Dr. Michael James Winding

Personal Information

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Research Vision: Social interactions form the bedrock of familial ties, friendships, and societal structures — especially in humans. Yet, across the animal kingdom, the underlying neuronal circuits driving these interactions remain enigmatic, as we lack detailed, synapse-resolution brain maps. Mapping even a small fraction of the human brain with this granularity remains beyond our technological grasp. I therefore study the social behaviours of insects, whose brains and behaviour are tractable and quantifiable. My past efforts led to the generation and analysis of the first synaptic wiring diagram (connectome) of an entire insect brain. Armed with this comprehensive brain map and linked experimental tools, my team aims to understand how brain-wide computations give rise to social behaviours, and how such computations go awry after social isolation or due to disease.

Professional Experience

2023.04.24 - current
Group Leader, The Francis Crick Institute
Founded the Social Circuits and Connectomics Laboratory

2019.09.16 - 2023.04.23
Research Associate, University of Cambridge, Department of Zoology
Advisors: Dr. Marta Zlatic and Dr. Albert Cardona
Project: The complete connectome of an insect brain

2016.10.03 - 2019.09.13
Postdoctoral Associate, HHMI/Janelia Research Campus, USA
Advisor: Dr. Marta Zlatic
Project: Integration of conflicting valence signals during action selection

2011.08.01 - 2016.08.25
PhD Student, Northwestern University, USA
Advisor: Dr. Vladimir I. Gelfand
Project: Cytoskeleton rearrangement in neurodevelopment and oogenesis

2009.01.13 - 2011.05.04
Undergraduate Researcher/REU Fellow, University Notre Dame, USA
Advisor: Dr. Kevin T. Vaughan
Project: Dynein's role in the mitotic spindle assembly checkpoint

Education

2011.09.01 - 2016.09.01
Ph.D. in the Field of Life Sciences (Cell and Molecular Biology)
Northwestern University, Chicago, IL, USA
Advisor: Dr. Vladimir I. Gelfand

2007.08.28 - 2011.08.10
Bachelor of Science in Biology
University of Notre Dame, Notre Dame, IN, USA

2007.08.28 - 2011.08.10
Bachelor of Arts in Studio Art
University of Notre Dame, Notre Dame, IN, USA

Publications [18]

1. Pedigo BD, Powell M, Bridgeford EW, **Winding M**, Priebe CE, Vogelstein JT. *Generative network modeling reveals quantitative definitions of bilateral symmetry exhibited by a whole insect brain connectome.* eLife. 2023. doi: https://doi.org/10.7554/eLife.83739

2. **Winding M**[†,*] , Pedigo BD*, Barnes C, [and 14 others], Priebe CE, Vogelstein JT[†], Zlatic M**[,†], Cardona A**[,†]. *The connectome of an insect brain.* Science. 2023. doi: https://doi/10.1126/science.add9330
*co-first, **joint supervision, [†]co-corresponding authors

3. Pedigo BD, **Winding M**, Priebe CE, Vogelstein J. *Bisected graph matching improves automated pairing of bilaterally homologous neurons from connectomes.* Network Neuroscience. 2023. doi: https://doi.org/10.1162/netn_a_00287

4. Croteau-Chonka EC*, Clayton MS*, Venkatasubramanian L, Harris SN, Jones BMW, Lakshmi Narayan L, **Winding M**, Masson J, Zlatic M**, Kristina T Klein**. *High-throughput automated methods for classical and operant conditioning of Drosophila larvae*. eLife. 2022. doi: https://doi.org/10.7554/eLife.70015 *co-first, ** joint supervision

5. Hayden HS, Basu A, Athreya A, Park Y, Vogelstein JT, Priebe CE, **Winding M**, Zlatic M, Cardona A, Bourke P, Larson J, Abdin M, Choudhury P, Yang W, White CW. *Distance-based Positive and Unlabeled Learning for Ranking.* Pattern Recognition. 2022. doi: 10.1016/j.patcog.2022.109085

6. Giachello NG*, Hunter I*, Pettini T, Knufer A, Pettini T, Coulson B, Cachero S, **Winding M**, Zarin AA, Kohsaka H, Fan YN, Nose A, Landgraf M, Baines RA. *Electrophysiological validation of monosynaptic connectivity between premotor interneurons and the aCC motoneuron in the Drosophila larval CNS.* J. Neurosci. 2022. doi: https://doi.org/10.1523/JNEUROSCI.2463-21.2022

7. Eschbach C*, Fushiki A*, **Winding M**, Afonso B, Andrade IV, [and 10 others], Cardona A, Zlatic M. *Circuits for integrating learned and innate valences in the insect brain.* eLife. 2021. doi**:** https://doi.org/10.7554/ELIFE.62567 *co-first

8. Eschbach C*, Fushiki A*, **Winding M**, Schneider-Mizell CM, [and 10 others], Cardona A**, Zlatic M**. *Recurrent architecture for adaptive regulation of learning in the insect brain*. Nat Neurosci. 2020. doi: https://doi.org/10.1038/s41593-020-0607-9
*co-first, **joint supervision

9. Jovanic T, **Winding M**, Cardona A, Truman JW, Gershow M, Zlatic M. *Neural Substrates of Drosophila Larval Anemotaxis.* Current Biology. 2019. doi: https://doi.org/10.1016/j.cub.2019.01.009

10. **Winding M**, Kelliher MT, Lu W, Wildonger J, Gelfand VI. *Role of kinesin-1-based microtubule sliding in Drosophila nervous system development.* PNAS. 2016. 113(34). doi: https://doi.org/10.1073/pnas.1522416113

11. **Lu W***, **Winding M***, Lakonishok M, Wildonger J, Gelfand VI. *Microtubule-microtubule sliding by kinesin-1 is essential for normal cytoplasmic streaming in Drosophila oocytes*. PNAS. 2016. 113(34). doi: https://doi.org/10.1073/pnas.1522424113 ***co-first**

12. Engelke MF, **Winding M**, Yue Y, Shastry S, Teloni F, Reddy S, Blasius TL, Soppina P, Hancock WO, Gelfand VI, Verhey KJ. *Engineered kinesin motor proteins amenable to small-molecule inhibition*. Nat Commun**.** 2016 Apr 5; 7:11159. doi: https://doi.org/10.1038/ncomms11159

13. del Castillo U, **Winding M**, Lu W, Gelfand VI. *Interplay between kinesin-1 and cortical dynein during axonal outgrowth and microtubule organization in Drosophila neurons*. eLife. 2015. doi: https://doi.org/10.7554/eLife.10140

14. Jolly A, Luan C, Dusel B, Dunne S, **Winding M**, Dixit V, Robins C, Saluk J, Logan D, Carpenter A, Cohen A, Gelfand VI. *A Genome-wide RNAi screen for Microtubule Bundle Formation and Lysosome Motility Regulation in Drosophila S2 Cells.* Cell Rep**.** 2016. 14(3):611-20. doi: https://doi.org/10.1016/j.celrep.2015.12.051

15. del Castillo U, Lu W, **Winding M**, Lakonishok M, Gelfand VI. *Pavarotti/MKLP1 regulates microtubule sliding and neurite outgrowth in Drosophila neurons.* Curr Biol. 2015. 25(2):200-5. doi: https://doi.org/10.1016/j.cub.2014.11.008

16. **Winding M**, Gelfand VI. *Breaking up isn't easy: myosin V and its cargoes need Dma1 ubiquitin ligase's help.* Dev Cell**.** 2014. 28(5): 479-480. https://doi.org/10.1016/j.devcel.2014.02.016

17. Kasuboski JM, Bader JR, Vaughan PS, Tauhata SB, **Winding M**, Morrissey MA, Joyce MV, Boggess W, Vos L, Chan GK, Hinchcliffe EH, Vaughan KT. *Zwint-1 is a novel Aurora B substrate required for the assembly of a dynein-binding platform on kinetochores.* Mol Bio Cell. 2011. 22(18): 3318-30. doi: https://doi.org/10.1091/mbc.e11-03-0213

18. Bader JR, Kasuboski JM, **Winding M**, Vaughan PS, Hinchcliffe EH, Vaughan KT. 2011. *Polo-like kinase1 is required for recruitment of dynein to kinetochores during mitosis.* J Biol Chem. 2011. 286(23): 20769-77. doi: https://doi.org/10.1074/jbc.m111.226605

Teaching

2022 and 2019	Demonstrator for Cell Microscopy Course, University of Cambridge
2019.02.04 - 2019.04.05	Completed "*Scientists Teaching Scientists"* Course (Certificate)
2012.09.01 - 2014.05.01	Mentored high-school student during RNAi project (IMSA SIR program)
2013.01.07 - 2013.03.16	Assisted in a graduate-level Cell Biology course, including a lecture
2010.08.24 - 2010.12.09	Assisted in a Cellular Biology Laboratory course (BIOS 31341)
2010.01.12 - 2010.04.28	Mentored undergraduates throughout a semester-long research project

Supervisory and Service

2023.09.25 – current	Primary supervisor of two PhD students
2023.09.25 – current	Member of two thesis committees
2021.02.25 - 2021.07.21	Digital Presence Working Group, Department of Zoology, Cambridge
2020.10.28 - 2020.11.03	Led CATMAID Tracing Workshop, University of Cambridge
2020.03.24 - 2021.01.20	Led team reconstructing the larval brain, University of Cambridge
2018.10.24 - 2020.11.03	Trained visiting scientists and new hires in EM reconstruction
2018.07.18 - 2019.09.16	Supervised research specialist in split-GAL4 screening project

Acted as Reviewer for the following journals, funders, conferences:
PNAS, PLOS ONE, Medical Research Council (MRC), Cosyne

Workshops and Outreach

2023.10.11	Project Lead, *The Crick Data Challenge 2023*
2023.03.24	Interviewed on live radio, *Radio New Zealand*
2023.03.16	Wrote an article for *The Conversation*, aimed at a lay audience
2020.12.01-2	Led workshop '*Collaborative neuron tracing, analysis and data sharing with CATMAID*' From Images to Knowledge (I2K) Virtual Conference, Janelia HHMI, USA.

Research Talks

2023.10.30 Biological Making Workshop, London, UK
2023.10.11 London Fly Meeting, London, UK
2022.05.29 Connectomics Conference, Berlin, Germany
2021.12.02 Neuromatch Conference, USA
2021.10.20 Plenary Speaker, Neurogenetics of *Drosophila* Larva, Bloomington, IN, USA
2021.05.10 Monthly Maggot Meeting (international seminar series), Cambridge, UK
2021.05.05 NeuroFly Conference, Madrid, Spain
2019.04.14 Max Planck / HHMI Connectomics Meeting, Berlin, Germany
2016.04.22 Chicago Cytoskeleton, Chicago, IL, USA

Invited Talks

2023.07.12 The Society of Neuroscientists of Africa Conference, Johannesburg, South Africa
2023.06.09 Biological and Behavioural Symposium, Queen Mary University of London, UK

Posters

2023.09.18 Lake Conference - Neural Coding and Dynamics, Allen Institute, Seattle, USA
2022.09.26 The Assembly and Function of Neural Circuits, Ascona, Switzerland
2018.10.08 Behavioural Neurogenetics of *Drosophila* Larva, Edinburgh, UK
2016.03.18 Chicago Cytoskeleton, Chicago, IL, USA
2015.10.24 Midwest *Drosophila* Conference, Monticello, IL, USA
2015.03.20 Chicago Cytoskeleton, Chicago, IL, USA
2014.12.09 American Society for Cell Biology Meeting, Philadelphia, PA, USA
2014.03.14 Chicago Cytoskeleton, Chicago, IL, USA
2010.12.13 American Society for Cell Biology Meeting, Philadelphia, PA, USA

Awards and Distinctions

2016.07.22 **Driskill Research Award** (for Exceptional PhD), Northwestern University, USA
2015.10.24 Best Poster Award, Midwest *Drosophila* Conference, Monticello, IL, USA
2011.05.21 Best of Show, B.A. Studio Art Thesis Exhibit

Funding

2023.04.24 Internal Funding, the Francis Crick Institute
2014.10.24 Northwestern Conference Travel Grant (CTG)
2010.06.21 NSF Research Experience for Undergraduates (REU) Fellowship
2010.12.11 Center for Undergraduate Scholarly Engagement (CUSE) Travel Award