

Creating Permanent and Temporary Inactivations in the Rat Posterior Parietal Cortex.

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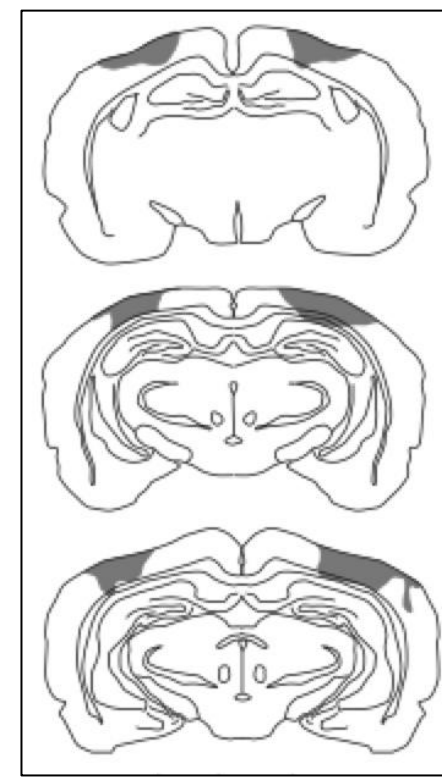
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The aim of this research was to determine the stereotaxic coordinates for targeting of the Posterior Parietal Cortex (PPC) in order to map structure to function. Two methods were used: permanent lesions created with NMDA (N-Methyl-D-aspartic acid) and temporary inactivations created with DREADDs (Designer Receptor Exclusively Activated by Designer Drugs). The majority of previous PPC research has only lesioned the dorsal PPC (dPPC), possibly due to the difficulty targeting the lateral position of the caudal PPC (cPPC). Refining the coordinates of this area will enable a more inclusive study of the PPC.

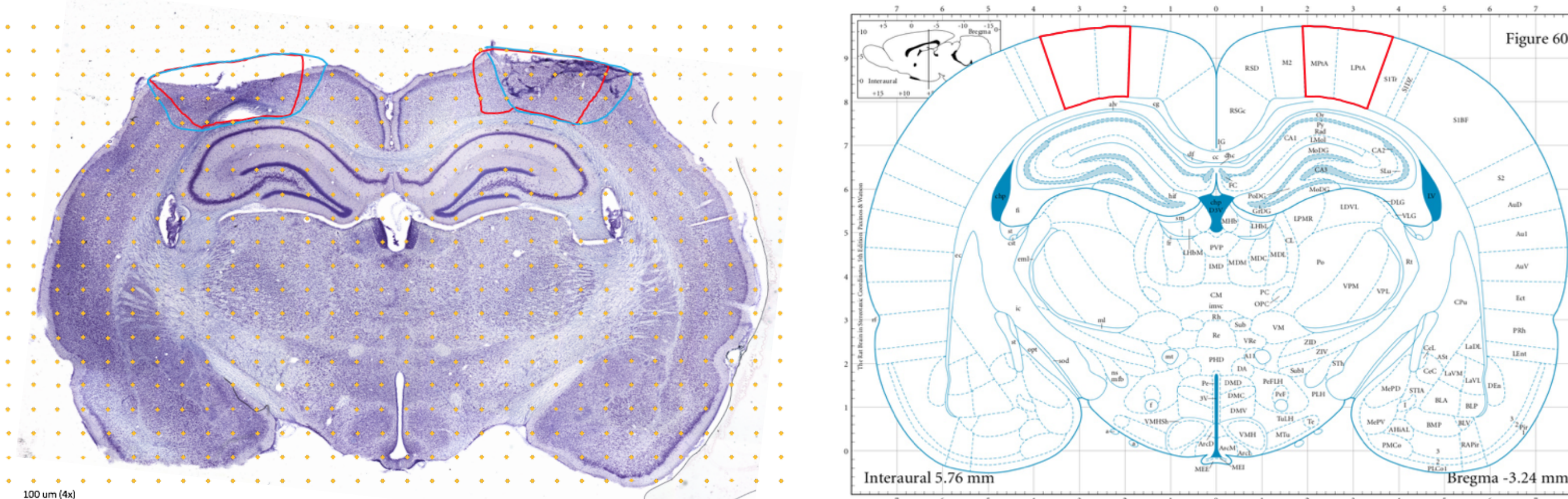
Permanent Brain Lesioning: NMDA

- NMDA was used to create permanent lesions to the dPPC and cPPC.
- Two pilot lesioned animals' brains showed successful targeting of both the dPPC and cPPC. (Shown right: extent of lesions)
- After brain coordinates were confirmed, 9 rats received bilateral PPC lesions and 10 rats served as controls. Rats were then tested on a battery of behavioral tasks, including memory, attention, spatial, and sociability tasks.
- Lesion extent was quantified via histology.

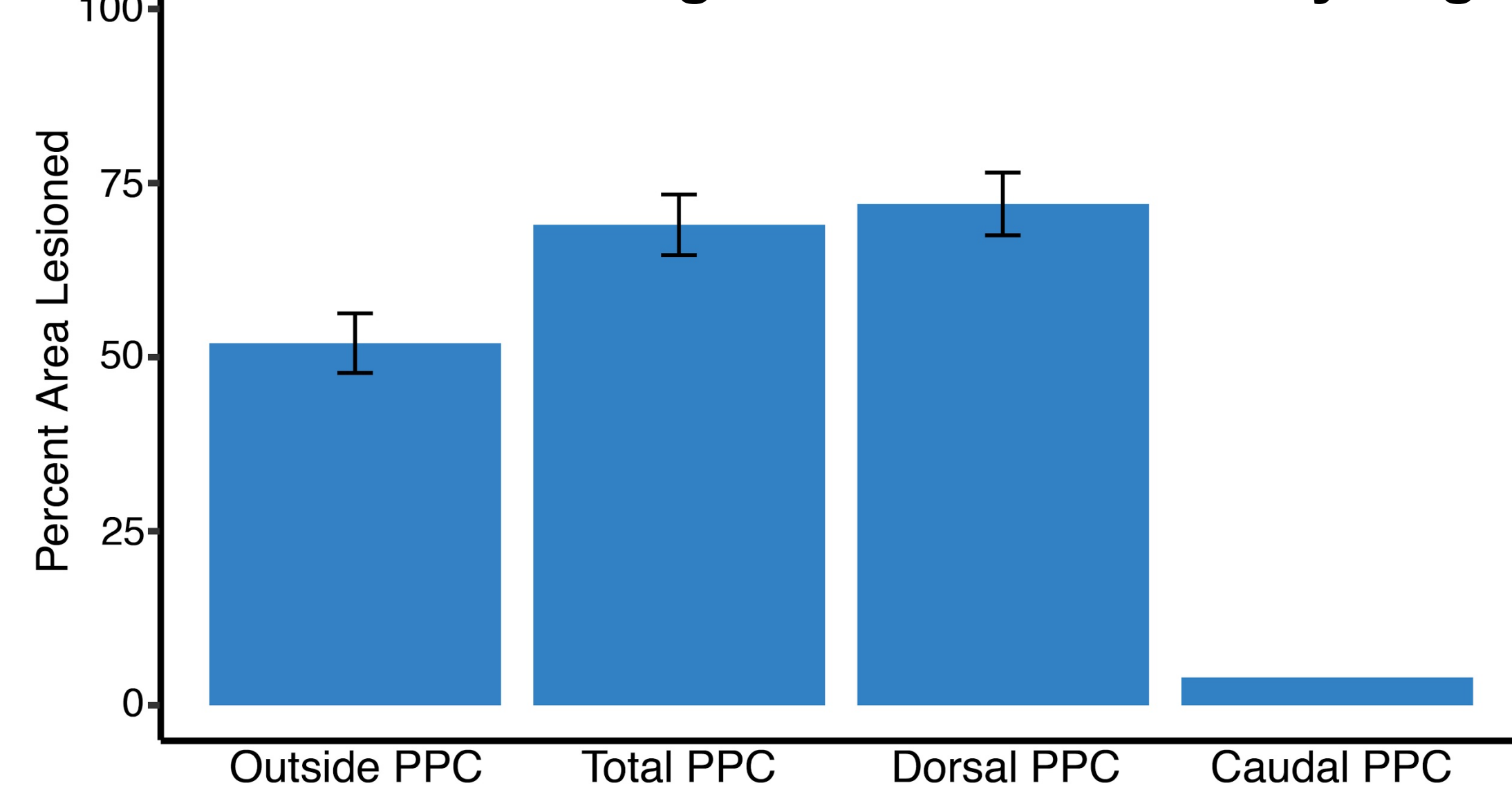


Successful dPPC But Not cPPC NMDA Lesions

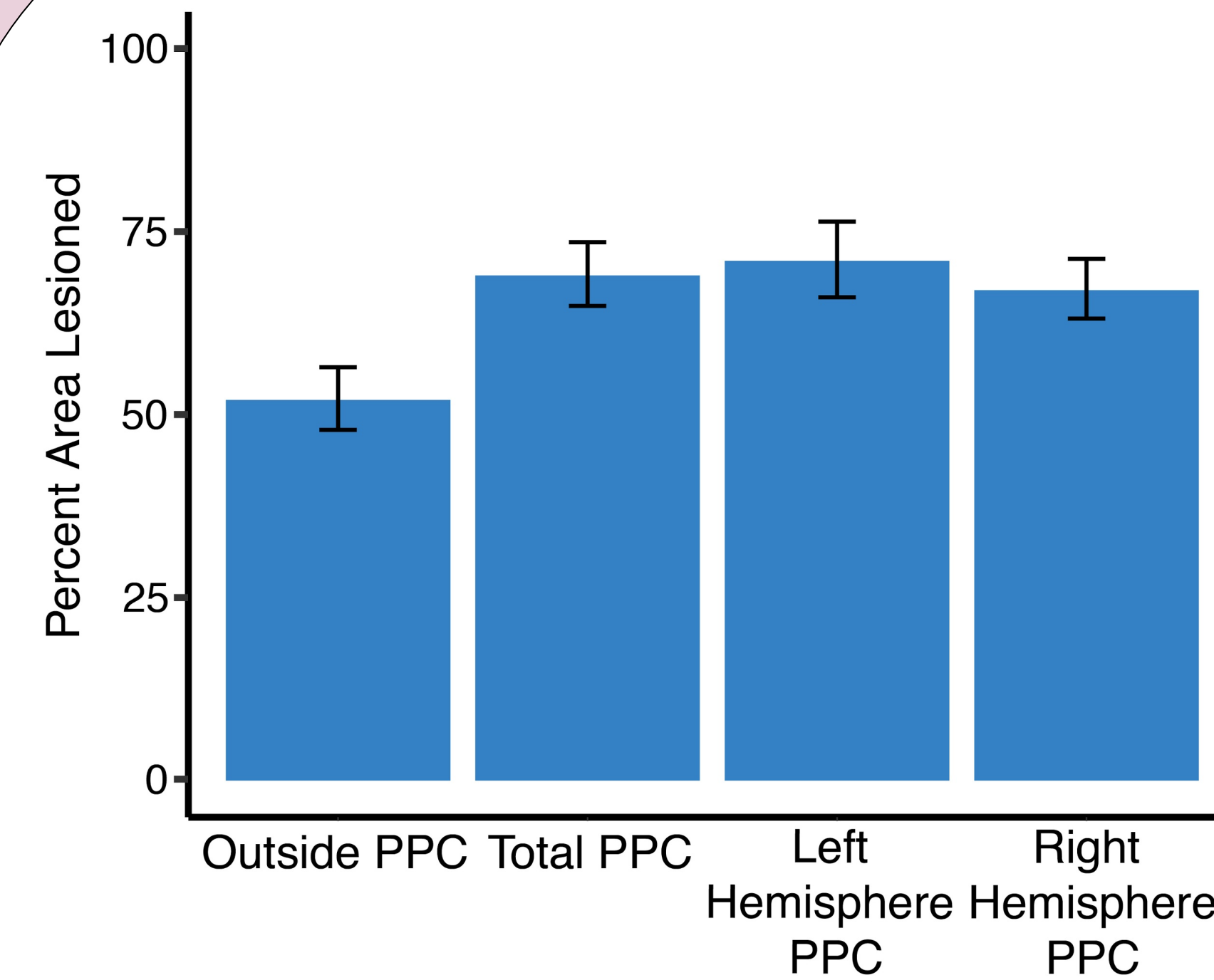
The cross-section of a permanently lesioned rat brain (left) and the atlas view (right). The blue outline is the lesion area, and the red is the dPPC.



Total Percentage of Area Lesioned by Region



Disparity of Left/Right Permanent Lesions



Results indicate that while NMDA lesions thoroughly ablated the dPPC, they minimally lesioned the cPPC, and created significant extra PPC damage.

Temporary Brain Inactivation: DREADDs

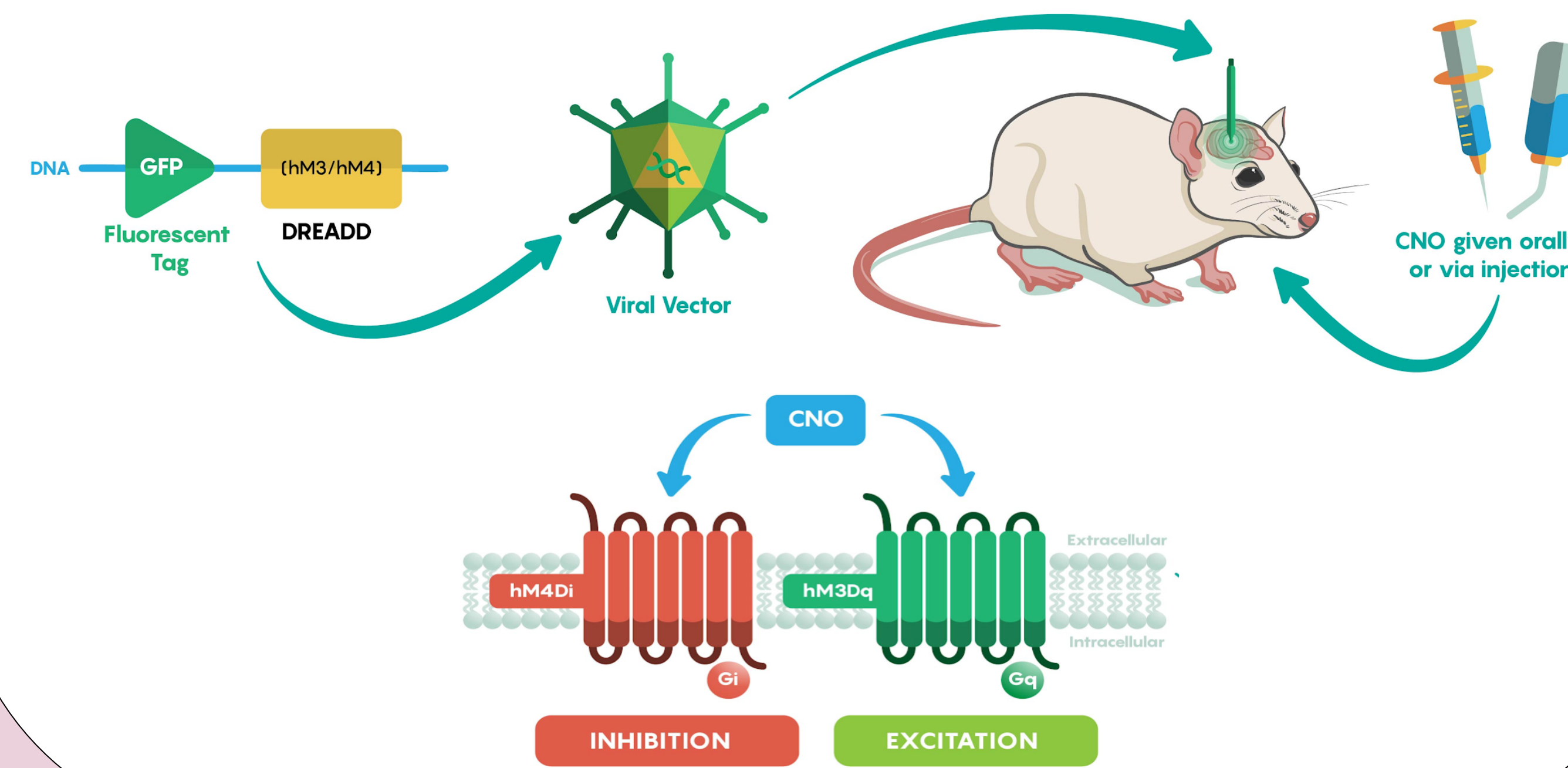
- Two male Long-Evans rats received fluorescent DREADDs virus injections intended to target both the dPPC and cPPC.
- Coordinates and injection amounts were adjusted from the NMDA injections, and again after histological analysis was performed on the first DREADDs subject.

Stereotaxic Coordinates for All PPC Injections

	AP		ML		DV		Injection (μL)	
Pilot and large cohort NMDA	-3.6 to -4.2	-5.0 to -5.6	2.4 to 4.2	4.8 to 5.2	-0.5	-0.95 to -1.75	0.1	0.1
DREADDs 1	-3.6 to -4.2	-5.0 to -5.6	2.4 to 4.2	4.8 to 5.2	-0.6	-0.95 to -1.75	0.8	0.5
DREADDs 2	-3.8 to -4.3	-4.8 to -5.4	2.4 to 4.4	4.8 to 5.2	-0.6	-1.0 to -1.75	0.6	0.4
	dPPC	cPPC	dPPC	cPPC	dPPC	cPPC	dPPC	cPPC

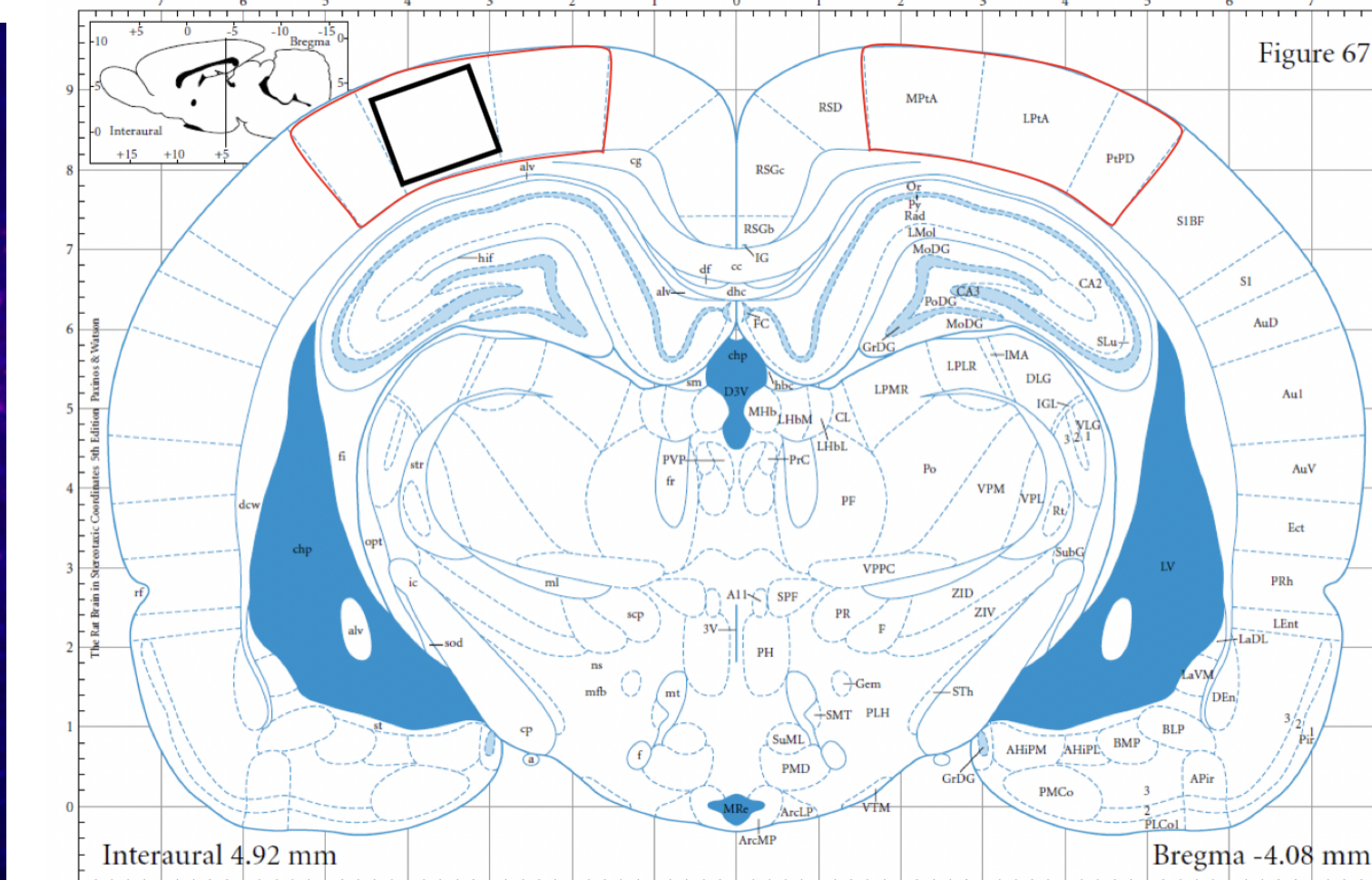
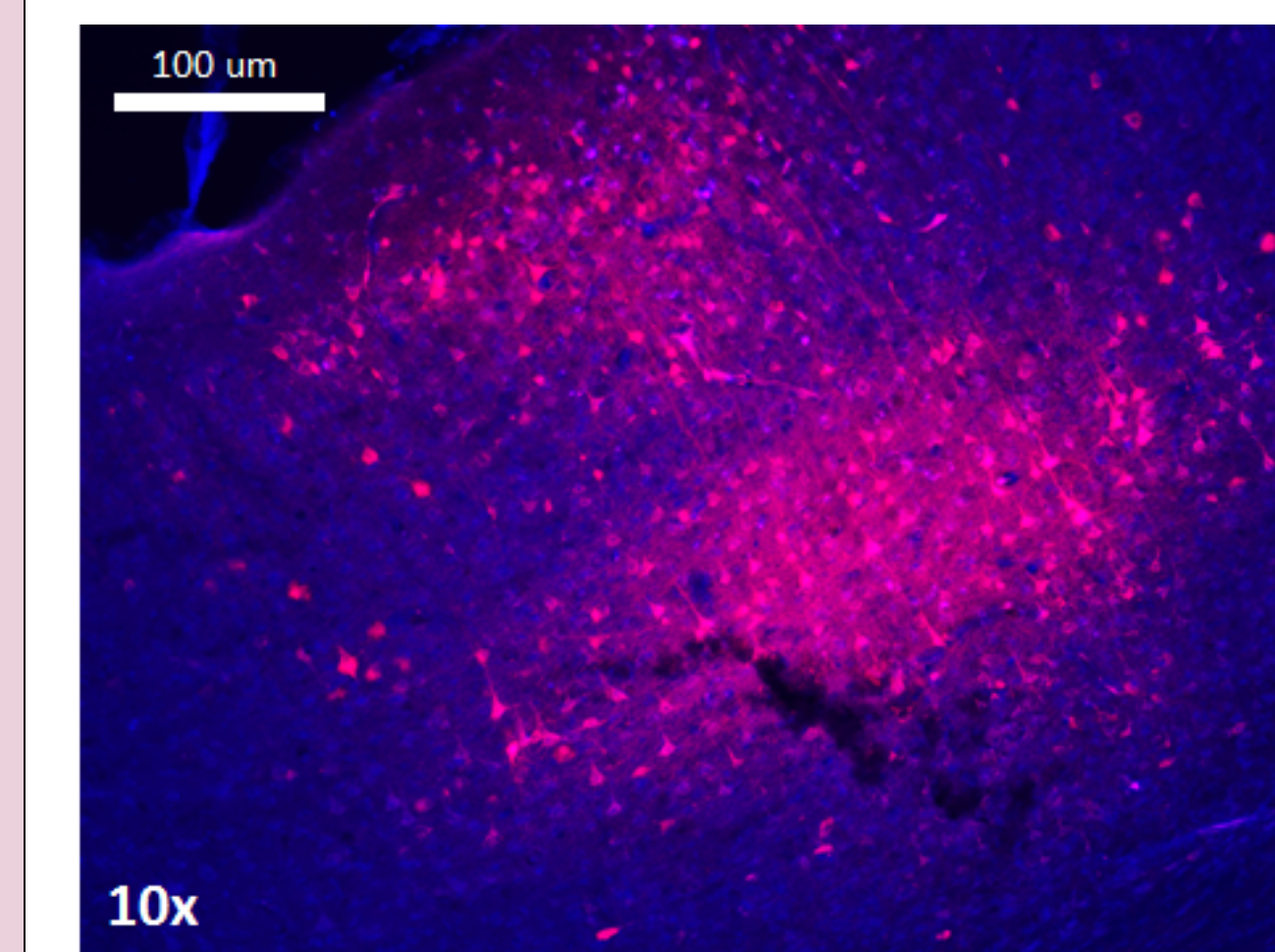
Visual Explanation of DREADDs Process

(Ju, Barany, Shcherbina, & Lee, 2017.)

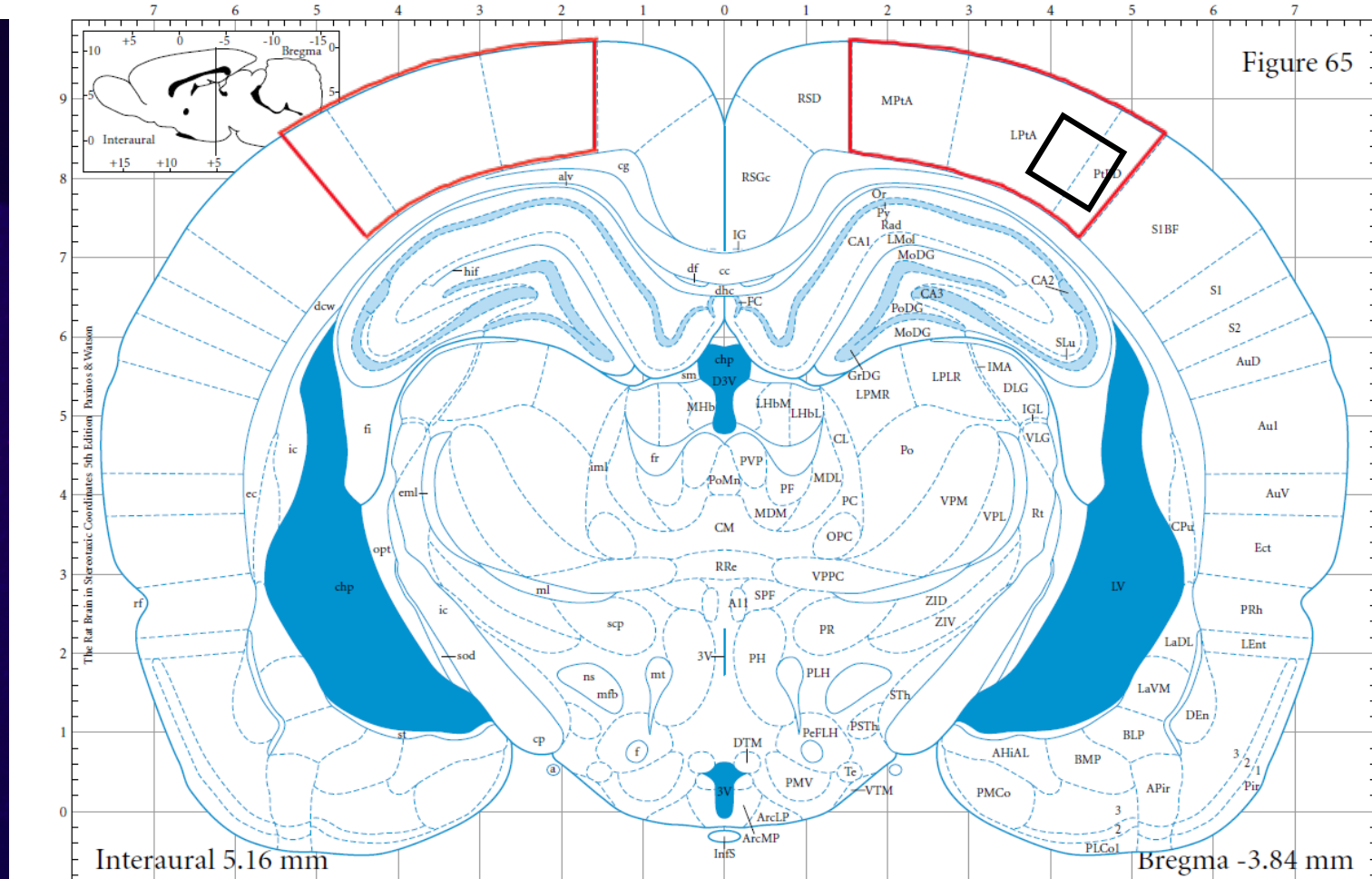
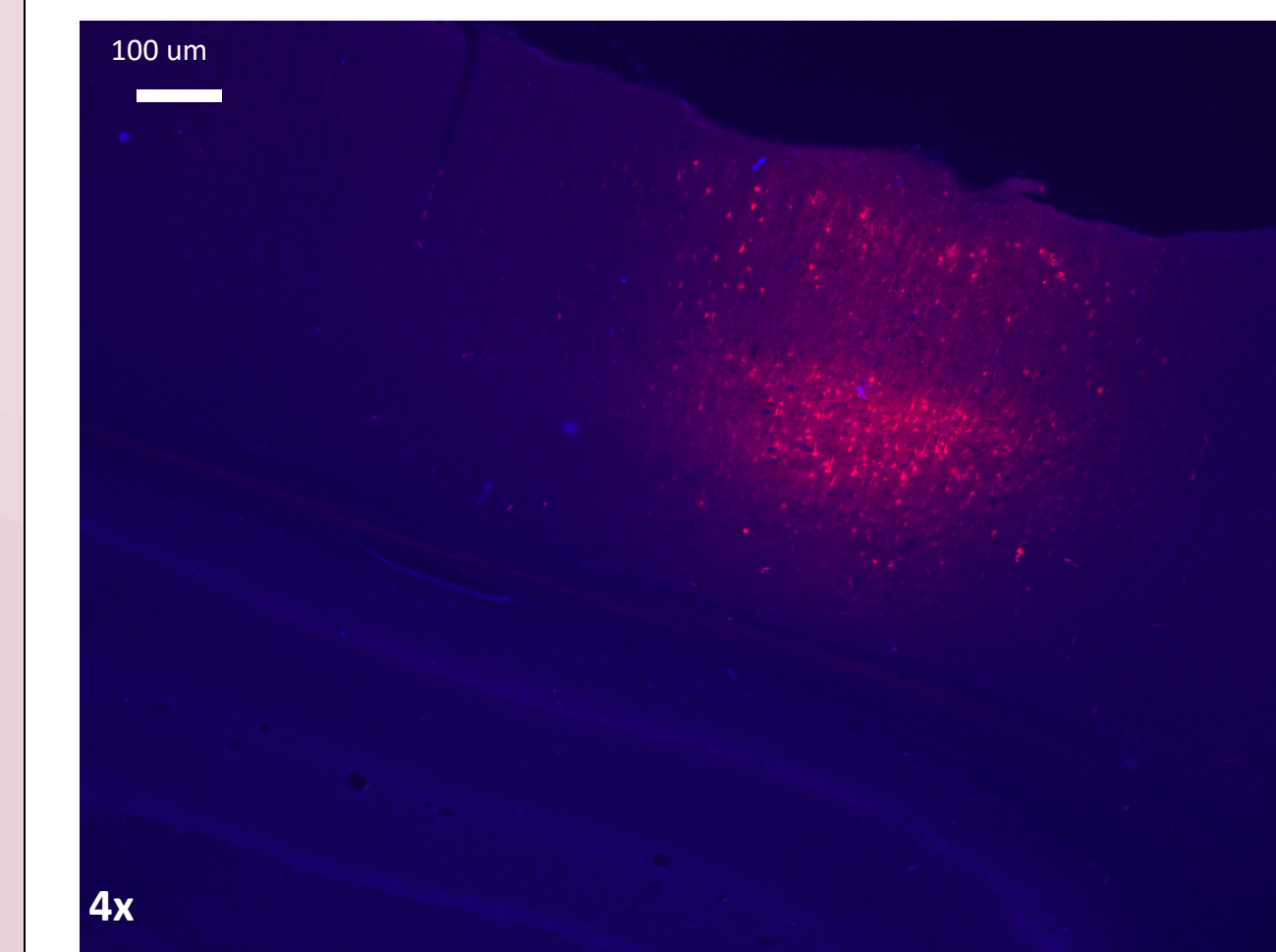


DREADDs Injections Successfully Targeted the dPPC and cPPC

Left hemisphere dPPC at -4.08 bregma (Left); Rat dPPC outlined in red on an atlas of the rat brain (Paxinos & Watson, 2013), with the DREADDs area outlined in black (Right).



Right hemisphere dPPC at -3.84 bregma (Left); Rat dPPC outlined on an atlas of the rat brain (Paxinos & Watson, 2013), with the DREADDs area outlined in black (Right).



- Fluorescent imaging of the DREADDs virus was conducted to determine spread.
- Results from the first subject show that coordinates accurately target both the dPPC and cPPC, with improved localized spread.

Conclusions and Future Directions

- Stereotaxic coordinates for the PPC are shown to be accurate after small adjustments for Long-Evans males of approximately 300-350g.
- The majority of previous PPC research has only targeted the dPPC; however, use of refined PPC coordinates will aid in determining the function of both the dPPC and cPPC.
- We intend to use these advanced temporary inactivation methods in future behavioral analysis, in which rats will be tested on a battery of memory, spatial, attentional, and sociability tasks.