Advanced Summer Research Scholarships

2019 Abstracts

INDIANA UNIVERSITY
UNDERGRADUATE RESEARCH
Scholarship Recipient: Julia Bourkland

Faculty Mentor: Vanessa Cruz Nichols, Department of Political Science

**ABSTRACT:** Julia’s project focuses on editorial treatment of female legislators. Looking at editorial news data available through LexisNexis, she uses political science dictionaries for sexist-coded language to measure the content of editorial articles, comparing how female legislators are discussed versus male legislators. Several additional variables were coded to test for multiple hypotheses. She used her stipend to code for US and UK databases through Amazon Mechanical Turk (MTurk) research service. Her preliminary research is presented in this poster.
Scholarship Recipient: Kyle Fulford

Faculty Mentor: Fernando Orejuela, Department of Folklore and Ethnomusicology

Sectarian Hymnody: Revisionist “Kingdom Songs” of Jehovah’s Witnesses

**ABSTRACT:** Jehovah’s Witnesses are a fundamentalist Christian sect with over eight million members worldwide. Since its inception in the 1880s, The Watchtower Organization has published hundreds of worship songs for its followers. This essay will use archival research to explain how audio and video recordings produced under the direction of the Governing Body of Jehovah’s Witnesses shape their doctrine and ensure compliance among its members. The primary sources used are Jehovah’s Witnesses publications, many of which are found at [http://wol.jw.org/](http://wol.jw.org/). I will also provide analysis of audiovisual media on www.jw.org and explain its role for viewers, particularly among children being raised in the religion. Finally, this essay will explain the paucity of research on Jehovah’s Witnesses, cite existing scholarship, and define the gaps in existing research.
Scholarship Recipient: Xuan Li

Faculty Mentor: Hui-Chen Lu, Department of Psychological and Brain Sciences

Elucidating the Roles of Fibroblast Growth Factors (FGFs) and FGF Receptors in Assembling Synaptic Contacts During Brain Development

Fibroblast growth factors (FGFs) and their receptors (FGFRs) are known to play a critical role in cortical patterning during brain development. A 2017 Lu Lab study found that FGFRs 1/2/3 play critical roles in the establishment of cortical sensory circuits in the primary somatosensory cortex of mouse brains, maintaining and stabilizing the established dendritic branch patterns of layer IV spiny stellate neurons. Furthermore, previous studies suggest synaptic contacts have a role in dendritic morphogenesis. To evaluate this hypothesis, dendritic spine densities of layer IV spiny stellate neurons in FGFR1/2/3 conditional knockout (KO) mice and their wild-type control littermates were examined and quantified. Dendritic segments of neurobiotin-labeled neurons prepared by Dr. Jui-Yen Huang via whole-cell voltage clamp recording were imaged via confocal microscopy on the Leica SP8. Three age groups were evaluated, P11-13 (postnatal day 11-13), P14-17, and P18-P20, and their dendritic spines counted with the aid of Bitplane Imaris’ filament module. To assess morphology, spines were classified as stubby, headed, or filopodia, with filopodia representing the weakest synapses and headed the strongest. A significant increase in the proportion of stubby spines was found at P11-P13, without a change in overall spine density. Interestingly, at P14-P17, a significant reduction in spine density became apparent. Furthermore, a trend towards a greater proportion of filopodia was seen at both P14-P17 and P18-P20, with a corresponding reduction in the proportion of strong, headed spines. When considered with Lu Lab electrophysiological data showing reduced spontaneous excitatory postsynaptic responses in FGFR1/2/3 knockout neurons, the spine density and morphology data obtained suggests that synaptic structural alterations likely contribute to observed functional deficits.
Scholarship Recipient: Aumunique Page

Faculty Mentor: Justin P. Kumar, Department of Biology

The Brahma Complex Project

**ABSTRACT:** The Brahma complex is a chromatin remodeling complex that is required for proper gene expression during development. This project aims to characterize mutant phenotypes resulting from loss of the Brahma complex in the fruit fly *Drosophila melanogaster* and to understand the underlying mechanisms that result in these phenotypes. Using the GAL4-UAS system of targeted gene expression, we conducted knockdown experiments using GAL4 drivers expressed in the eye-antennal disc. Specifically, the ey-GAL4 and Dorsal-eye GAL4 (DE-GAL4), as well as DE-GAL4, toyRNAi which additionally expresses an RNAi line against a master regulator of eye development, were crossed to RNAi lines against: Brahma Associated Protein- 60kd (Bap60), Dalao, Bramha Associated Protein-170kd (Bap170) and a dominant negative mutant Brahma protein (BrmDN). Their eye-antennal imaginal discs, larval tissues which will give rise to adult eye, antenna and head tissue, were dissected and stained with primary antibodies marking important developmental genes in the eye-antennal disc. The results of this screen showed that the BrmDN and the dalao RNAi lines exhibited mutant phenotypes, suggesting that they play a role in controlling gene expression in the eye-antennal disc.
Scholarship Recipient: Michael Rea

Faculty Mentor: Francis Tyers, Department of Linguistics

*Morphological Analyzer for the Crow Language*

**ABSTRACT:** This project involved the creation of a program that analyzes common morphological structures in the native American Language Crow. Crow is spoken by around four thousand people in southern Montana. On the Intergenerational Disruption Scale, Crow is categorized as a 6b (Threatened), meaning “The language is used for face-to-face communication within all generations, but it is losing users”. In the Information Age, a loss of speakers such as this is often attributed to the lack of support for marginalized languages on computers. For a speaker of a language such as Crow, how often will a smartphone or computer have their language available, let alone the various websites they use? Often speakers will simply begin using exclusively English, since their native language appears to be less useful to them in day-to-day life.

Availability of interfaces using the language requires tools, such as machine translation and spell-checking, and the program created through this project is the first step towards producing them. Prior, to working with the grammar of Crow, a corpus was needed. A corpus is essentially a body of writing in the language being worked on that can be used for testing. Since Crow has virtually no writings publicly available, the corpus had to be made by hand from the Research Grammar that was referenced for the project. This corpus, along with formatted files compiling derivations and inflections of nouns and verbs, form a framework that can be used to create not only this analyzer, but other NLP applications as well. The analyzer itself itself consists of a file containing word lists and rules for adding prefixes and suffixes to them, and a file containing phonological rules.
ABSTRACT: Opioid overdose death rates have escalated precipitously in the current opioid epidemic due to the introduction of illicit opioids, such as fentanyl, that produce robust respiratory depression. We hypothesized that activation of cannabinoid CB2 receptors would show promise for suppressing harmful side effects of opioids, including opioid-induced respiratory depression. The cannabinoid CB2 agonist LY2828360 was previously tested in a clinical trial for osteoarthritis pain. Although this drug lacked therapeutic efficacy in this Phase 2 clinical trial, it showed no overt signs of toxicity in people. Recent findings from our laboratory indicate that LY2828360 effectively suppresses neuropathic pain in mice and also attenuates both the development of opioid tolerance as well as signs of opioid withdrawal (Lin et al. (2018) Molec Pharm 93(2):49-62). The present study was conducted to test the hypothesis that the CB2 agonist LY2828360 would also attenuate opioid-induced respiratory depression in mice. We used whole-body plethysmography to analyze the impact of LY2828360 on opioid-induced respiratory depression. We also compared the impact of two opioids (fentanyl and morphine) on multiple parameters of respiratory function (minute volume, respiratory frequency, tidal volume). Both fentanyl and morphine reduced respiratory parameters in mice, with fentanyl producing a greater decline in respiratory frequency compared to morphine. Fentanyl administration to mice markedly suppressed both minute volume and respiratory frequency. Coadministration of LY2828360 (3 mg/kg acute i.p.) with fentanyl (0.2 mg/kg acute i.p.) blocked fentanyl-induced respiratory depression in wild-type (WT) mice. This protective effect of LY2828360 was absent in CB2 knock out (CB2KO) mice, consistent with mediation by CB2. Our studies suggest that activation of CB2 receptor mechanisms attenuates several harmful side effects of opioids, including opioid-induced respiratory depression. Because LY2828360 was effective in blocking opioid-induced respiratory depression in otherwise naïve mice treated with fentanyl, this CB2 agonist may be useful as an effective medication to reduce opioid overdose death rates observed for individuals struggling with opioid addiction.