

Neuroscience Lab Experience

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Working in Western Kentucky University's Neuroscience Lab this semester has proven to be an invaluable experience. Along with a new understanding of the scientific process and a more in-depth knowledge of general neuroscience as well as specific knowledge of visual neuroscience, I have also gained practical problem solving knowledge as well as knowledge concerning lab preparation, animal care, optics, and computer programming. I have also witnessed firsthand the importance of communication and teamwork in a scientific setting and the sense of achievement associated with working with fellow scientists and presenting results in a prestigious setting.

Upon familiarizing myself with the lab and its contributors, I began work collecting electroretinogram (ERG) data and began contributing to the lab. I was first introduced to basic neuroanatomy and physiology, specifically that of the vertebrate eye. I was also given a brief review of the existing literature concerning zebrafish research. I learned the procedures for anaesthetizing, paralyzing, and placing the zebrafish subject into the test chamber. I also learned how the drug was injected into the subject's eye. The procedures also conveyed to me the importance of using critical thinking to foresee any experimental confounds that may need to be controlled for before data collection. Such confounds include order effects and unknowingly changing environmental conditions from subject to subject. I then learned how to operate the data collection program and how to organize, analyze, interpret, and present the collected data. I discovered what normal ERG waveforms looked like and how the waveforms changed in response to the introduction of drugs in the eye. I also began to understand the importance of measuring data in a qualitative as well as quantitative manner and in an accurate, precise manner. I also became more familiar with statistical analyses and learned how to apply the statistics I had learned earlier in my courses, but never had the opportunity to apply.

Specific experiments I contributed to in the lab varied in purpose and procedure. The aforementioned procedures were used in collecting physiological data from the zebrafish eye. We attempted to change this physiological response to a monochromatic light stimulus by changing stimulus wavelength and attenuation (brightness). We also used pharmacological agents, such as AP-7, CNQX, PDA, and NMDA to change the ERG responses in an attempt to isolate the ERG components. This research would help us to understand the complex wiring involved in the vertebrate visual system and what kind of neural receptors were involved and where they were in the retina.

We would also use different light sources to elicit different responses. I learned how to change the optical system from a monochromatic stimulus to a white light LED. I then learned how to program and operate a new data collection program for the LED stimulus. This setup allowed us to analyze the OFF-response component of the ERG without being affected by the ON-response component.

Along with learning how to collect physiological data using the ERG, I also learned how to collect behavioral data using the paradigm designed by a former graduate student of Western Kentucky University. This setup included a totally different optical system and test chamber. I was trained to set up the training apparatus, safely place the subject into the apparatus, and correctly train the subject using appetitive conditioning. Again, I learned the importance of maintaining constant conditions for every subject tested and the importance of objectively and quantitatively measuring response. I also learned different techniques of organizing, analyzing, and graphing the results. We used this appetitive conditioning paradigm to explore wavelength discrimination in the zebrafish's visual processing. We found that the zebrafish could correctly

learn how to swim to a light stimulus of certain wavelength and brightness to obtain a food reward, therefore proving that zebrafish have color vision and use it to discriminate.

During the semester, I was also responsible for mixing and storing the anaesthetic used in our physiological experiments. This endeavor allowed me to develop biotechnological skills that are said to be valuable in one's search for graduate study. I also learned how to feed, inspect, and treat respectfully the subjects used in the lab. It is very important to keep the subjects at a high level of health in order to ensure good data is obtained and to ensure that enough subjects survive so that we may continually collect data and not lose valuable time restocking our zebrafish supply.

Recently, we have been altering our optical system in the lab. I have therefore had the added opportunity to gain knowledge of optics. Above all, I have learned the precision and tedium needed to ensure that the optical system works properly, increasing the accuracy of our measurements and thus protecting our results from confounds.

Overall, the lab has taught me the importance of doing one's job correctly and quickly. This allows the group as a whole to succeed. If everyone does their job, the lab can collect, analyze, and organize data simultaneously and greatly increase the productivity of the lab. This not only raises the number of publications the lab can achieve in a given time, but also reflects well upon those who contribute to the lab. If those who follow the lab's work see a consistent flow of high quality work coming from the lab, they will associate such success with the individuals involved in the lab.

I was also given the honor of presenting one of the lab's projects at the Kentucky Academy of Sciences annual meeting in Richmond, Kentucky. This experience allowed me to become more comfortable with teaching others and gave me an opportunity to learn how to

present research in a prestigious setting. I was also awarded second place overall in the field of psychology, which also provides a research feather in my undergraduate cap.

Overall, I feel extremely fortunate to have the opportunity to work in the Neuroscience Lab at Western Kentucky University. I have been provided an excellent opportunity to develop a respectable honors thesis and have picked up many research strategies from the experience as well as improved my situation in my venture towards graduate school.

Outcomes

M. Abo, E. V. Vukmanic, M. L. Risner, **T. Thornberry**, C. Uessler and J. Bilotta. *Blocking NMDA Receptors Eliminates the d-wave and Enhances the b-wave in Adult Zebrafish ERG*. Department of Psychology & Biotechnology Center, Western Kentucky University, Bowling Green, KY. Abstract submitted to Association for Research in Vision and Ophthalmology (ARVO, May 2006).

J. Bilotta, M. M. Abo, **T. S. Thornberry, Jr.** and P. J. DeMarco. *ERG Responses of the Adult Zebrafish to Positive and Negative Flashes*. Department of Psychology & Biotechnology Center, Western Kentucky University, Bowling Green, KY. Abstract submitted to Association for Research in Vision and Ophthalmology (ARVO, May 2006).

Timothy S. Thornberry, Jr., Eric Vukmanic, Cassandra Cantrell and Joseph Bilotta. *Dark-Adaptation Functions of the Developing Zebrafish*. Department of Psychology & Biotechnology Center, Western Kentucky University, Bowling Green, KY. Research presentation presented at Kentucky Academy of Sciences (KAS, November 2005).