

YOU ARE INVITED TO ATTEND THE  
DEFENSE OF THE DOCTORAL  
DISSERTATION

**“IMPAIRMENTS IN VESTIBULAR FUNCTION ASSOCIATED WITH  
TRAUMATIC BRAIN INJURY IN BOTH ACUTE SPORTS RELATED  
INJURY AND CHRONIC MILD TRAUMATIC BRAIN INJURY”**

By

Thuy Tien C. Le

Biomedical Engineering Program  
B.S. 2013, New York Institute of Technology, NY, NY

Mentor:

Jorge Serrador, Ph.D.

Department of Pharmacology, Physiology and Neuroscience, Rutgers Biomedical and  
Health Sciences, Newark, NJ, United States

Co-Mentor:

Michael C. Schubert, Ph.D.

Department of Physical Medicine and Rehabilitation, Johns Hopkins University  
School of Medicine, Baltimore, MD, US

Wednesday, July 31, 2024

9:00 A.M.

<https://uws.zoom.us/j/88336149042?pwd=ZmwvZWlTbmVOYW83N3JrREtOZnpqQT09>

## ABSTRACT

Mild traumatic brain injury (mTBI) can severely impact quality of life. Although extensive research finds that mTBI results in vestibular dysfunction, there are no rapid or readily accessible tests to detect mTBI immediately after injury. Vestibular function may not be evaluated for months or years after the injury, which results in an underreporting of mTBI and can cause long-term effects, including depression, memory impairments, and vestibular deficits. Efficient, reliable tools are needed to identify mTBI immediately after injury. This thesis investigates the effectiveness of portable vestibular function diagnostics to evaluate mTBI soon after injury: the video head impulse test (vHIT) and a diagnostic that pairs vertical alignment nulling (VAN) and torsional alignment nulling (TAN) tests. vHIT is relatively new in assessing the function of the semicircular canals, and VAN TAN is a novel diagnostic that can evaluate the function of the vestibular system indirectly through the perception of binocular alignment. Given the prevalence of mTBI in rugby athletes and veterans, this study assesses the function of the vestibular organs, namely the three pair of semi-circular canals and the otolith (saccule and utricle) via the vHIT and VAN TAN test in these populations. Recent studies also suggest that sex and age differences in vestibular function are evident across various aspects of vestibular physiology and function, especially otolith function. Therefore, this thesis also analyzes the aging effect on the vestibular system between the sexes. This thesis finds that vHIT is a reliable clinical assessment to quantify semicircular canal function and the presence of compensatory saccades. The results also suggest the TAN test can distinguish rugby athletes who experienced an acute head injury from healthy athletes immediately after injury, however VAN is not as sensitive in detecting an mTBI. The data also show that age and sex play a significant role in vestibular function. This is the first study to detect potential mTBI/concussion immediately after injury via the vestibular system using objective, novel, and portable assessment tools. These tools may be used in sports environments, the military, and in telemedicine to improve treatment for individuals suffering from symptoms of mTBI.