WINONA STATE UNIVERSITY
UNDERGRADUATE STUDENT RESEARCH & CREATIVE PROJECTS FINAL REPORT

Electronically submit complete final report ten (10) days following completion of project to Grants & Sponsored Projects (grants@winona.edu).
Hover over fill-able fields for additional guideline and completion information.

Student Name: Taylor Hobbs

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Student Major: Cell and Molecular Biology

Faculty Sponsor: Jacob Hines

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Title of Project: Synaptic Vesicle Localization within Axons

Project Abstract:

Oligodendrocytes (OLs) are the myelinating cells in the central nervous system (CNS) that extend long branchy processes to explore many different neurons 1−4. These myelinating cells provide support to the neuron which allows for messages to be sent rapidly from axon to axon. Without myelin, diseases such as multiple sclerosis effect millions of individuals. Neural impulses are potentiated by releasing synaptic vesicles at the terminal ends of neurons. An emerging area of interest within the field is that vesicle release occurs along the length of axons4 and works as a functional regulator of myelination1. OLs have heightened interactions at synaptic vesicle enrichment, a part of the neuron (unpublished data). Concurrently, OLs have heightened interactions at varicosities. The structure of these varicosities and vesicle enrichment sites are not well characterized. The aim of this study is to determine if the synaptic vesicle enrichments are localized within varicosities. Additionally, if there is an enrichment of synaptic vesicles located within the varicosities, are they motile or transient? The answers to these questions will give us a further insight as to how axons and their subdomains instruct or restrict myelination. These questions were addressed by obtaining short time lapses using in vivo, confocal microscopy of four-day old transgenic zebrafish embryos. From these time lapses, it was determined that synaptic vesicles can indeed reside in and enrich varicosities. We were also able to determine that individual vesicles can be motile while large areas of vesicle enrichments tend to remain transient in the time course observed.

The student-authored final report **MUST** include each of the following (check boxes to verify inclusion of each component):

☐ This report form, fully completed (page 1 of this form)
☐ A copy of the project end product, appropriate to the standards of the discipline

Applicant Signature: Taylor L. Hobbs

Date: 4/29/2020

Faculty Sponsor Signature:

Date:

Submit complete reports electronically to Grants & Sponsored Projects (grants@winona.edu).

A deans' sub-committee makes decisions on Undergraduate Student Research & Creative Projects proposals.

Note that a copy of the project end product will be forwarded to Krueger Library for archival purposes.

In vivo confocal microscopy of synaptic vesicles within varicosities. This data was presented at the Society for Neuroscience in Chicago, IL in October 2019.

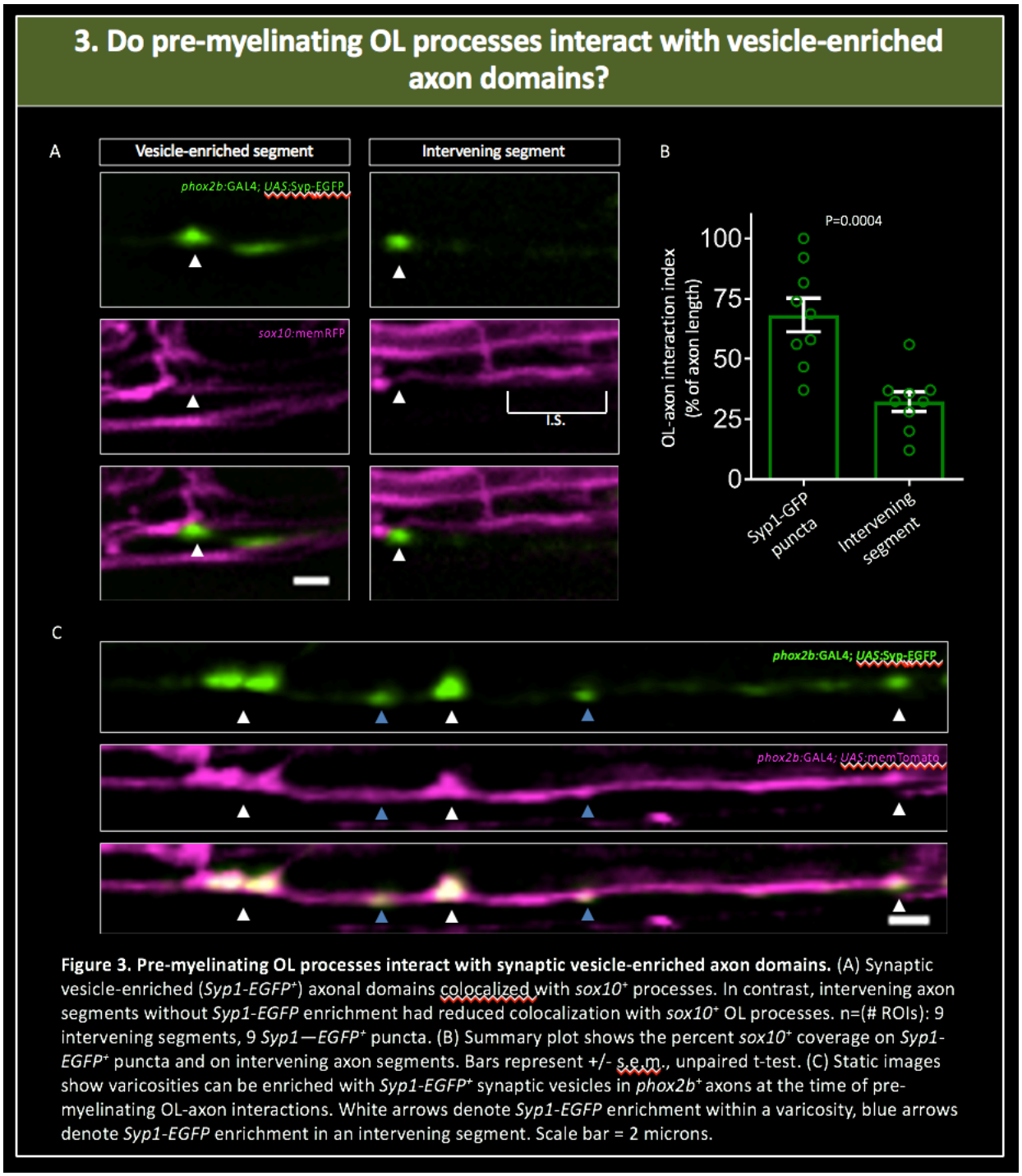

Figure 3. Pre-myelinating OL processes interact with synaptic vesicle-enriched axon domains. (A) Synaptic vesicle-enriched (*Syp1-EGFP*$^+$) axonal domains colocalized with *sox10*$^+$ processes. In contrast, intervening axon segments without *Syp1-EGFP* enrichment had reduced colocalization with *sox10*$^+$ OL processes. n=(# ROIs): 9 intervening segments, 9 *Syp1—EGFP*$^+$ puncta. (B) Summary plot shows the percent *sox10*$^+$ coverage on *Syp1-EGFP*$^+$ puncta and on intervening axon segments. Bars represent +/- s.e.m., unpaired t-test. (C) Static images show varicosities can be enriched with *Syp1-EGFP*$^+$ synaptic vesicles in *phox2b*$^+$ axons at the time of pre-myelinating OL-axon interactions. White arrows denote *Syp1-EGFP* enrichment within a varicosity, blue arrows denote *Syp1-EGFP* enrichment in an intervening segment. Scale bar = 2 microns.