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Degeneration and Neurogenesis Following an Excitotoxic Focal Lesion to the Olfactory Bulb of Zebrafish

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Background

Zebrafish are an excellent model to study neurogenic plasticity following damage and disease due to their extensive regeneration mechanisms. Our lab has shown that the olfactory bulb completely recovers structurally after direct lesion.

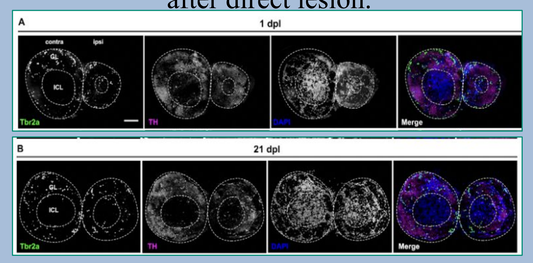


Fig. 1 Tbr2a, TH, and DAPI staining of lesioned olfactory bulb with control A) Images of lesioned bulb 1dpl. B) Images showing recovery of lesioned olfactory bulb after 21dpl.

However, neurogenesis in the olfactory bulb has not been studied. **Our goal is to study neural regeneration in the olfactory bulbs following an excitotoxic lesion, and how the rebirth of new neurons is contributing to its structural recovery.**

Hypotheses

Following lesion, the olfactory bulb will reveal the generation of new neurons, which leads to its full structural and recovery after 21 days.

Methods

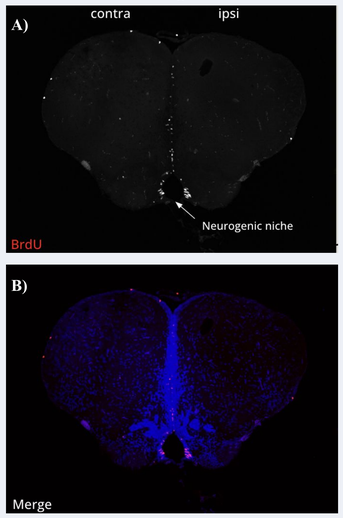
- Adult zebrafish were lesioned with 15mM quinolinic acid in the right olfactory bulb, and left to recovery for 1 day or 21 days
- Brains were dissected and embedded in paraffin for immunohistochemistry processing
- Thymine marker, BrdU, is used and tracked with antibodies to mark any new cells that have regenerated after lesioning
- Tissues are treated with fluorescent antibodies and observed with confocal microscopy

Results

Following lesion to the OB, there was increased BrdU profiles in the VZ at 1 dpl, and remained increased by 21 dpl
BrdU+ cells and mitral cells migrated from the VZ to the OBs by 21 dpl

1 dpl

Fig. 2



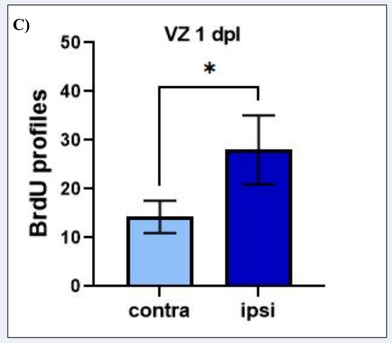
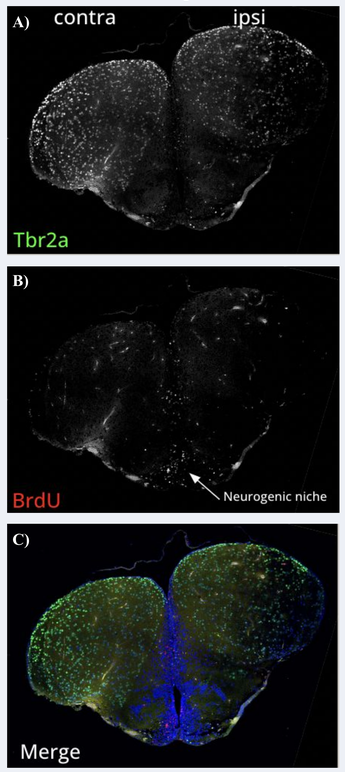


Fig. 2 BrdU staining in magnified images of contra and ipsilateral increased cell proliferation in the VZ at 1 dpl. A) Black and white profile of VZ at 1 dpl.
B) Colored profile of VZ at 1 dpl.
C) Quantitative comparison of increased cell proliferation at 1 dpl of VZ.

21 dpl

Fig. 3



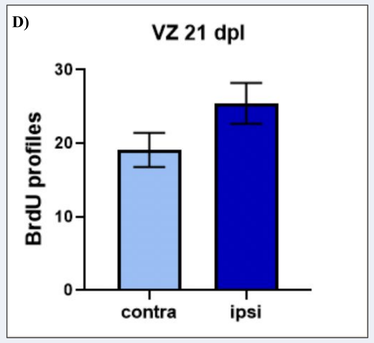
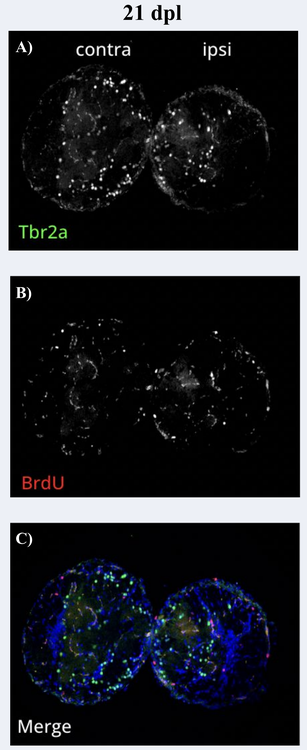


Fig. 3 BrdU and Tbr2a staining in magnified images of contra and ipsilateral cell proliferation in the VZ at 21 dpl. A) Black and white staining with Tbr2a of VZ at 21 dpl.
B) Black and white staining with BrdU of VZ at 21 dpl.
C) Colored image with both Tbr2a and BrdU stainings of VZ at 21 dpl.
D) Quantitative comparison of continued increased cell proliferation by 21 dpl of contra and ipsilateral VZ.

21 dpl

Fig. 4



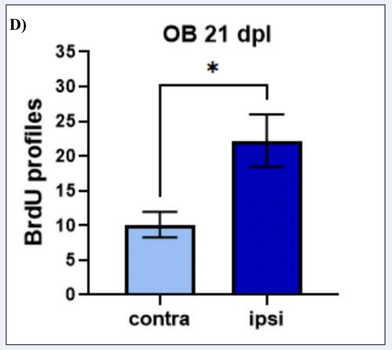


Fig. 4 BrdU and Tbr2a staining contra and ipsilateral profiles of OBs and new cell migration at 21 dpl. A) Black and white magnified image with Tbr2a of OBs at 21 dpl.
B) Black and white images with BrdU of OBs at 21 dpl.
C) Colored profile of both Tbr2a and BrdU stainings in the OBs at 21 dpl.
D) Quantitative comparison of cell proliferation at 21 dpl of contra and ipsilateral OBs.

Conclusion

Our results show that there is evidence of new cell proliferation following the lesion:

1. **The lesion in the OB increased cell proliferation in the VZ (ventricular zone) at 1 dpl.**
2. **There is a remained increase in neurons and mitral cells in the VZ at 21 dpl. Some cells are migrating away from the neurogenic niche.**
3. **The new cells generated and new mitral cells had migrated to the OBs from the VZ and remained there by 21 dpl.**

Ongoing Research

We hope to continue to analyze the neurogenic mechanisms following damage to the OB and assess the counts of new glutamatergic neurons specifically, and how this cell proliferation is contributing to the recovery of the olfactory bulbs

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