2019). doi: 10.1073/pnas.1901623116.

10. Akhund-Zade J, Ho S*, O'Leary C, **de Bivort B**. The effect of environmental enrichment on behavioral variability depends on genotype, behavior, and type of enrichment. *Journal of Experimental Biology.* (2019). doi: 10.1242/jeb.202234.

11. Xu C, Theisen E, Maloney R, Peng J, Santiago I, Yapp C, Werkhoven Z, Rumbaut E, Shum B, Tarnogorska D, Borycz J, Tan L, Courgeon M, Meinertzhagen I, **de Bivort B**, Drugowitsch J, Pecot M. Control of Synaptic Specificity by Establishing a Relative Preference for Synaptic Partners. *Neuron.* (2019). doi.org/10.1016/j.neuron.2019.06.006

12. Crall J, **de Bivort B**, Dey B, Versypt A. Social buffering of pesticides in bumblebees: agent-based modeling of the effects of colony size and neonicotinoid exposure on behavior within nests. *Frontiers in Ecology and Evolution*. (2019). 7, 51.

13. Crall J, Switzer C, Oppenheimer R, Versypt A, Dey B, Brown A*, Eyster M*, Guérin C, Pierce N, Combes S, **de Bivort B**. Neonicotinoid exposure disrupts bumblebee nest behavior, social networks, and thermoregulation. *Science*. (2018). 632(6415): 683-686.

14. Alisch T, Crall J, Zucker D, **de Bivort B.** MAPLE: a Modular Automated Platform for Large-scale Experiments, a low-cost robot for integrated animal-handling and phenotyping. *eLife.* (2018). 7: e37166.

15. Brown A, **de Bivort B**. Ethology as a physical science. *Nature Physics.* (2018). 14: 653-657.

16. Kakaria K, **de Bivort B**. Ring attractor dynamics emerge from a spiking model of the entire protocerebral bridge. *Frontiers of Behavioral Neuroscience*. (2017). 11(8). *doi:10.3389/fnbeh.2017.00008.*

17. Todd J, Kain J, **de Bivort B**. Systematic exploration of unsupervised methods for mapping behavior. *Physical Biology*. (2017). 14: 015002.

18. Isakov A & Buchanan S, Sullivan B*, Ramachandran A*, Chapman J*, Lu N*, Mahadevan L, **de Bivort B**. Recovery of locomotion after injury in *Drosophila melanogaster* depends on proprioception. *Journal of Experimental Biology*. (2016). 219: 1760-1771.

19. **de Bivort B** & van Swinderen B. Evidence for selective attention in the insect brain. *Current Opinion in Insect Science*. (2016). 15: 9-15.

20. Crall J, Souffrant A*, Akandwanaho D* & Hescock S*, Callan S* & Coronado M*, Baldwin M, **de Bivort B**. Social context modulates idiosyncrasy of behavior in the gregarious cockroach *Blaberus discoidalis*. *Animal Behaviour*. (2016). 111:297-305.

21. Giribet G, Boyer S, Baker C, Fernández R, Sharma P, **de Bivort B**, Daniels S, Harvey M, Neethling J, Griswold C. A molecular phylogeny of the temperate Gondwanan family Pettalidae (Arachnida, Opiliones, Cyphophthalmi) with biogeographic and taxonomic implications. *Zoological Journal of the Linnean Society*. (2016). *doi:10.1111/zoj.12419.*

22. Buchanan S, Kain J, **de Bivort B**. Neuronal control of locomotor handedness in *Drosophila*. *Proceedings of the National Academy of Sciences USA.* (2015). 112(21):6700-6705.

23. Ayroles J, Buchanan S, O'Leary C*, Skutt-Kakaria K, Grenier J, Clark A, Hartl D, **de Bivort B**. Behavioral individuality reveals genetic control of phenotypic variability. *Proceedings of the National Academy of Sciences USA.* (2015). 112(21):6706-6711.

24. Kain J, Zhang S*, Akhund-Zade J, Samuel A, Klein M, **de Bivort B**. Variability in thermal and phototactic preferences in *Drosophila* may reflect an adaptive bet-hedging strategy. *Evolution.* (2015). 69(12): 3171-3815.

25. Kain J, Stokes C, Gaudry Q, Song X, Foley J, Wilson R, **de Bivort B**. Leg-tracking and automated behavioural classification in *Drosophila*. *Nature Communications.* (2013). 4: #1910.

26. Kane A, Gershow M, Afonso B, Larderet I, Klein M, Carter A, **de Bivort B**, Sprecher S, Samuel A. Sensorimotor structure of *Drosophila* larva phototaxis. *Proceedings of the National Academy of Sciences USA.* (2013). 110(40): E3868-E3877.

27. Giribet G, **de Bivort B**, Hitchcock A, Swart P. On *Speleosiro argasiformis* – a troglobitic Cyphophthalmi (Arachnida, Opiliones, Pettalidae) from Table Mountain, South Africa. *Journal of Arachnology.* (2013). 41: 416-419.

28. Kain J, Stokes C, **de Bivort B**. Phototactic personality in fruit flies and its suppression by serotonin and white. *Proceedings of the National Academy of Sciences.* (2012). 109(48): 19834-19839.

29. Song E, **de Bivort B**, Dan C, Kunes S. Determinants of the *Drosophila* Odorant Receptor pattern. *Developmental Cell.* (2012). 22(2): 363-376.

30. Raz S, Graham J, Cohen A, **de Bivort B**, Grishkan I, Nevo E. Growth and asymmetry of soil microfungal colonies from "Evolution Canyon," Lower Nahal Oren, Mount Carmel, Israel. *PloS ONE.* (2012). 7(4): e34689.

31. **de Bivort B**, Clouse R, Giribet G. A cladistic reconstruction of the ancestral mite harvestman (Arachnida, Opiliones, Cyphophthalmi): portrait of a Paleozoic detritivore. *Cladistics.* (2012). 22:582-597.

32. Gaudry Q, Hong E, Kain J, **de Bivort B**, Wilson R. Asymmetric neurotransmitter release enables rapid odour lateralization in *Drosophila*. *Nature.* (2012). 493: 424-428.

33. Boyer S, Giribet G, Sharma P, Benavides L, Clouse R, **de Bivort B**, Dimitrov D, Kawauchi G, Murienne J, Schwendinger P. Evolutionary and biogeographic history of an ancient and global group of arachnids (Arachnida, Opiliones, Cyphophthalmi) with a new taxonomic arrangement. *Biological Journal of the Linnean Society.* (2012). 105(1): 92-130.

34. Clouse R, **de Bivort B**, Giribet G. Phylogenetic signal in morphometric data. *Cladistics.* (2011). 27(4): 337-340.

35. Clouse R, **de Bivort B**, Giribet G. A phylogenetic analysis for the South-east Asian mite harvestman family Stylocellidae (Opiliones: Cyphophthalmi) – a combined analysis using morphometric and molecular data. *Invertebrate Systematics.* (2010). 23(6): 515-529.

36. **de Bivort B**, Clouse R, Giribet G. A morphometrics–based phylogeny of the temperate Gondwanan mite harvestmen (Opiliones, Cyphophthalmi, Pettalidae). *Journal of Zoological Systematics and Evolutionary Research.* (2010). 48(4): 294-309.

37. **de Bivort B**, Giribet G. A systematic revision of the South African Pettalidae (Arachnida: Opiliones: Cyphophthalmi) based on a combined analysis of discrete and continuous morphological characters with the description of seven new species. *Invertebrate Systematics.* (2010). 24(4): 371-406.

38. **de Bivort B**. Derivation of large-scale cellular regulatory networks from biological time series data. in *Methods in molecular biology: Systems Biology in Drug Discovery and Development*, Yan Q (ed.). (2010). 662: 149-165.

39. **de Bivort B**. Cellular-Level Gene Regulatory Networks: Their Derivation and Properties. in *Systems Biology for Signaling Networks*, Choi S (e.d). (2010). 429-446.

40. Bar-Yam Y, Harmon D, **de Bivort B**. Attractors and democratic dynamics. *Science.* (2009). 323(5917): 1016-1017.

41. **de Bivort B**, Guo H-F, Zhong Y. Notch signaling is required for activity-dependent synaptic plasticity at the Drosophila neuromuscular junction. *Journal of Neurogenetics.* (2009). 23(4): 395-404.

42. **de Bivort B** & Perlstein E, Kunes S, Schreiber, S. Amino acid metabolic origin as an evolutionary influence on protein sequence in yeast. *Journal of Molecular Evolution.* (2009). 68(5): 490-497.

43. Perlstein E & **de Bivort B**, Kunes S, Schreiber, S. Evolutionarily conserved optimization of amino acid biosynthesis. *Journal of Molecular Evolution.* (2007). 65(2): 186-196.

44. **de Bivort B**, Huang S, Bar-Yam Y. Empirical multiscale networks of cellular regulation. *PLoS Computational Biology.* (2007). 3(10): e207.

45. **de Bivort B**, Chen C-C, Perretti F, Negro G, Philip T, Bar-Yam Y. Metabolic implications for the mechanism of mitochondrial endosymbiosis and human hereditary disorders. *Journal of Theoretical Biology.* (2007). 248(1): 26-36.

46. Ciupe M, **de Bivort B**, Bortz D, Nelson P. Estimating kinetic parameters from HIV primary infection data through the eyes of three different mathematical models. *Mathematical Biosciences.* (2006). 200(1): 1-27.

47. **de Bivort B**, Giribet G. A new genus of cyphophthalmid from the Iberian Peninsula with a phylogenetic analysis of the Sironidae (Arachnida: Opiliones: Cyphophthalmi) and a SEM database of external morphology. *Invertebrate Systematics.* (2004). 18(1): 7-52.

48. **de Bivort B**, Huang, Sui, Bar-Yam Y. Dynamics of cellular level function and regulation derived from murine expression array data. *Proceedings of the National Academy of Sciences USA.* (2004). 101(51): 17687-17692.

Invited non-peer-reviewed publication

49. **de Bivort B**. Courtship behavior: hearing new notes in classic songs. *Current Biology*. (2018). 28(15): R826–R845.

50. Honegger K, **de Bivort B**. Stochasticity, individuality and behavior. *Current Biology*. (2018). 28(1):R8-R12.

51. **de Bivort B**. Watching a fly on a ball could help us understand its brain. *The Conversation.* (2013, May 29). *https://theconversation.com/watching-a-fly-on-a-ball-could-help-us-understand-its-brain-14735.*

Other preprints

52. Kottler B, Fiore V, Ludlow Z, Buhl E, Vinatier G, Faville R, Diaper D, Stepto A, Dearlove J, Adachi Y, Brown S, Chen C, Solomon D, White K, Humphrey D, Buchanan S, Sigrist S, Endo K, Ito K, **de Bivort B**, Stanewsky R, Dolan R, Martin J-R, Hodge J, Strausfeld N, Hirth F. A lineage-related reciprocal inhibition circuitry for sensory-motor action selection. *bioRxiv.* (2017). *doi:10.1101/100420.*

53. **de Bivort B**. Isotemporal classes of n-gons. *arXiv.* (2005). arXiv:math/0501171v1.

54. **de Bivort B**. Isotemporal classes of diasters, beachballs, and daisies. *arXiv.* (2013). arXiv: 1309.2003v1.

Selected press write-ups

1. Raine N. Pesticide affects social behavior of bees. *Science*. (2018, November 9). *http://science.sciencemag.org/content/362/6415/643*.

   Pertains to: Crall et al., 2018.

2. Kennedy M. A new robot tracks sick bees wearing tiny coded backpacks. *Wired*. (2018, November 8). *https://www.wired.com/story/bumblebee-tracking-robot*.

   Pertains to: Crall et al., 2018.

3. Simon M. Scientists spy on bees, see harmful effects of common insecticide. *NPR*. (2018, November 9). *https://www.npr.org/2018/11/09/665634367/scientists-spy-on-bees-see-harmful-effects-of-common-insecticide*.

   Pertains to: Crall et al., 2018.

4. Dambrot S. From gene to phene: Scientists demonstrate genetic control of phenotypic variability. *MedicalxPress*. (2015, June 2). http://medicalxpress.com/news/2015-06-gene-phene-scientists-genetic-phenotypic.html.

   Pertains to: Ayroles et al., 2015.

5. Singer E. Roots of animals' individuality revealed with 'Groundhog Day' experiments. *Scientific American*. (2015, June 1). *http://www.scientificamerican.com/article/roots-of-animals-individuality-revealed-with-groundhog-day-experiments*. Reprinted from *Quanta Magazine*.

   Pertains to: Buchanan et al., 2015; Ayroles et al., 2015; Kain et al., 2015; Kain et al., 2012.

6. Williams S. Eye on the fly. *The Scientist*. (2015, January 1). *http://www.the-scientist.com/?articles.view/articleNo/41700/title/Eye-on-the-Fly.*

   Pertains to: Kain et al., 2013.

7. Costa J. Eleven young neuroscientists share their cutting-edge research. WBUR. (2014, June 12). *http://www.wbur.org/news/2014/06/12/neuroscientists-brain-videos*.

8. Pastrana E. Fly walk. *Nature Methods.* (2013, June 27). 10:604 – 605. *doi:10.1038/nmeth.2545*.

   Pertains to: Kain et al., 2013.

9. Berezow A. Do fruit flies have free will? *Real Clear Science*. (2012, November 17). *http://www.realclearscience.com/journal_club/2012/11/17/do_fruit_flies_have_free_will_106407.html*.

   Pertains to: Kain et al., 2012.

Ongoing research support

This grant supports a collaboration between the de Bivort lab, Missy Holbrook of OEB and Sam Meyers of the HU Center for the Environment to investigate, using the tools of computational ethology, how atmospheric CO_2 affects pollinator behavior directly and through effects on pollen and nectar.

Harvard/MIT Basic Neuroscience Grant	2018.10.01 – 2020.09.30
Discovering the nanoscale structure of loci of behavioral individuality	**$119,130** (direct)

Role: Co-PI

This grant supports a collaboration between the de Bivort lab and the Boyden lab of MIT to use expansion microscopy techniques to characterize nanoscale correlates of individual behavioral biases.

National Science Foundation PHY-1806818	2018.09.15 – 2023.08.31
Collaborative Research: Formation of a High Flux Student Research Network (HF-SRN) as a Laboratory for Enhancing Interaction in the PoLS SRN	**$0** in research support $1,250,000.00 in training support (direct+indirect)

Role: Co-PI

This training grant supports the Physics of Living Systems Student Research Network, a virtual network of graduate education and research opportunities across Harvard University, Georgia Tech, Emory, Rice and the University of Maryland.

National Institute of Mental Health Phase I SBIR 1R43MH119092-01	2018.07.01 – 2018.12.31 **$112,432** (direct+indirect)
A Modular Automated Platform for Large-scale Drosophila Experiments and Handling	

Role: Lead Investigator of a Subcontract

This subcontract supports a collaboration between the de Bivort lab and FlySorter LLC, specifically the development and stress testing in the lab of a prototype commercial-grade fly-handling experiment-automating robot.

Smith Family Odyssey Award	2018.07.01 – 2020.06.31
Mapping loci of individuality for spontaneous and stimulus-evoked behaviors	**$300,000** (direct)

Role: PI

This proposal seeks cellular-level correlates of individual behavioral biases, focusing in equal portion on spontaneous and stimulus-evoked behaviors, A goal is to test hypotheses about how such "loci of individuality" are distributed across circuits that generate behavior.

Klingenstein-Simons Fellowship Award	2017.07.01 – 2020.06.31
Discovering loci of individuality in Drosophila sensory circuitry	**$225,000** (direct)

Role: PI

The first goal of this project is to identify "loci of individuality," physiological correlates of individual preferences in stimulus response behaviors to light and odor gradients. Having identified these, the next aim is to characterize the shape of the transition by which information representing stimuli is transformed to information representing individual behavior. Loci of individuality may coincide with discontinuities in this transformation.

Completed research support

National Science Foundation IOS-1557913   2014.09.01 – 2019.08.31
Discovering the mechanistic basis of individual   **$675,000** (direct+indirect)
differences in sensory representation and their
effects on preference behavior
Role: PI

The goals of this project are to measure intragenotypic variability in odor preferences, determine how different cell types in the early olfactory system contribute to the distribution of preferences, determine how neuromodulation affects the distribution, and determine what Ca^{++} activity patterns in the early olfactory circuit are predictive of individual behavioral tendencies.

Dean's Competitive Fund   2018.07.01 – 2019.06.31
Pesticides and pollinators: harnessing automated   **$49,966** (direct)
tracking to characterize the effects of environmental
stressors on bee colonies and the ecosystem
services they provide
Role: PI

This supports the development of automated techniques for studying the combined effects of low-level exposure to neonicotinoid pesticides and temperature fluctuations on individual worker behavior and colony performance in bumblebees, a crucial pollinator in both wild and agricultural ecosystems.

Alfred P. Sloan Foundation   2014.09.15 – 2018.09.14
Discovering the neurological basis of individuality   incl. one year no-cost extension
Role: PI   **$50,000** (direct)

The major goals of this project are 1) understanding the neural circuit basis of the distribution of intragenotypic differences in behavior, using molecular and systems neuroscience approaches, 2) identifying olfactory circuit correlates of behavioral idiosyncrasies ("engrams of individuality") and 3) characterizing the natural history and adaptive value of intragenotypic behavioral diversity.

Mind Brain Behavior Initiative Faculty Award   2016.09.15 – 2017.03.15
Doing it right (or left): social and genetic roots of   **$15,000** (direct)
lateralization
Role: PI
This fund supports work to test the hypothesis that predicts that more social behaviors, such as courtship, will evolve population-level laterality, whereas solitary behaviors, such as solo spontaneous exploration will develop individual-level laterality.

Mind Brain Behavior Initiative Faculty Award   2015.07.01 – 2016.06.31
From individual variation to the genetic basis of   **$50,000** (direct)
phenotypic variability: Understanding the role of
serotonin in mediating individuality
Role: PI
This fund supported my work on the role of serotonin as a regulator of behavioral variability. We are investigating the effects of genetic background on serotonin sensitivity using a panel of sequenced, inbred isofemale lines.

Rowland Junior Fellows Program   2008.07.01 – 2013.06.31
Evolution of Behavior Group   **$1,339,000** (direct)
Role: PI
This fund supported my independent research as a PI at the Rowland Institute to identify mechanisms by which behavioral diversity is established through evolution and stochastic variations in the genus *Drosophila*, develop new instruments for automated behavioral quantification, and develop new statistical approaches for the supervised and unsupervised classification of behavioral data.

Invited talks and seminars

2020   SAGE Center for the Study of the Mind Workshop, UC Santa Barbara

2019   Cornell Department of Neurobiology and Behavior

2019   Hanna H. Gray Fellows Mentor Workshop, Howard Hughes Medical Institute

2019   Conference of the Animal Behavior Society & Ethological Conference

2019   Crete Workshop on Neural Circuits and Behavior of *Drosophila*

2019   Tufts Allen Discovery Center Cognition group meeting

2019   Sloan Kettering Developmental Biology Department

2019   Klingenstein-Simons Fellowship Awards Meeting

2019   Sölden International Neuroscience Winter Conference (workshop organizer)

2019   Institute of Science and Technology Austria (IST) Austria

2019   Columbia Workshop on Brain Circuits, Memory and Computation

2019   Kirby Neurobiology Center & Dept. of Neurobiology, Harvard Medical School

2018   Princeton Biophysics

2018   Janelia Conference: Function of the Insect Central Complex

2018   Woods Hole Oceanographic Institute Biology Department

2018   Champalimaud Centre: CAJAL Adv. Neuro. Prog., Behavior & Neural Systems

2018   Rockefeller University

2018   Aspen Center for Physics: Workshop on The Physics of Behavior

2018   Klingenstein-Simons Fellowship Awards Meeting

2018   University of Iceland Life and Environmental Sciences Seminar

2018   University of Virginia Department of Biology Seminar

2018   Kavli Brain Forum, Emory & Georgia Tech

2017   Max Planck Workshop on Mechanisms of Natural Behaviors, Shanghai China

2017   University of Ottawa Neuroscience Seminar

2017   Annual Meeting of the German Zoological Society (main speaker)

2017   Regensburg University Behavioral Biology Mini-Symposium

2017   Ludwig Maximilian University-Harvard Young Scientists Forum

2017   Crete Workshop on Neural Circuits and Behavior of *Drosophila*

2017   NeuroTuscany: Circuits and Behavior

2017   COSYNE workshop on High-Dimensional Neuro-Behavioral Analyses

2016   Simons Foundation Workshop on Unbiased Quantitative Analysis of Behavior

2016   University of Edinburgh Inst. of Perception, Action and Behavior Seminar Series

2016   Johns Hopkins University Department of Neuroscience Seminar Series

2016   Champalimaud Centre: CAJAL Adv. Neuro. Prog., Behavior & Neural Systems

2016   The Allied Genetics Conference

2016   Fond. des Treilles Workshop: From Indiv. Variation to Gen. Basis of Environ. Sensitivity

2016   NeuroTuscany: Circuits and Behavior

2016   Janelia Conference: Function of the Insect Central Complex

2015   Society for Neuroscience Meeting

2015   TEDx Beacon Street

2015   Rockefeller University Neuroscience Seminar Series

2015   Champalimaud Centre: CAJAL Adv. Neuro. Prog., Behavior & Neural Systems

2015   Imperial College London MRC Clinical Sciences Centre Seminar

2015   Crete Workshop on Neural Circuits and Behavior of *Drosophila*

2015   University of Iceland Life and Environmental Sciences Seminar

2015   Gordon Research Seminar on Neuroethology (invited faculty representative)

2015   Harvard University Center for Brain Science Annual Retreat

2015   *Drosophila* Research Conference

2015   American Physical Society Meeting

2014   Kavli Frontier Symposium

2014   Lehigh University Biological Sciences Fall Colloquium Seminar Series

2014   Michigan State University Science at the Edge Seminar Series

2014   ESF-EMBO Symp: Flies Worms & Robots – Minibrains & Behavior

2014   Central South Univ., Changsha, China – Research Collaboration Seminar

2013   Harvard University Center for Brain Science Brownbag Seminar Series

2013   Neurodevelopmental Behavior Core, Harvard Medical School

2013   Harvard University Center for Brain Science Annual Retreat

2013   Princeton University Biophysics Seminar

2012   Janelia Conference: Function of the Insect Central Complex

2008   Harvard Organismic and Evolutionary Biology Seminar Series

2005   Boston Area Graduate Student Symposium

II. TEACHING & MENTORING EXPERIENCE

Postdoctoral fellows

2018 – present   Matt Churgin, PhD   postdoctoral fellow
Research focus: Identification of cellular-level features, such as synapse morphologies or channel expression levels, that predict individual behavioral biases, in stimulus-evoked and spontaneous behaviors.

2018 – present   Carolyn Elya, PhD   postdoctoral fellow
Research focus: Elucidation of genetic, molecular and neural circuit mechanisms by which the fungal parasite *Entomophthora muscae* alters the behavior of its host, *Drosophila melanogaster*.

2016 – present   James Crall, PhD   postdoctoral fellow
Research focus: Effects of environmental stress on individual and collective behavior of bumblebees, high-throughput, automated tracking to discover the role of individual variation in collective behavior.

2015 – 2017   Charuni Gunaratne, PhD   postdoctoral fellow
Research focus: Molecular and circuit mechanisms controlling individuality in light preference behavior.

2014 – 2015   Julien Ayroles, PhD   postdoctoral fellow
Current position: Assistant Professor, Princeton University
Research focus: Quantitative genetics, and specifically: mapping genetic determinants of intragenotypic variability in locomotor behavior.

2013 – 2017   Kyle Honegger, PhD   postdoctoral fellow
Current position: Data Scientist, Children's Hospital of Chicago
Research focus: Molecular and circuit mechanisms controlling individuality in olfactory behavior.

2009 – 2013   Sean Buchanan, PhD   <u>postdoctoral fellow (at Rowland)</u>
Current position: Scientist II. Dept. Stem Cells & Regenerative Biology, Harvard Univ.
Research focus: Molecular, genetic, and circuit mechanisms controlling individuality in locomotor behavior, and the genetic control of locomotor plasticity following injury.

2008 – 2013   Jamey Kain, PhD   <u>postdoctoral fellow (at Rowland)</u>
Current position: Clinical Res. Scientist, Machaon Diagnostics; Scientist, Glowing Plant
Research focus: Quantification of behavior, mechanisms controlling individuality in light preference behavior, modeling of adaptive value of behavioral variability.

Graduate students

2019 – present   Danylo Lavrentovich   <u>graduate student</u>, Systems Biology 2nd year
Research focus: Computational modeling of individuality in circuits and behavior.

2019 – present   Shraddha Lall   <u>graduate student</u>, OEB 1st year
Research focus: Evolution and behavioral variability.

2019 – present   David Zimmerman   <u>graduate student</u>, Biophysics 2nd year
Co-advisor: Aravi Samuel, Harvard Department of Physics
Research focus: *Drosophila* larval odor coding and learning and memory.

2018 – present   Tom Alisch   <u>graduate student</u>, OEB 2nd year
Research focus: New tools for the automation of behavioral experiments, and the neurobiological basis of decision-making.

2017 – present   Denise Yoon   <u>graduate student</u>, OEB 3rd year
Research focus: Measuring variability of wild flies in the wild, using field deployable autonomous instruments, adaptive value of individuality in locomotor behavior.

2015 – present   Matt Smith   <u>graduate student</u>, MCO 6th year
Research focus: Measuring intragenotypic variability in learning and memory, and determining the role of synaptic plasticity genes in giving rise to intragenotypic variability.

2015 – present   Jamilla Akhund-Zade   <u>graduate student</u>, MCO 6th year
Research focus: Experimentally testing the bet-hedging hypothesis as the adaptive function of intragenotypic variability, focusing on variability in thermal preference.

2014 – present   Zach Werkhoven   <u>graduate student</u>, MCO, now postdoc
Dissertation: *The structure of behavioral variation within a genotype*.

2014 – present   Jess Kanwal   <u>graduate student</u>, PiN, now postdoc
Dissertation: *From unisensory to multisensory processing in the early olfactory system of the* Drosophila *larva*.

2013 – 2018   Kyobi Skutt-Kakaria   <u>graduate student</u>, MCO, PhD 2018
Dissertation: *Establishment and control of behavioral bias in* Drosophila melanogaster.

2009 – 2012   Elizabeth Kane   <u>graduate student</u>, BBS, PhD 2012
Co-advisor: Aravi Samuel, Harvard Department of Physics

Dissertation: *The sensory and behavioral basis of* Drosophila *larval phototaxis.*

Undergraduate researchers

2015 – 2019   Pablo Reimers   Harvard College
Thesis: *Stochastic individuality in* Drosophila melanogaster:
The effect of neural morphological asymmetry on idiosyncratic behavior. (Hoopes Prize winner)

2017 – 2017   Alyssa Bravin   Harvard College
Research focus: Using automated high-throughput instruments to conduct behavior experiments to measure behavioral covariation within a genotype.

2017 – 2017   Andrea Brown   Harvard College
Research focus: Determining whether individual exposure to environmental pollutants is more determined by individual or collective behavior.

2015 – 2017   William Long   Harvard College
Research focus: Developing software and optimizing hardware for our automated individual fly-handling robot.

2014 – 2016   Ned Lu   Harvard College
Thesis: *Locomotor plasticity in* Drosophila melanogaster*: A role for proprioception in acute response to injury.* (Dowling Prize winner)

2015 – 2016   Yong Li Dich   Harvard College
Research focus: Developing hardware for our automated individual fly-handling robot.

2011 – 2012   Josh Chapman   Harvard Extension School (at Rowland)

2010 – 2011   Sarah Zhang   Harvard College (at Rowland)

2006   Weiyin He   Princeton College (during PhD)

Visiting researchers

2017 – 2017   Tom Alisch   visiting graduate student
Master's student: University of Groningen
Thesis: *An individual fly-handling robot allows high-throughput longitudinal measurement of* Drosophila *social networks*

2016 – 2017   Elisabetta Versace   visiting postdoctoral fellow
Advisor: Giorgio Vallortigara, University of Trento
Research focus: Testing the hypothesis that social coordination leads to population level behavioral lateralization

2016 – 2017   Claire Guérin   visiting graduate student
MEME program in Evolutionary Biology
Research focus: Automated quantification of bumblebee micro colonies

2016 – 2017   Christian Rohrsen   <u>visiting graduate student</u>
 Advisor: Björn Brembs, Regensburg University
 Research focus: Neural circuit mechanisms of operant conditioning and coding of self-learning valence.

2011 – 2012   Shmuel Raz, PhD   <u>visiting postdoctoral fellow (at Rowland)</u>
 Advisor: Eviatar Nevo, University of Haifa
 Current position: Co-founder, Torasha Next Generation Sequencing

2011   Bruno Afonso, PhD   <u>visiting postdoctoral fellow (at Rowland)</u>
 Advisor: Aravi Samuel, Harvard Department of Physics
 Current position: Postdoctoral fellow, Janelia Research Campus

2008   Quentin Gaudry, PhD   <u>visiting postdoctoral fellow (at Rowland)</u>
 Advisor: Rachel Wilson, Harvard Department of Neurobiology
 Current position: Assistant Professor, University of Maryland

Current and former researchers in other positions

2018 – present	Nicole Pittoors	research assistant
2018 – present	Emily Lee	research assistant
2017 – present	August Easton Calabria	research assistant
2019	Kayleigh Cronin	research assistant
2019	Aundrea Koger	REU student
2019	Valerie Saykina	high school intern
2019	Simon Risman	high school intern
2019	James Marvel-Coen	rotation student
2019	Jialu Bao	rotation student
2018	Jasper Duval	high school intern
2018	Fosca Bechthold	high school intern
2018	Benno Rodeman	high school intern
2018	Katy Loubet-Senear	rotation student
2018	Anna Soloshenko	high school intern
2018	Maya Basak	high school intern
2018	Gary Qin	high school intern
2016	Julien Grimaud	rotation student
2016	Rebecca Senft	rotation student
2015 – 2016	Erika Gajda	research assistant
2014 – 2015	Akshitha Ramachandran	high school intern

2015	Michael Isakov	high school intern
2014	Michelle Frank	rotation student
2014	Brian Sullivan	research assistant
2014	Vivian Hemmelder	post-baccalaureate researcher
2013	Sandra Ho	high school intern
2012 – 2014	Chelsea Jenney	undergraduate and research assistant
2005	Oliver Jawitz	high school intern (during PhD)

Courses taught at Harvard

Term	Course Taught	Enroll-ment	Q-score, out of 5 (Course)	Comments
Fall 2019	LS 50A: Integrated Science‖	TBD	TBD	
Spring 2019	LS 50B: Integrated Science‖	25	**4.5** (4.6)	
January 2019	MCB 356: Practical Introduction to Robotics	13	**4.7** (4.8)	
Fall 2018	LS 50A: Integrated Science‖	33	**3.8** (4.2)	
Spring 2018	LS 50B: Integrated Science§	32	**4.3** (4.3)	
January 2018	MCB 356: Practical Introduction to Robotics	14	**5.0** (5.0)	
Fall 2017	LS 50A: Integrated Science§	37	**3.8** (4.0)	
Spring 2017	LS 50B: Integrated Science ‡	18	**4.7** (4.3)	
Spring 2017	BIOPHYSICS 242R: Special Topics in Biophysics: Biophys., Brain & Behavior◇	12	NA (4.0)	
January 2017	MCB 356: Practical Introduction to Robotics	18	**4.7** (4.5)	
Fall 2016	LS 50A: Integrated Science‡	21	**4.4** (4.4)	
Spring 2016	LS 50B: Integrated Science*	22	**4.2** (4.4)	new course
January 2016	MCB 356: Practical Introduction to Robotics	20	NA	new nanocourse
Fall 2015	LS 50A: Integrated Science*	24	NA (4.1)	new course
Spring 2015	OEB 131: Neuroethology	3	**5.0** (5.0)	
Fall 2014	LS 200: Integrated Science*†	9	NA	new course
Spring 2014	OEB 131: Neuroethology	6	**4.5** (4.2)	new course

‖ co-instructors: Andrew Murray, Cassandra Extavour, Michael Desai, Aravi Samuel
§ co-instructors: Andrew Murray, Cassandra Extavour, Michael Desai, Sean Eddy
‡ co-instructors: Andrew Murray, Cassandra Extavour, Michael Desai, Erel Levine, Sean Eddy
◇ co-instructors: Aravi Samuel, Florian Engert
* co-instructors: Andrew Murray, Cassandra Extavour, Michael Desai, Erel Levine, Mary Wahl
† pedagogical course for graduate students

Courses taught elsewhere

Term	Course Taught	Enrollment	Comments
Summer 2018	CAJAL Advanced Neurobiology Programs: Behavior & Neural Systems, Champalimaud Centre	20	co-directed CAJAL BNS course. Provided direct co-instruction for 2/3 weeks
Summer 2016	CAJAL Advanced Neurobiology Programs: Behavior & Neural Systems, Champalimaud Centre	20	supervised independent student projects for 10 days of 21 day course
Summer 2015	CAJAL Advanced Neurobiology Programs: Behavior & Neural Systems, Champalimaud Centre	20	supervised independent student projects for 10 days of 21 day course

Guest lecturer

2015 – 2019	OEB 399: Topics in Organismic and Evolutionary Biology
2018	BIOPHYSICS 300: Introduction to Laboratory Research
2017	NEUROBIO 109. Precision Neurosci.: Neural Circuits for Individuality
Falls 2013 – 2015	MCB 294: Interesting Questions in Engineering and Physical Biology
Spring 2013	BIOPHYSICS 242R: Spec. Top. in Biophys.: Biophysics, Brain & Behavior
Fall 2010	OEB 181: Systematics
2006 – 2009	New England Complex Systems Institute Summer & Winter Schools

Undergraduate Integrative Biology concentration advising

Spring 2017 – present	Zeke Benshirim
Spring 2016 – present	Maya Learned
Spring 2014 – Spring 2016	Kate Freedberg

Graduate committee mentoring and advising

Student	Advisor(s)	Program	PQE *	DAC †	Thesis Def. ◊
Michael Myagi	Desai/Wakeley	OEB	X		
Evan Hoki	Pierce	OEB	X		
Shoyo Sato	Giribet	OEB	X		
Nicole Bedford	Hoekstra	OEB		X	X

Name	Advisor	Program	PQE*	DAC†	Thesis◊
Alex Hyde	Nowak/Mahadevan	OEB	X	X	
Jake Gable	Hoekstra	OEB	X	X	
Jake Peters	Combes/Mahadevan	OEB	X	X	X
James Crall	Combes/Pierce	OEB		X	X
Ambika Kamath	Losos	OEB		X	X
Hillery Metz	Hoekstra	OEB		X	X
Tamsin Jones	Extavour	OEB	X		
Katie Boronow	Losos	OEB	X		
Yuqi Qin	Zhang	OEB		X	X
Kumaresh Krishann	Engert	MCO	X		
Kristian Herrera	Engert	MCO	X	X	X
William Menegas	Uchida	MCO	X	X	X
Javier Masis	Cox	MCO	X	X	
Yang Jiang	Kunes	MCO	X	X	X
Caitlin Lewarch	Hoekstra	MCO	X	X	X
Emily Hager	Hoekstra	MCO	X	X	
Felix Baier	Hoekstra	MCO	X	X	
Jasper Maniates-Selvin	Lee	PiN		X	
Jenny Lu	Wilson	PiN	X	X	
Sasha Rayshubskiy	Wilson	PiN	X	X	
Robert Johnson	Engert	PiN	X	X	
He Yang	Kunes	PiN	X	X	
Michael Marquis	Wilson	PiN	X	X	
Willie Tobin	Wilson	PiN			X
Joe Bell	Wilson	PiN			X
Alexandra Batchelor	Wilson	PiN	X	X	X[C]
Luis Hernandez	Samuel	Biophysics			X
Mariela Petkova	Engert	Biophysics	X		
Drago Guggiana-Nilo	Engert	Biophysics	X		X
Jacob Baron	Samuel	Physics	X		X
Alex Isakov	Samuel	Physics	X		X
Matt Berck	Samuel	Physics	X		X
Roshan Satapathy	Jösch	Inst Sci & Tech, Vienna	X		X
Alejandro Lopez	Bargmann	Rockefeller University			X
Balazs Szigeti	Webb	University of Edinburgh			X

* Preliminary qualifying exam (PQE)

† Dissertation advisory committee (DAC)

◊ Thesis defense committee

C Served as committee chair

III. ACADEMIC SERVICE

Harvard affiliations

Department of Organismic and Evolutionary Biology

Center for Brain Science

Molecules, Cells, Organisms Graduate Program

Program in Neuroscience Graduate Program

Biophysics Graduate Program

Mind, Brain, Behavior Initiative

Leverett House Senior Common Room

Departmental service and committee membership

2013 – present	OEB Undergraduate Committee
2013 – present	Graduate admissions interviewer for OEB
2013 – present	Faculty reader of 21 Undergraduate honors theses
2017 – 2018	OEB Global Change Ecology Search Committee
2015 – 2017	OEB Webpage Committee

University service and committee membership

2017 – present	Standing Committee on Degrees in Neuroscience/Neurobiology
2013 – present	Graduate admissions interviewer for MCO
2013 – present	Mind Brain Behavior Standing Committee
2018	Judge, Harvard iGEM BioHackathon
2013 – 2018	MCO Graduate Training Program Journal Club Committee Coach for 21 total MCO Journal Club presentations
2017	GSAS Alumni Day Presenter
2017	Mind Brain Behavior Faculty Award Reviewer
2015 – 2016	Program in Neuroscience Graduate Admissions Committee
2015	Speaker at FAS Campaign event: "Concentrations: Exploring the Basis of Behavior & Cognition"
2013 – 2014	Life Science Curriculum Committee

2004 – 2008	Resident Tutor, Leverett House
2003 – 2004	Non-Resident Tutor, Leverett House
2003 – 2004	MCB Genetics and Genomics Training Program webpage committee
2002 – 2003	Co-Organizer of Genetics and Genomics Training Program Symposium: "Species Interactions and Coevolution" – joint between MCB, OEB

Professional service and memberships

2017 – present	Codirector CAJAL Advanced Neuro. Prog.: Behavior & Neural Systems
2016 – present	Member, Genetics Society of America
2015 – present	Member, Society for the Study of Evolution
2015 – present	Scientific Advisor, FlySorter LLC

Ad-hoc reviewer

Nature • Current Biology • eLife • Nature Neuroscienceˆ• Journal of Experimental Biology • PLoS Biology • Nature Methods • Nature Communications • Journal of Comparative Neurology • Physical Biology • PLoS ONE • Philosophical Transactions of the Royal Society B • Journal of the Royal Society Interface • Cladistics • Zoologica Scripta • Frontiers in Behavioral Neuroscience • Frontiers in Psychology • Journal of the Royal Society: Interface • Scientific Reports • Science Advances • Journal of Neuroscience Methods • Mathematical Biosciences and Engineering • BMC Bioinformatics • Bioinspiration & Biomimetics • The European Physical Journal • Human Frontier Science Program • Wellcome Trust Postdoctoral Fellowship • Wellcome Trust Dale Fellowship • Forschungsgemeinschaft • KU Leuven Interdisciplinary Research Projects Grant

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IV. Other

2013 – present	Superforecaster for: Good Judgement Project, Hybrid Forecasting Competition, INSEAD Forecasting Study, GJP 2 FOCUS
2005 – present	Member Team Left Out, MIT Mystery Hunt (11 top-10 finishes, 5 top-3 finishes, and 1 win in 2019 in 15 years of competition)
2012 – 2013	Forecaster, Good Judgement Project
2010	Volunteer interpreter, Boston Museum of Science: Butterfly Hall