

Determining dopamine microelectrode placement in the rat brain

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Introduction

- **OBJECTIVE:** Determine dopamine microelectrode placement in rat dorsal striatum
- Rats were anesthetized with urethane
- Make an incision to clear skin and fascia
- Drill a hole for FSCV microelectrode in the dorsal striatum using 2mm dremel bit at
AP = +1.0mm; ML = +2.0mm; DV = -4.5mm
- Drill a hole for stimulating electrode in the medial forebrain
AP = -4.6mm; ML = +1.4mm; DV = -7.0mm
- Make a final hole for a reference electrode
- Dopamine signals were recorded (stim at 60 Hz, 60 pulses, 300 μ A) at five-minute intervals

Methodology

- After dopamine is recorded, we proceed to our experiment
- Remove stimulating and reference electrodes and connect zapper to FSCV electrode
- Zap for 45 sec
- Decapitate and remove brain
- Freeze brain in liquid nitrogen for 10 sec then store in freezer (-20°C)
- Section brain (12 μ m coronal sections) in cryostat (kept at -20° C) and put brain sections on microscope slide
- Stain brain sections and then protect it with permamount
- Visualize with a dissection microscope

Results

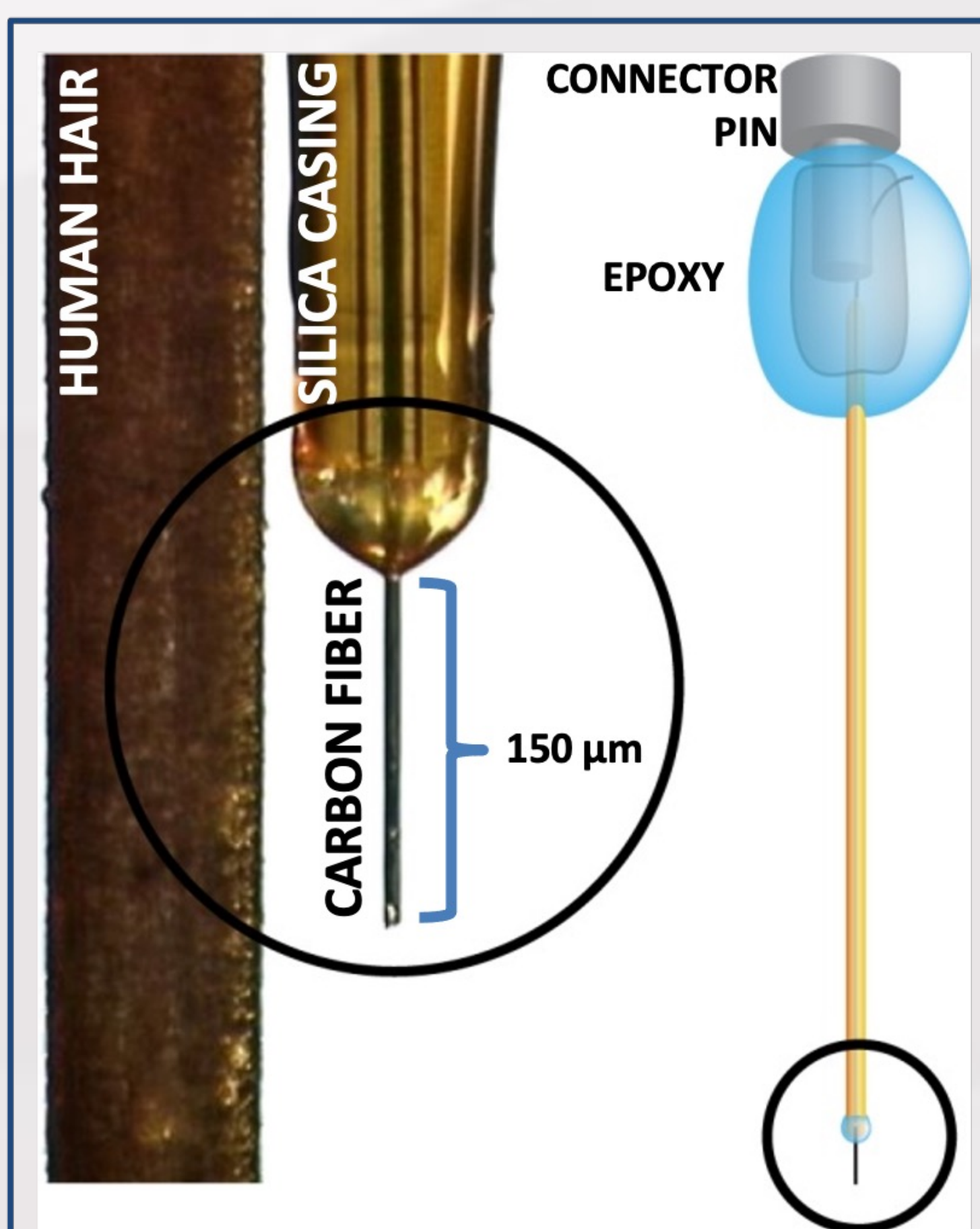


Fig. 1. Chronic fast-scan cyclic voltammetry (FSCV) microelectrode. Relative small size of the carbon fiber sensor (~150 μ m x 5 μ m) results in little tissue damage at DA recording site. Modified from Clark et al. 2010.

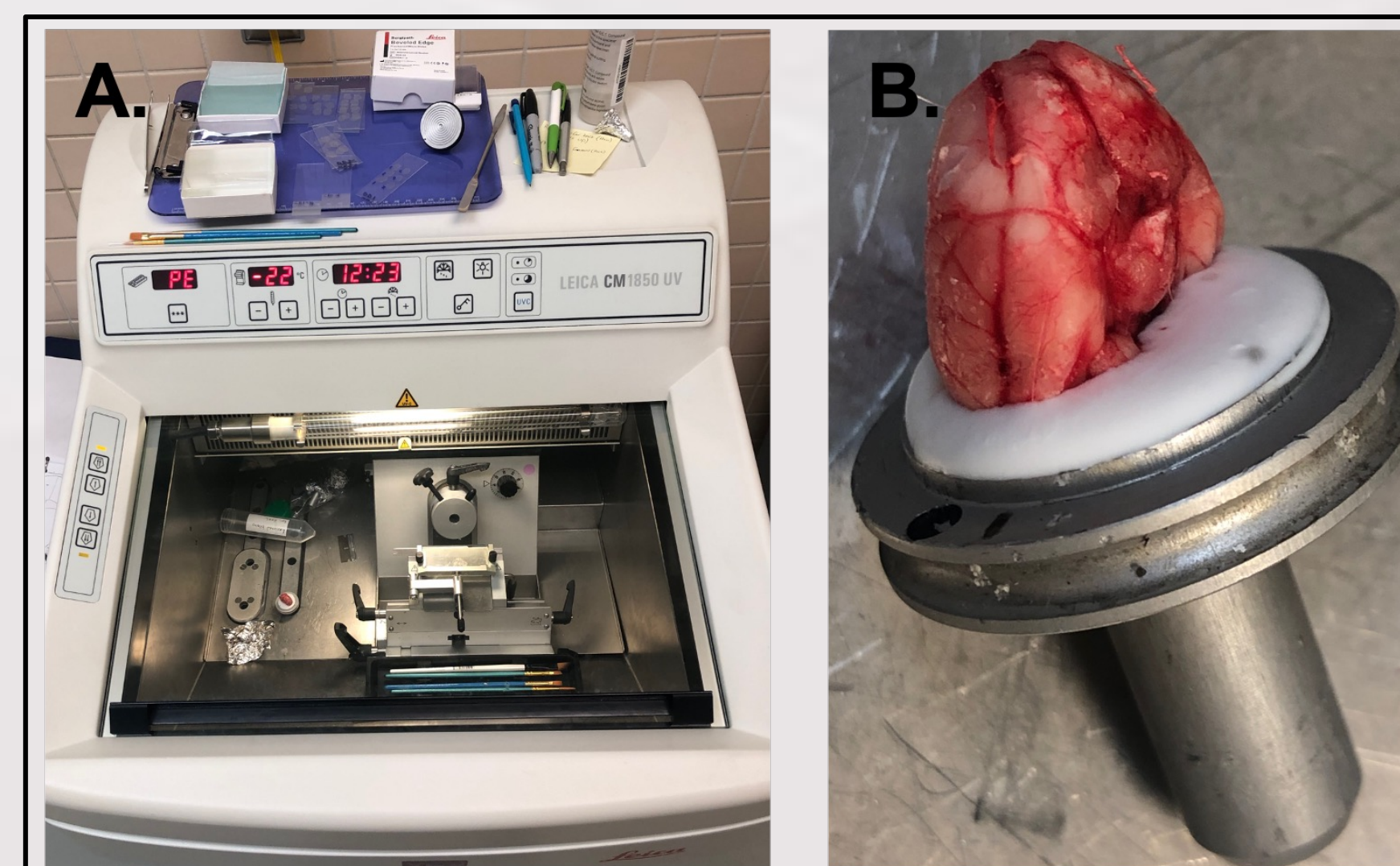


Fig. 2. Cryostat brain slicing machine. (A.) Cryostat machine used to slice rat brains. (B.) Rat brain on cryostat chuck

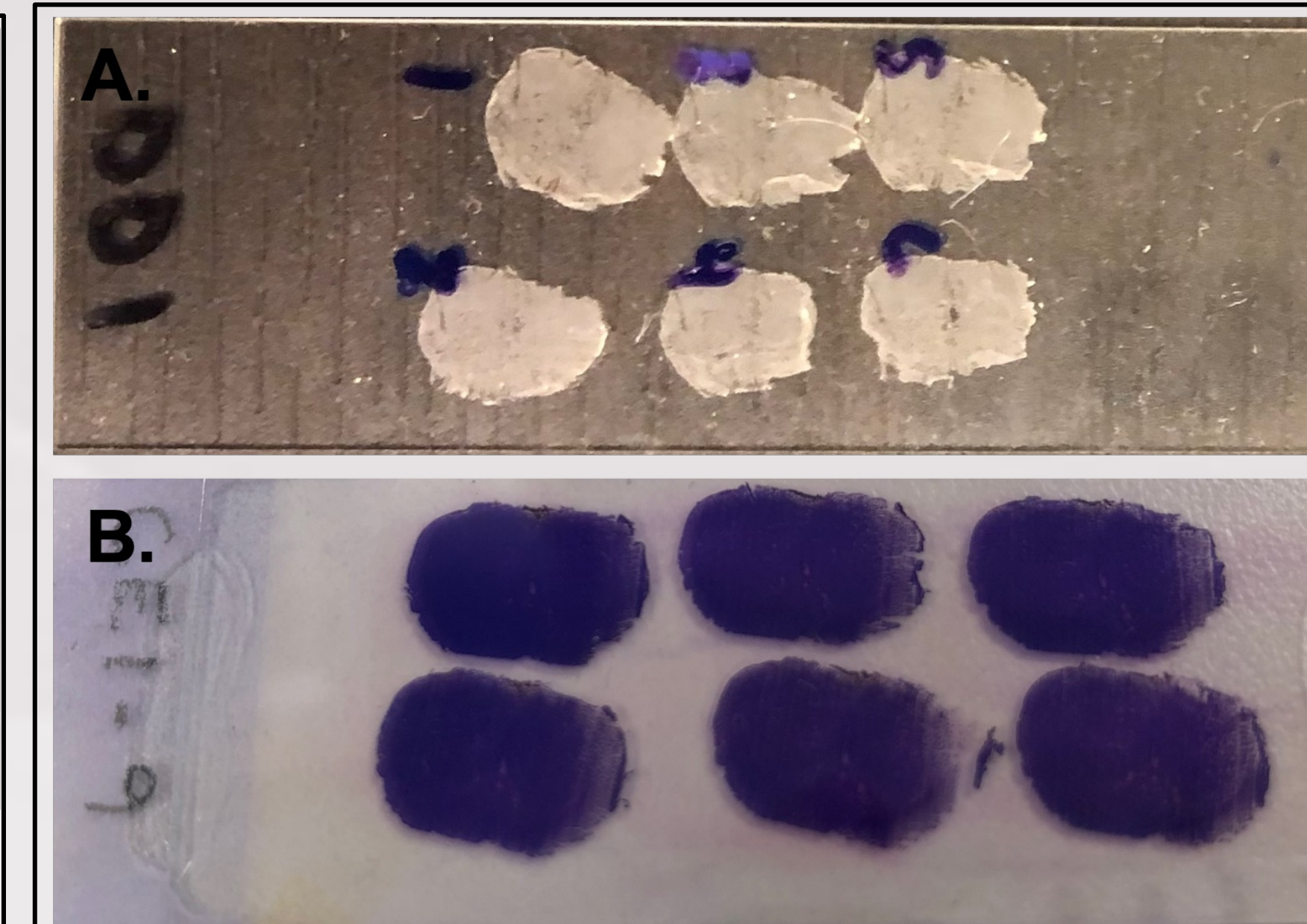


Fig. 3. Brain sections (12 μ m coronal sections on microscope slides). (A.) Unstained sections (B.) Stained sections

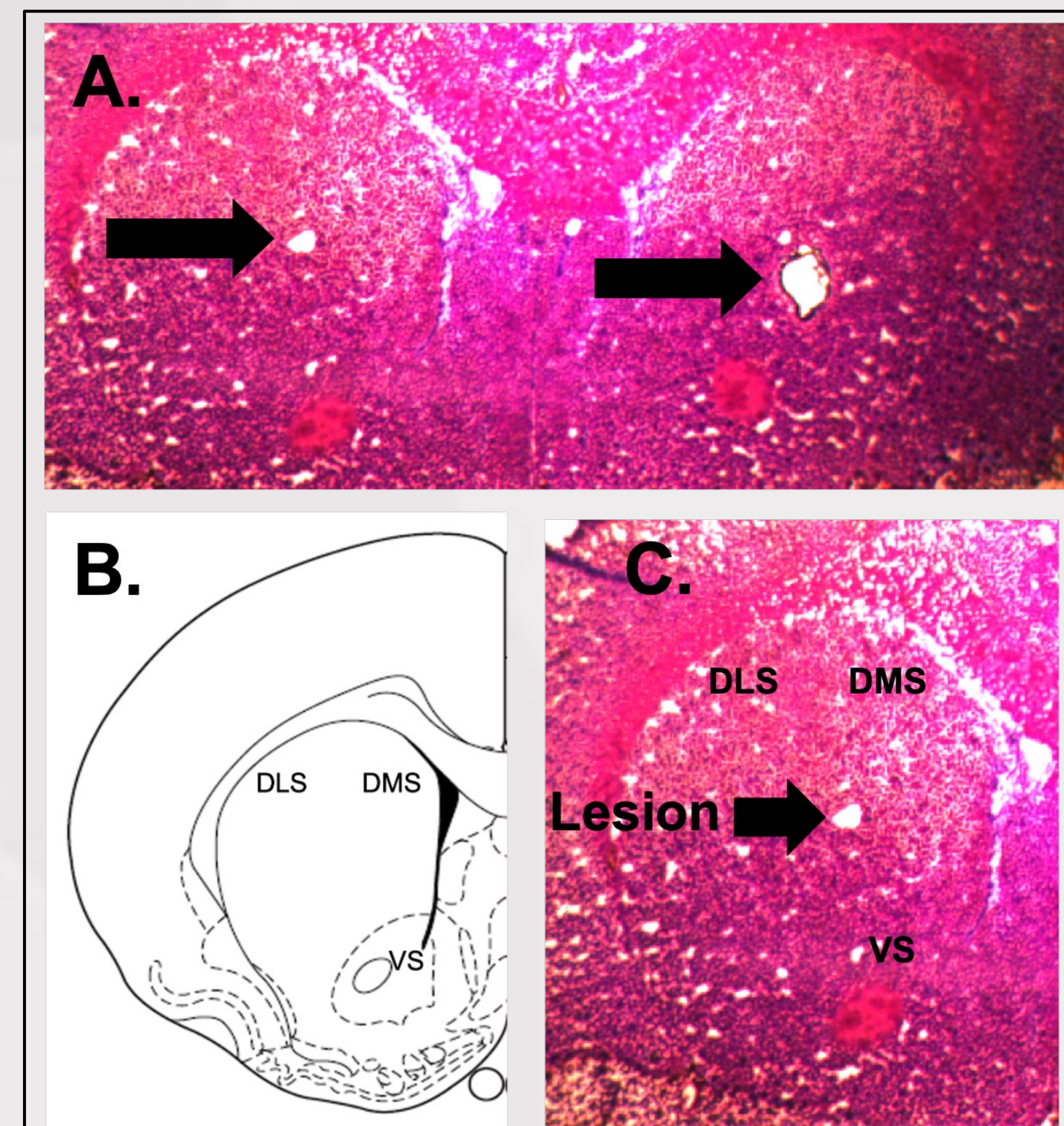


Fig. 4. Microelectrode tip identification. (A.) Electrically lesioned area of microelectrode tip (arrow) located in the superior aspect of the nucleus. (B.) Schematic diagram of the coronal section of rat brain illustrating dorsal lateral striatum (DLS), dorsal medial striatum (DMS), and ventral striatum (VS, also known as nucleus accumbens). (C.) Microelectrode tip location (arrow) at higher magnification.

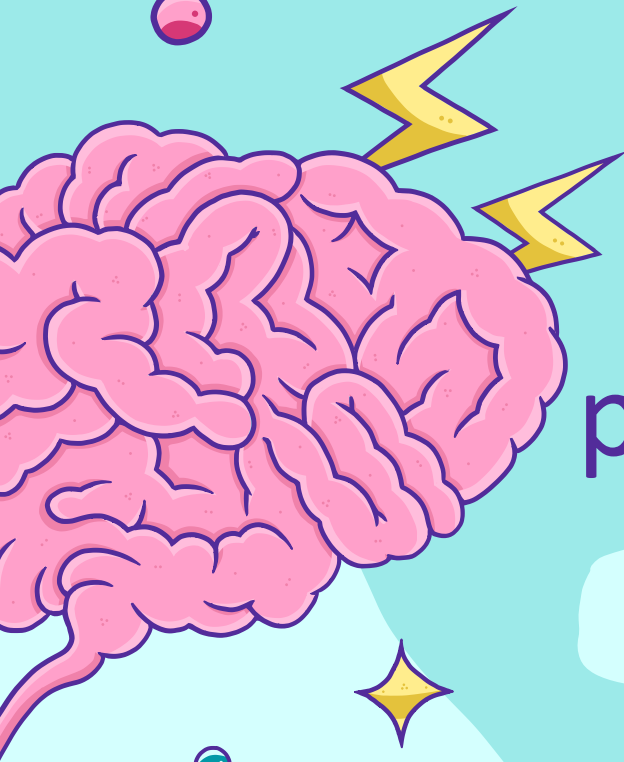
Conclusion

References

Clark et al. (2013) Dopamine encoding of Pavlovian incentive stimuli diminishes with extended training. *J Neurosci* 33:3526-3532.

Funding and Acknowledgements

- Funding :
- EWU Department of Biology
 - McNair Research funding

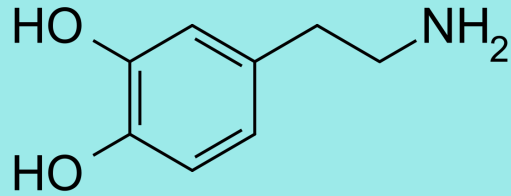


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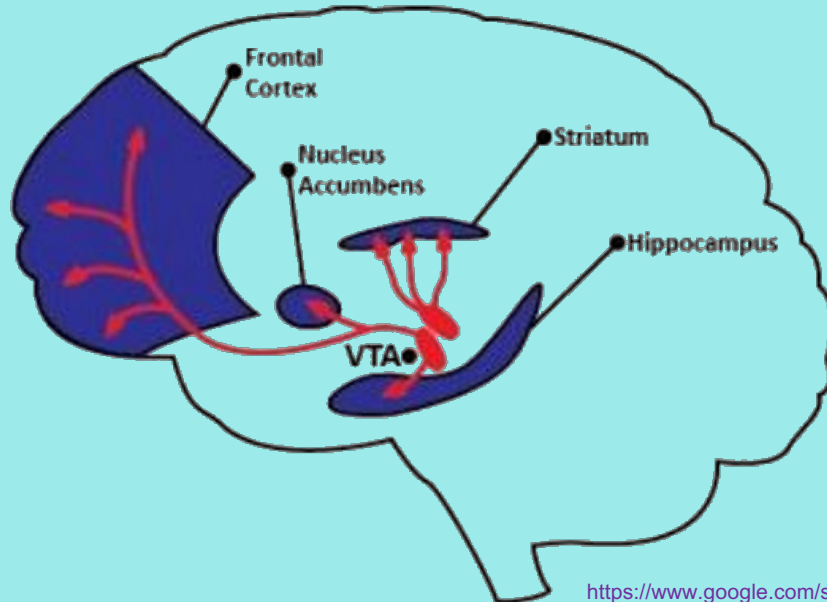
By Claudio Escalante
August 17, 2022



Dopamine



Dopamine Pathways



Functions

- Motor
- Reward

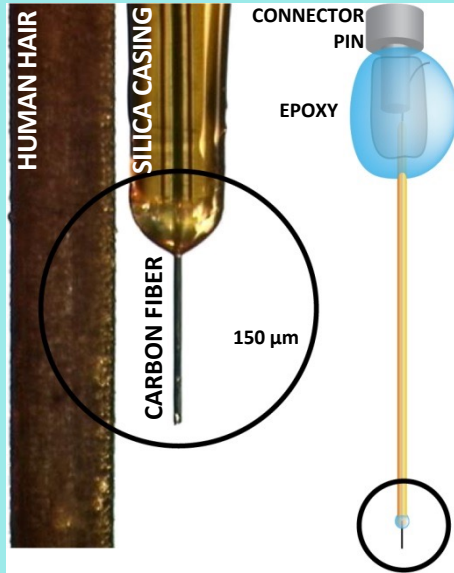


Fig. 1. Chronic fast-scan cyclic voltammetry (FSCV) microelectrode. Relative small size of the carbon fiber sensor (~150 μm x 5 μm) results in little tissue damage at DA recording site. *Modified from Clark et al. 2010.*

Fast Scan Cyclic Voltammetry (FSCV)

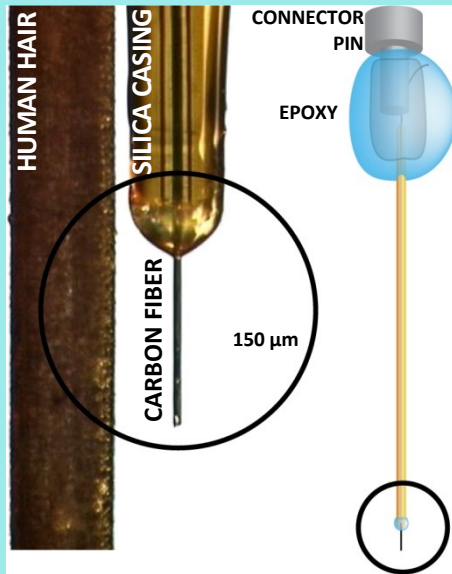
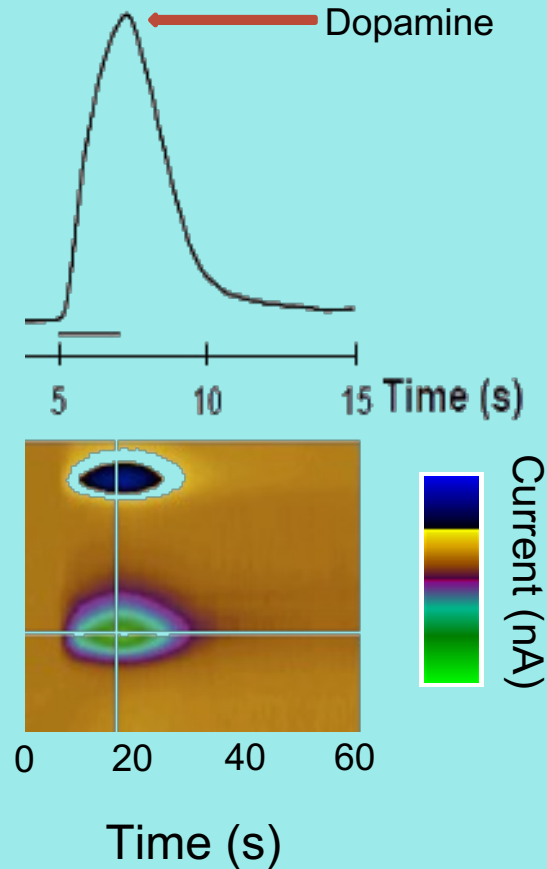
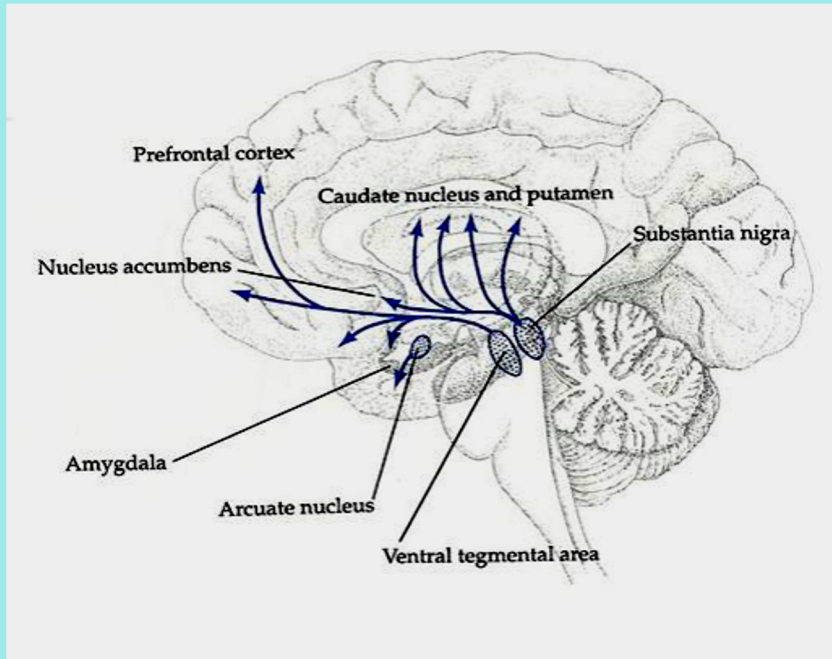


Fig. 1. Chronic fast-scan cyclic voltammetry (FSCV) microelectrode. Relative small size of the carbon fiber sensor ($\sim 150 \mu\text{m} \times 5 \mu\text{m}$) results in little tissue damage at DA recording site.
Modified from Clark et al. 2010.

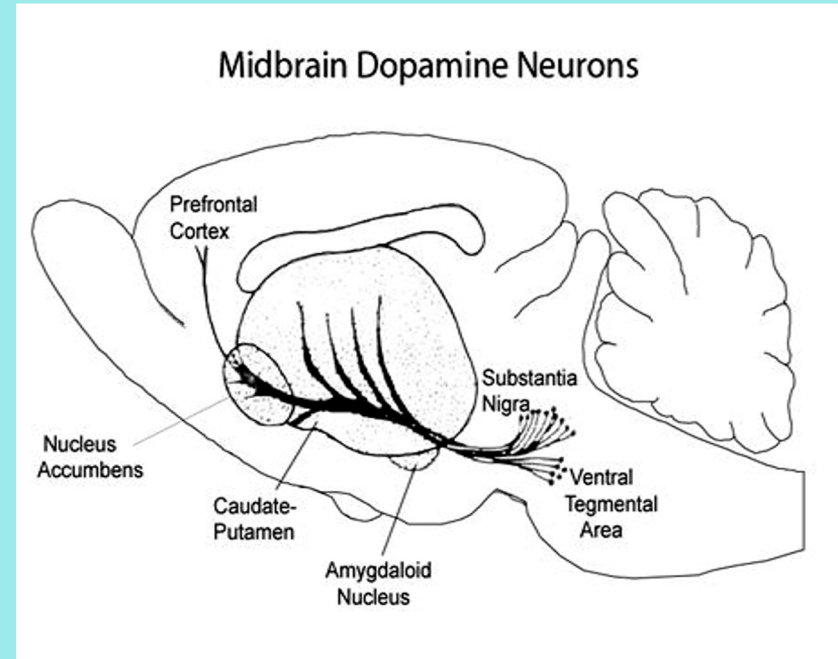


Dopamine Neuroanatomy

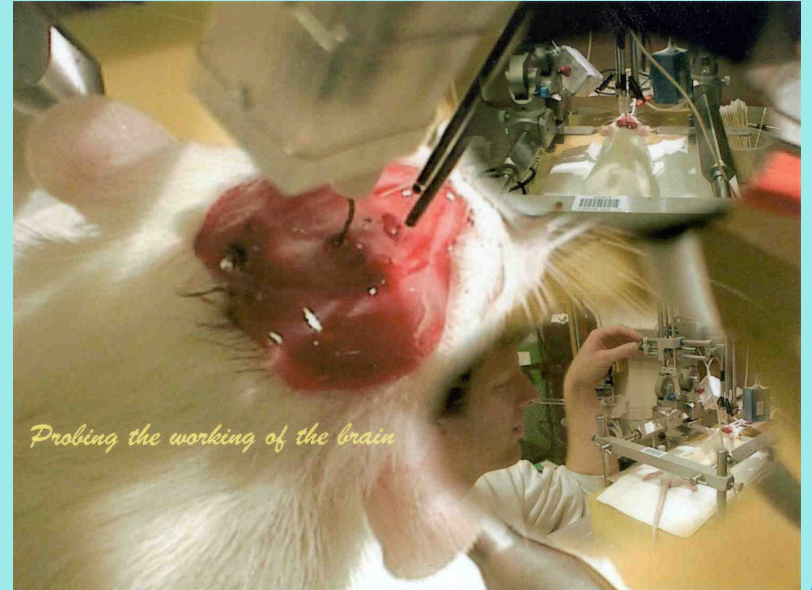
Human



Rat



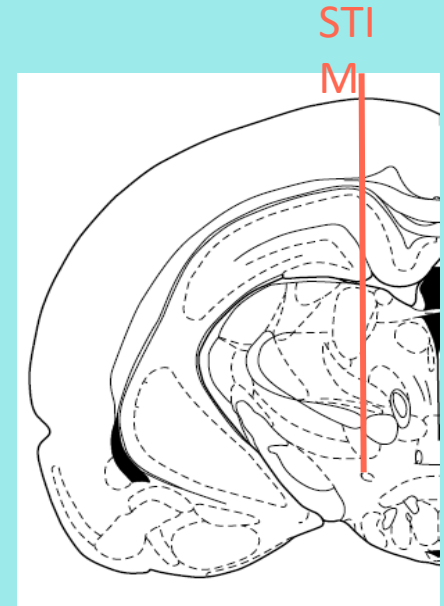
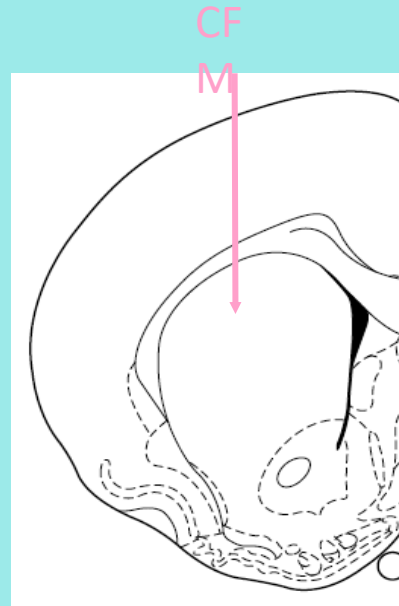
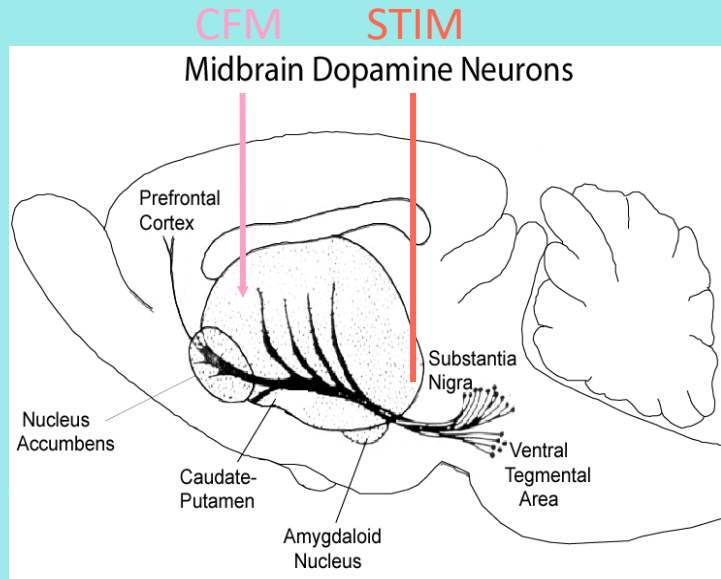
Dopamine Surgery



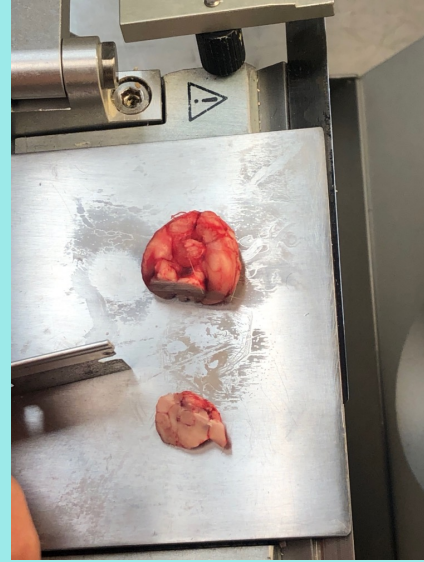
Experimental Design

CFM = carbon fiber microelectrode

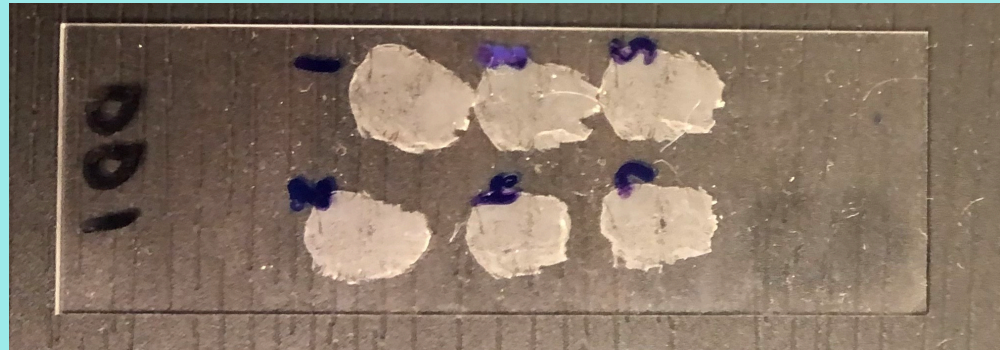
STIM = stimulating electrode



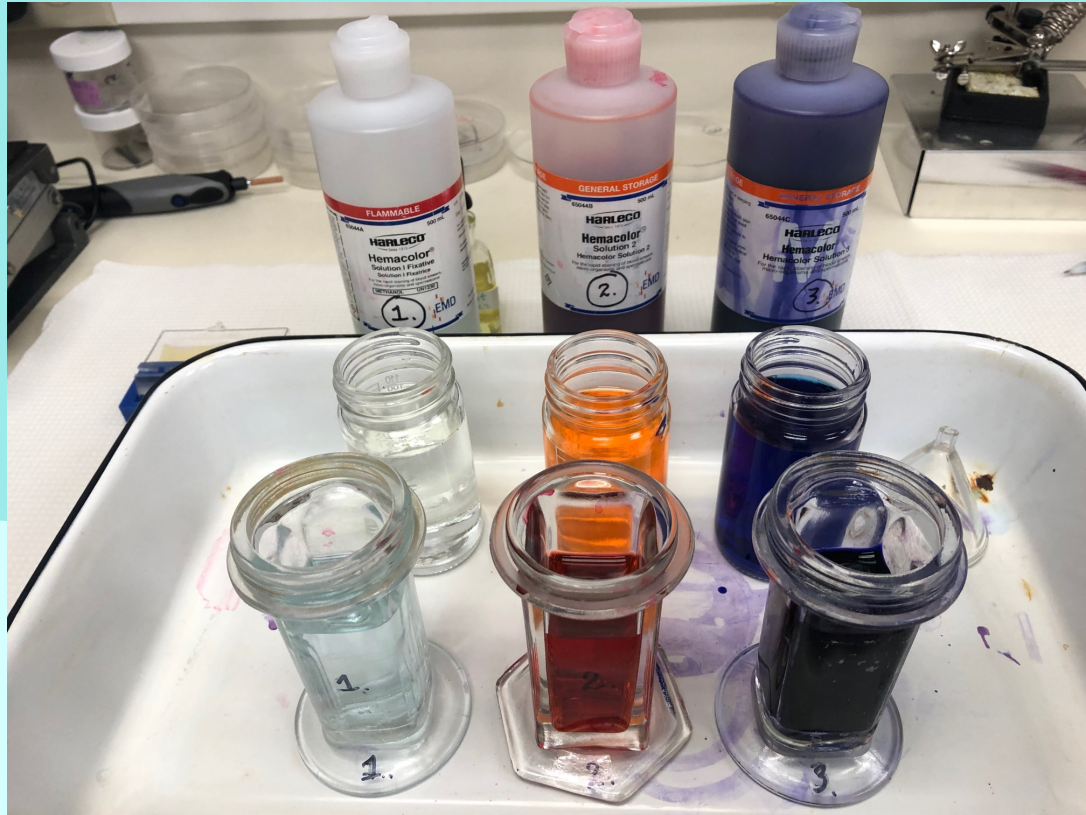
Brain slicing prep



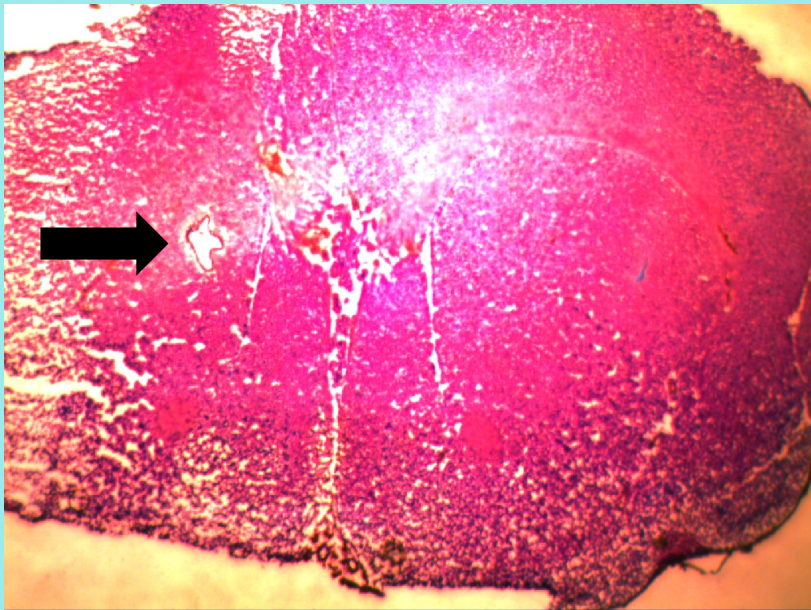
Cryostat brain slicing machine



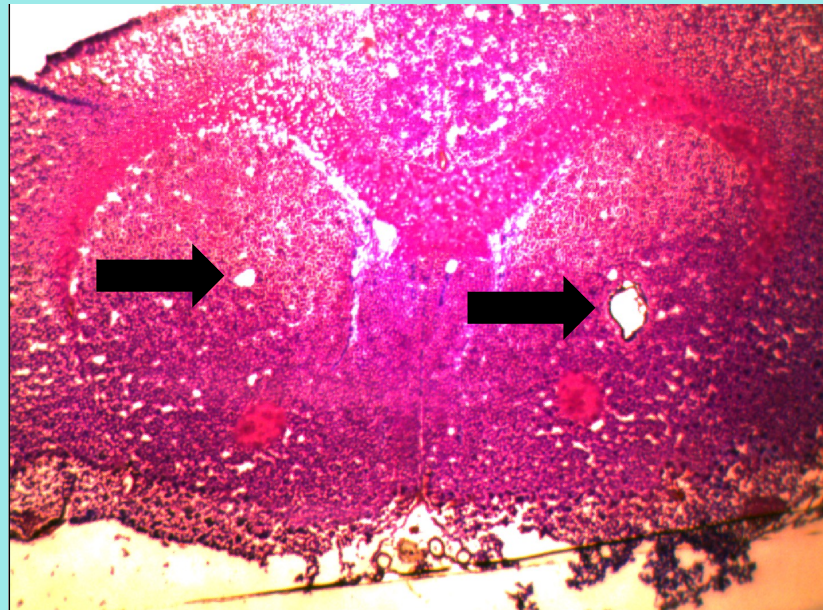
Staining



Results

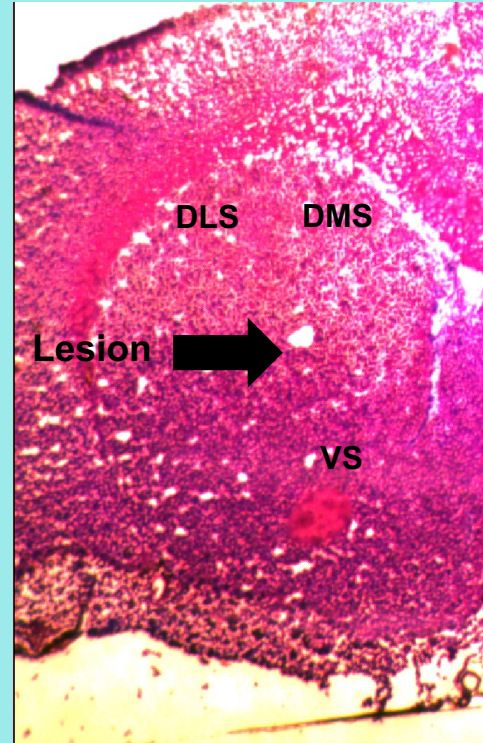
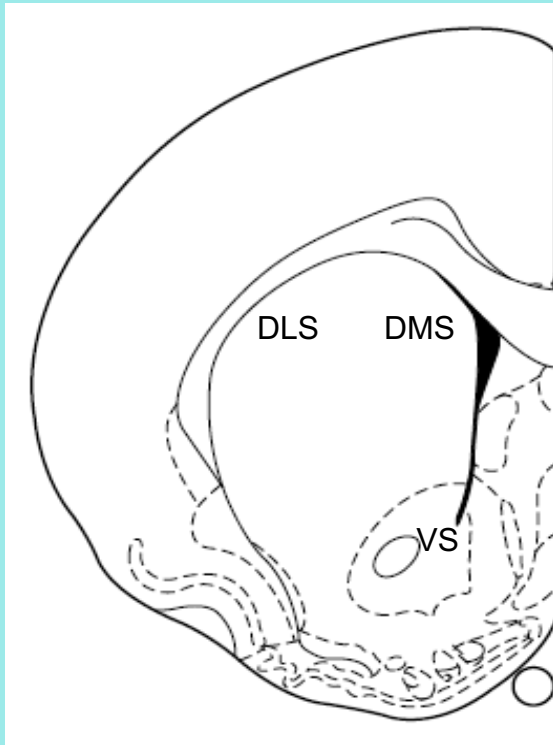


CE sectioned – rat surgery 6-01-22
slide 4 – section 4



GR sectioned – rat surgery 5-25-22
slide 8 – section 1

Results

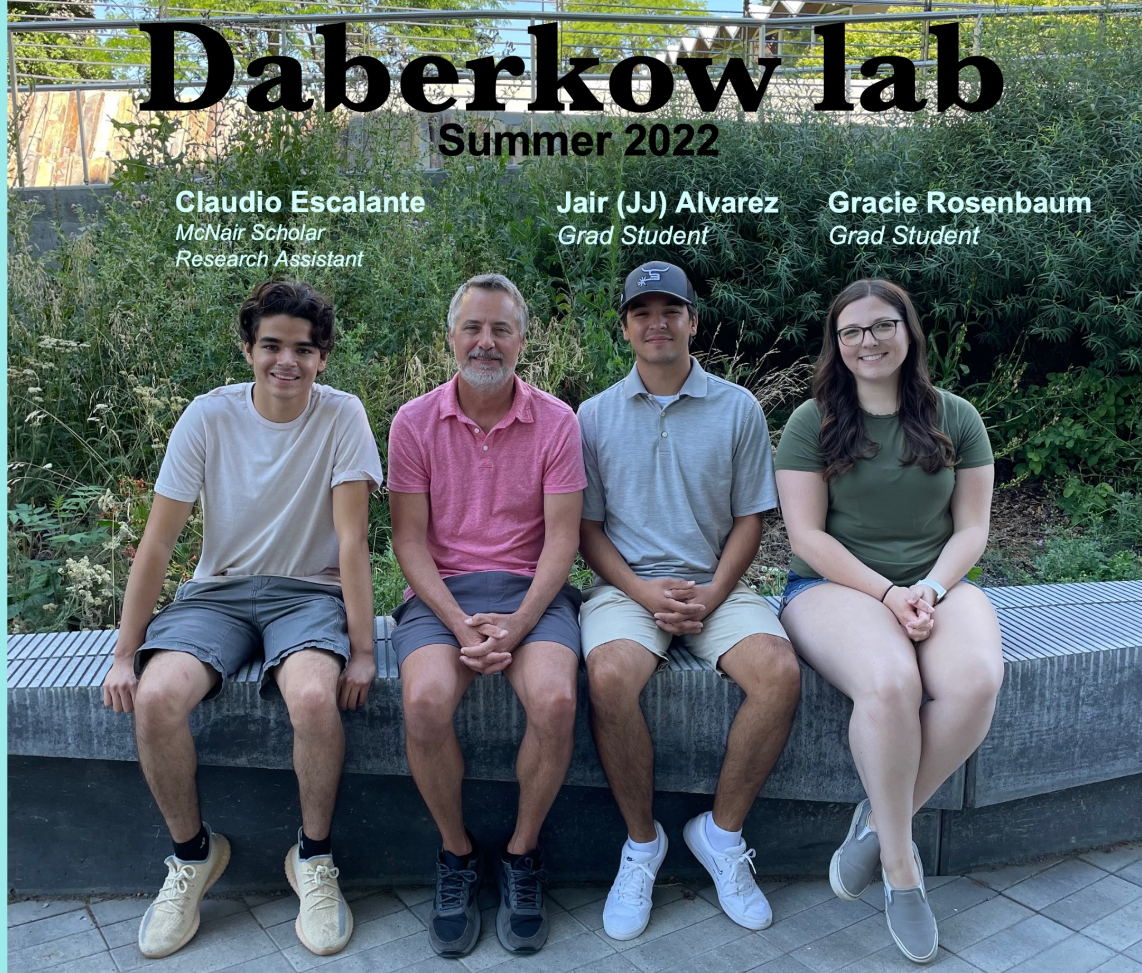


DLS = Dorsal lateral striatum

DMS = Dorsal medial striatum

VS = Ventral striatum

Questions?



Daberkow lab

Summer 2022

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Grad Student

Acknowledgements

- Daberkow lab
- EWU Department of Biology
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