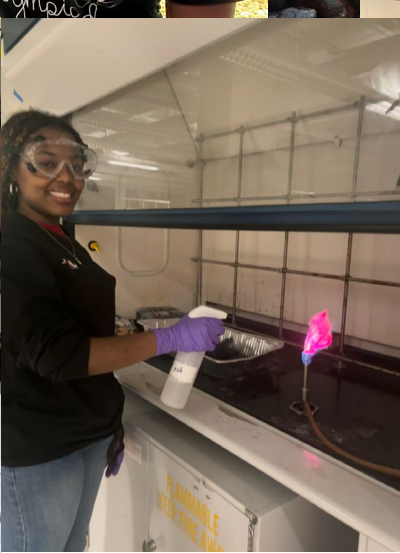
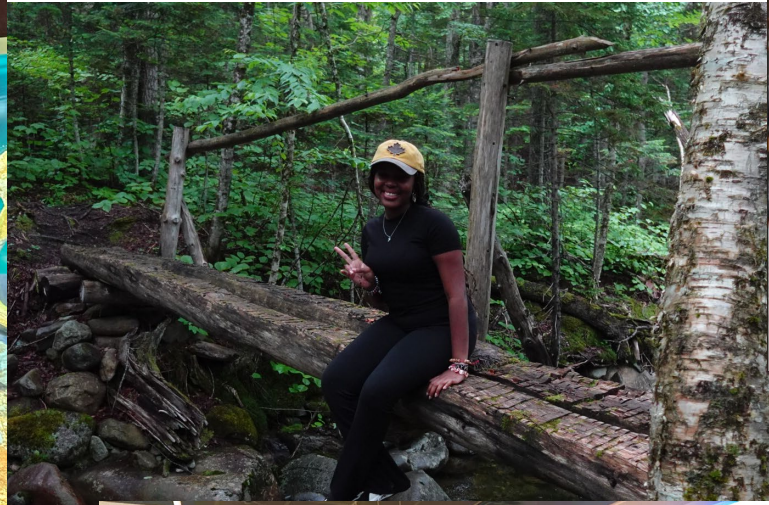


Exploring Potential Interactions Between Blood Cells and The CNS in *Drosophila melanogaster*

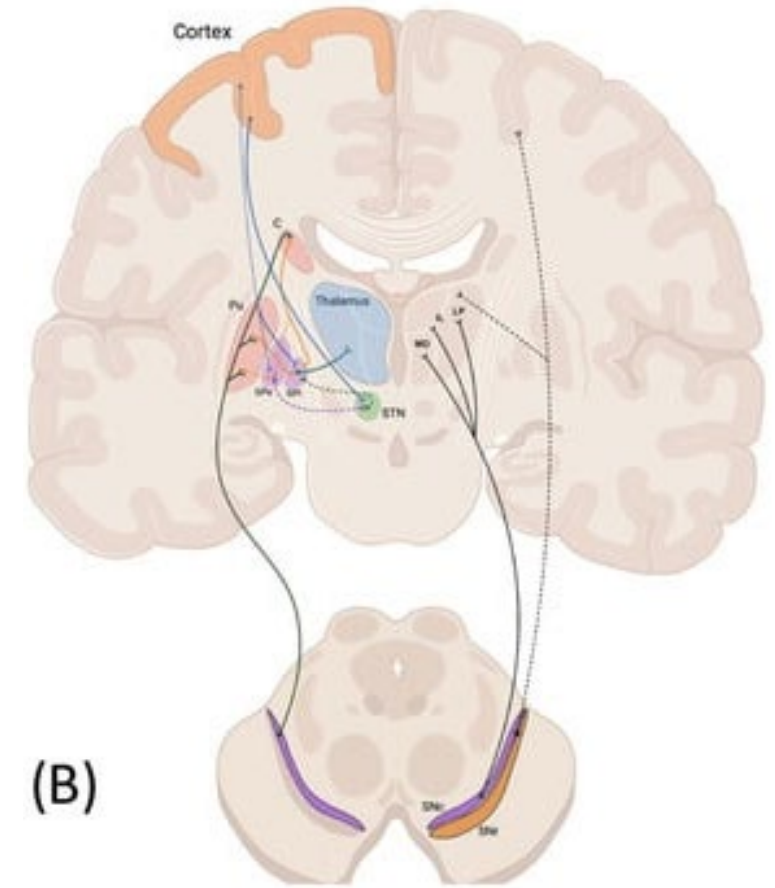
Chiara Chie

About Me!



Parkinson's Disease

- Dopaminergic loss in Substantia Nigra¹
 - Lewy bodies, α -synuclein (inflammation)
 - Irregular movement
- Second most common neurodegenerative disorder
 - Over 10 million diagnosed today
 - Populations over 60
- Treatments
 - Levodopa, MAO-B inhibitors, DBS, Therapy, Lifestyle changes
 - NONE are disease MODIFYING
- Cause of dopaminergic neuron loss is unknown²
 - PARK genes (SNCA, PRKN, PINK1, LRRK2 etc) but only ~10% of PD patients²
 - Neuroinflammation correlated with exacerbated pathology



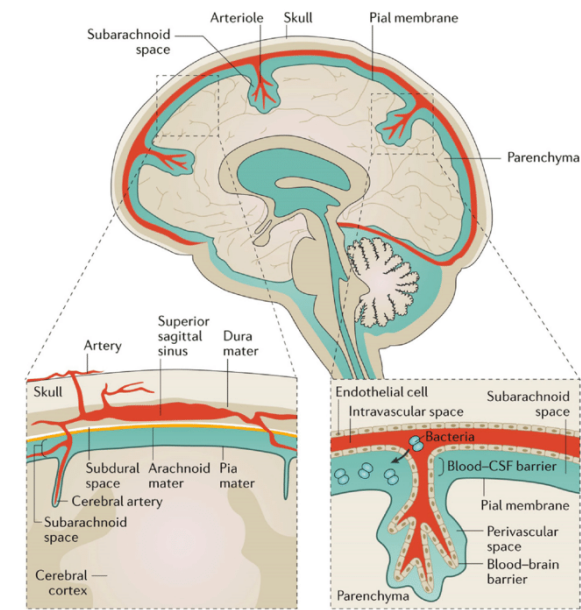
(B)
Schematic representation of the nigrothalamic system¹

(1) Bublíková, I.; Mareček, S.; Krajča, T.; Malá, C.; Dušek, P.; Krupička, R. Structural Connectivity of the Substantia Nigra: A Comprehensive Review of Diffusion Imaging and Tractography Studies. *Applied Sciences* **2025**, *15* (14), 7902.

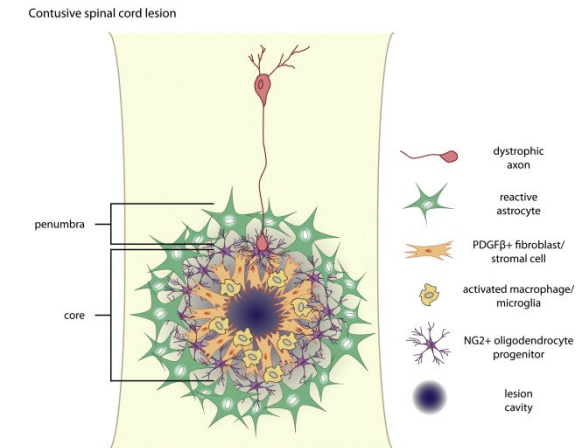
(2) Tran, J., Anastacio, H. & Bardy, C. Genetic predispositions of Parkinson's disease revealed in patient-derived brain cells. *NPJ Parkinsons Dis* **6**, 8 (2020).
<https://doi.org/10.1038/s41531-020-0110-8>

The CNS and The BBB

- Blood-Brain Barrier
 - Endothelial cells with tight junctions
 - Pericytes and Astrocytes can fluctuation permeability
 - Prevents peripheral diffusion (including immune cells!)
- Glial cells play protective and neurotoxic roles
 - Microglia = Macrophages Specific to the CNS
 - Reactive glia can release neurotoxins to signal damage and stop neuronal growth



Anatomical representation of the human brain and meningeal structures¹



Anatomy of a contusive spinal cord lesion²

(1) https://www.researchgate.net/figure/Anatomical-representation-of-the-human-brain-and-meningeal-structures-affected-by_fig1_324049748

(2) Cregg, J. M. *et al.* Functional regeneration beyond the glial scar. *Experimental Neurology* **253**, 197–207 (2014). <https://doi.org/https://doi.org/10.1016/j.expneurol.2013.12.024>

Neuroinflammation in PD

- T-cells and B-cells invade BBB both during surveillance and inflammation¹
- Neutrophils and other immune cells are debated to participate
 - Could macrophages cross the BBB during inflammation?
 - Could macrophages be involved in neuroinflammatory response?

Article | [Open access](#) | Published: 26 June 2023

Border-associated macrophages mediate the neuroinflammatory response in an alpha-synuclein model of Parkinson disease

[A. M. Schonhoff](#), [D. A. Figge](#), [G. P. Williams](#), [A. Jurkuvenaite](#), [N. J. Gallups](#), [G. M. Childers](#), [J. M. Webster](#), [D. G. Standaert](#), [J. E. Goldman](#) & [A. S. Harms](#) 

[Nature Communications](#) **14**, Article number: 3754 (2023) | [Cite this article](#)

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Article

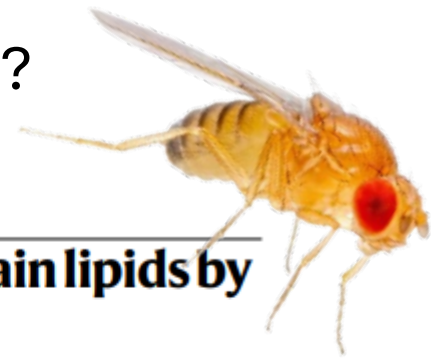
Sleep-dependent clearance of brain lipids by peripheral blood cells

<https://doi.org/10.1038/s41586-025-10050-w>

Received: 17 April 2025

Accepted: 12 December 2025

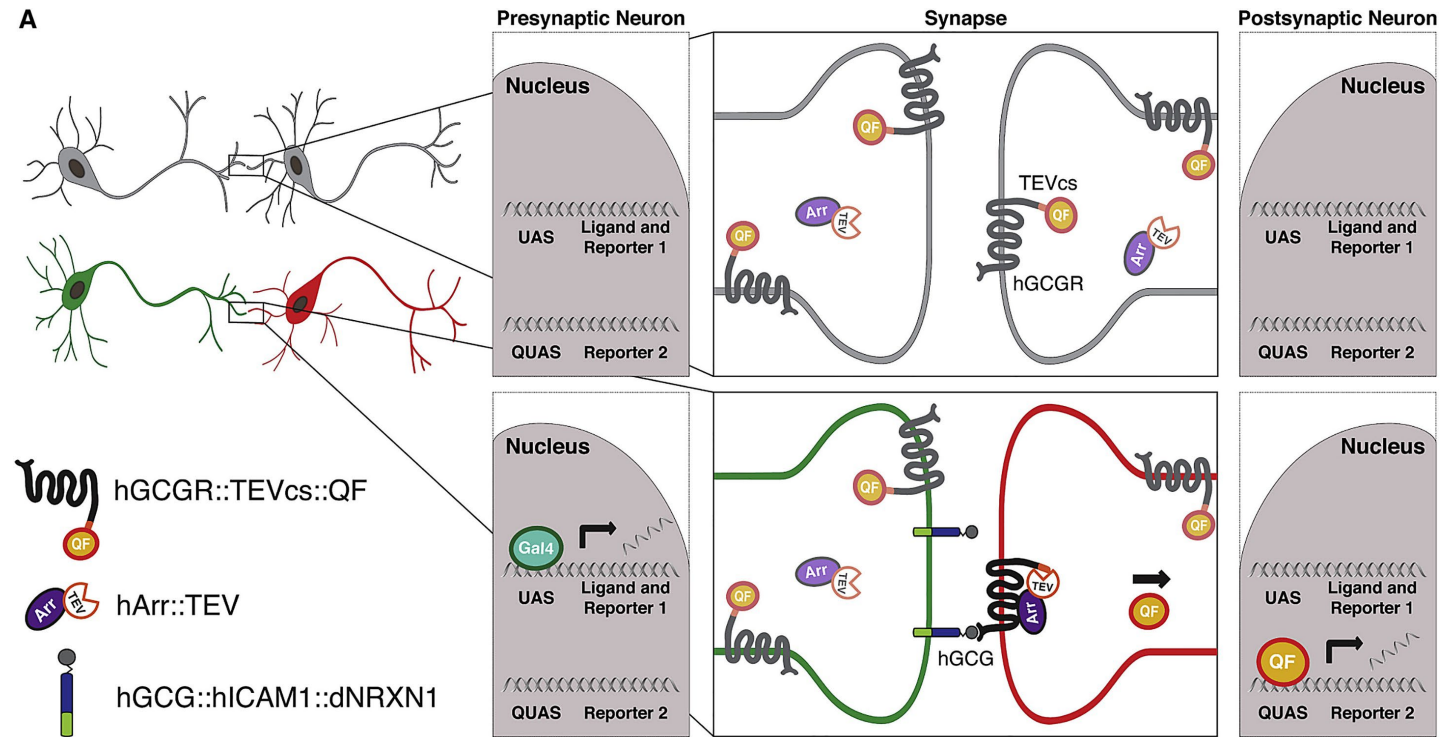
Bumsik Cho^{1,2}, Diane E. Youngstrom^{1,2}, Samantha Killiany^{1,2}, Camilo Guevara^{1,2}, Caitlin E. Randolph², Connor H. Beveridge², Pooja Saklani², Gaurav Chopra^{3,4,5,6,7,8} & Amita Sehgal^{1,2,9}



1) Marchetti, L. & Engelhardt, B. Immune cell trafficking across the blood-brain barrier in the absence and presence of neuroinflammation. *Vasc Biol* **2**, H1–h18 (2020). <https://doi.org/10.1530/vb-19-0033>

Evaluating Peripheral Immune Cell Invasion in *Drosophila melanogaster*

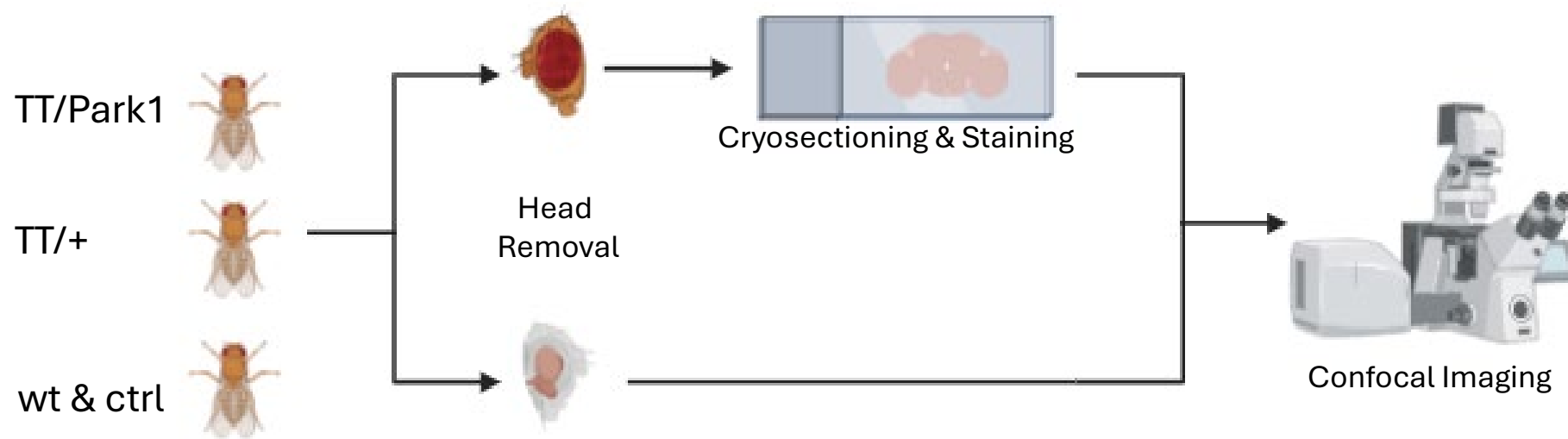
- Why *Drosophila melanogaster*?
 - High genetic similarity
 - Hemocyte phagocytic capacity
- How can we track Hemocytes and the BBB?
 - Trans-Tango technique
 - Crossing flies with fluorescent markers to view cell location and activation



Design and Implementation of *trans*-Tango in the Fly¹

Experimental Setup

- Fluorescent Microscopy
 - Head clearing much faster than cryosectioning and antibody staining
 - Fluorescent proteins should be distinct enough to show BBB and hemocyte location



Article

Sleep-dependent clearance of brain lipids by peripheral blood cells

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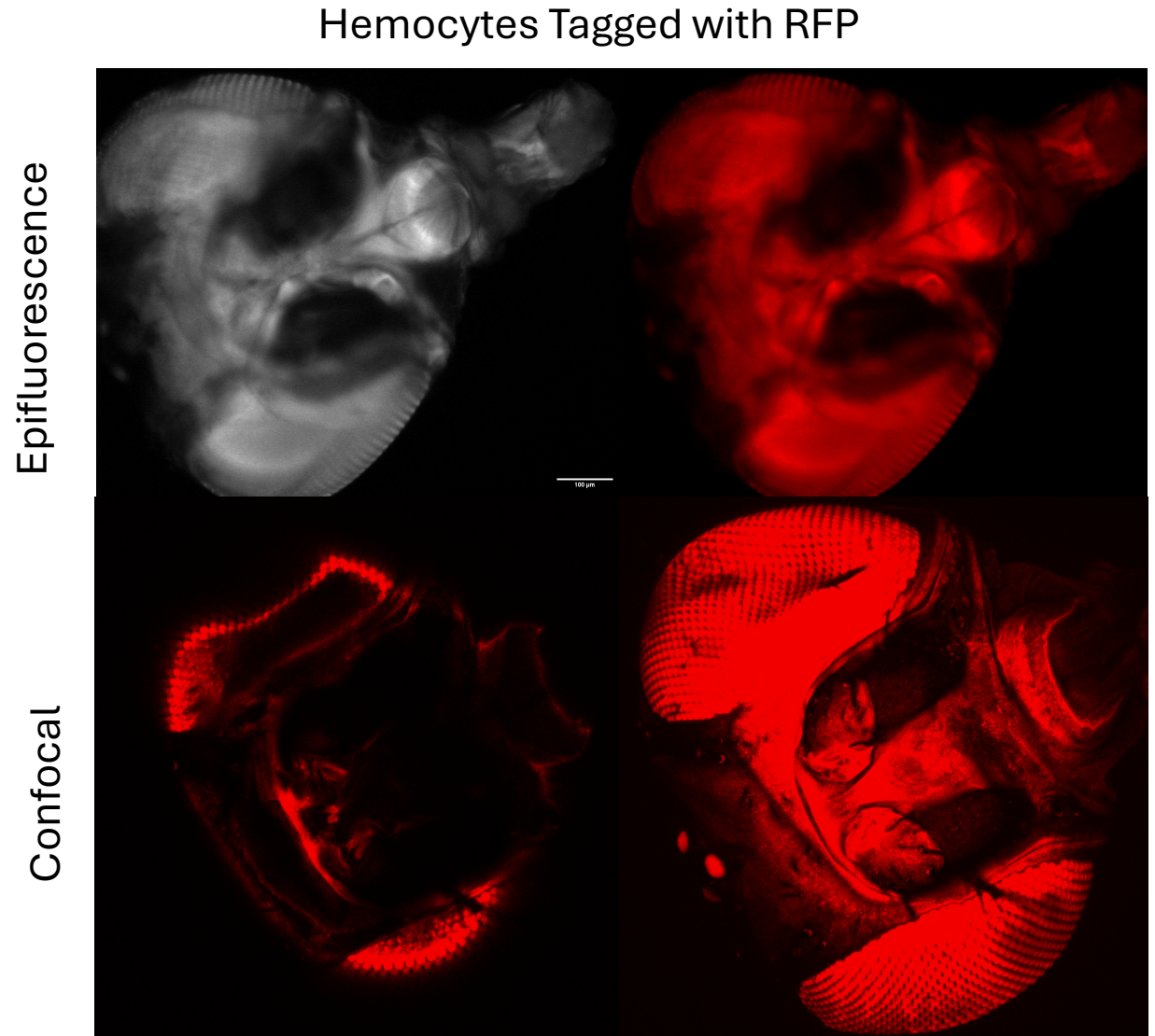
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Current Progress

- Imaging experimentation
 - Working to optimize a protocol to quickly image fly heads
 - Whole head extraction and clearing
- Challenges
 - Autofluorescence
 - Need to cancel out background signal



Future Experiments

- Drosophila head clearing
 - Adjust microscope settings to possibly cancel background signal
 - Begin using Trans Tango flies for head clearing and imaging
- Cyrosectioning
 - Staining heads and imaging may provide clearer pictures
- Macrophages in a mammalian model
 - Evaluate the role of perivascular microglia in a Parkinson's model and possible BBB invasion