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Identifying Biomarkers for Post-Traumatic Stress Disorder (PTSD) in Humans

Faculty proposal for the Research or Creative Experience for Undergraduate 2018

1. **Dr. Joseph D. Ng, Professor**-Department of Biological Sciences, Shelby Science and Technology Center Rm 369J, Email: NGJ@UAH.EDU, Phone: (256) 824-6166
Proposal Identifier: **RCEU19-BYS-JDN-02**

2. **Project Description.** Post-Traumatic Stress Disorder (PTSD) is a severe anxiety disorder resulting after exposure to a traumatic event or experience. Previous studies have suggested that many soldiers returning from war zones, survivors of natural disasters and crime have significant behavioral and medical distress or illness due to PTSD. The economic impact of PTSD is estimated at \$2-3 billion per year. Without early intervention, diagnosis and treatment, PTSD will continue to contribute to an overwhelming cost to our economy and to the health of thousands of our citizens.

The goal of the research project is to identify unique biomarkers that may be associated with PTSD. Previous studies have suggested that alterations in the immune system, chemical modifications of the individual's genetic material and expressions of certain neural and endocrine proteins are associated with PTSD-affected and -unaffected individuals. Even though the biological foundation of PTSD is not well understood, it is strongly believed that biological factors play an imminent role in behavioral responses to challenging environments. In this project, **the objective** is to specifically examine the *immune repertoire* from blood derived from military veterans diagnosed with PTSD and compare them to their control groups. An immune repertoire is a functional composite of diverse B and T cells in one's circulation at any given time. B and T cells are types of white blood cells circulating in the blood and they are part of the body's defense system against pathogens or foreign particles. Humans have the ability to generate more than 1000 different B and T cells, each specific to a particular antigen (or binding target such as a pathogen surface). However, not all of the 1000+ different B and T cells are expressed at the same time for any given individual. Since

the immune system is at the forefront of genetic-environment interactions, this type of analysis can reveal unique gene expression signatures that may be correlated to PTSD.

3. Student Duties, Contributions and Outcomes. The student's **specific duty** will include performing bioinformatics analyses on RNA samples from an immune repertoire analysis. Total message RNA that has been previously sequenced using state-of-the-art sequencing instrumentation at the HudsonAlpha Institute for Biotechnology will be examined. Using open-source computational software, the gene expression associated with PTSD individuals compared to those of control groups will be identified and quantitated. The **tangible contributions** the students will make include a poster, slide presentation and abstract in the Alabama Academy of Science conference book. Any publishable data will be included in a formal submission to a peer-reviewed journal that will include the student's name among the author list. The **specific outcomes** projected for the student include 1) Fundamental knowledge of immunology; 2) experience in bioinformatics analysis of gene sequences related to expression of CDR3 receptors; and 4) Experience in macromolecular modeling of CDR3 regions.

4. Faculty Requirements and Mentorship. Student applicants should be in good academic standing with a GPA of 3.0 or better and must be at least a rising sophomore. Required coursework includes BYS119 and BYS120 or their equivalents. It is preferable, but not required, that the student has taken BYS363. The student is expected to not have any outside employment and preferably not take any classes while performing RCEU activities. Dr. Ng will serve as the primary mentor to the student. Current technicians and research associates (postdoctoral fellow) in the Ng lab will assist the student and research associates in his/her technical training. They will also be available during the work period to answer any questions or respond to any concerns that the student may have. Reports will be submitted on a weekly basis summarizing the progress of the experiment. The student will also attend weekly team meetings to discuss the progress of the experiment with Dr. Ng and the rest of his laboratory group.

5. Prior Awardees

1. 2017 Recombinant purification and crystallization of Inorganic Pyrophosphatase

Tangible contribution: Research results were shown as a poster presentation as well as an internal department student seminar talk.

Specific outcomes: Student was able to purify and crystallize recombinant proteins. In addition, the student learned basic biochemical laboratory including SDS-PAGE analysis, column chromatography and large-scale fermentation.

2. 2014 Transcriptome analysis of white blood cell samples from Post-Traumatic Stress Disorder patients.

Tangible contribution: Research results were shown as a poster presentation as well as a report given to the Rensselaer Polytechnic Institute (RPI) and the Naval Reserve Officers Training Corps (NROTC).

Specific outcomes: The student obtained 1) Experience in high through-put RNA purification and handling and 2) Fundamental knowledge of immunology.