



# THE GSSI VALHALLA CLINICAL RESEARCH LAB



## ABOUT US

Founded in 1985 as part of the R&D facility in Barrington IL, GSSI is committed to helping athletes optimize their health and performance through research and education in hydration and nutrition science. Core to the mission of GSSI is the Internal Clinical Research Program, which helps inform product formulations, determine product efficacy, and validate technologies linked to personalized hydration and nutrition.

Now in 2023, GSSI's Clinical Research Headquarters is housed in the R&D facility in Valhalla, NY. Here, GSSI will continue to serve the athlete and support business needs by studying the effects of exercise, hydration, and nutrition on the human body using the latest scientific technology and equipment in the physiology, biochemistry, exercise performance, and energy metabolism laboratories. The clinical labs in Valhalla, NY includes a state-of-the-art environmental chamber as well as expanded capabilities to test mental performance in athletes and physically active individuals alike. Here is a deeper dive into some of our testing capabilities:



## ENVIRONMENTAL CHAMBER

Technology integrated into the environmental chamber allows GSSI scientists to precisely control the temperature and relative humidity of the room while athletes exercise. This is key to establishing a well-controlled environment for clinical research and allows us to mimic a specific environment of interest. With a temperature range of 15 to 40°C and relative humidity of 20 to 80%, we can simulate anything from a cool-dry autumn day in New York to the hot-humid conditions of the IRONMAN® Triathlon Championships in Kona Hawaii. The chamber is used to assess the effects of environmental conditions on sweating rate, electrolyte loss, and body temperature as well as the efficacy of hydration and nutrition interventions on the performance of athletes.



## MUSCLE PERFORMANCE

Optimal muscle function is a critical component of athlete performance. The capabilities at GSSI to determine muscle performance include an isokinetic dynamometer to measure muscle strength and power. Additionally, we can monitor the performance of sport-specific movements (i.e., jumping, walking, running) by measuring the magnitude and direction of force displaced by an athlete using our force plates.



## BODY COMPOSITION

Body composition testing is an accurate way to determine the make-up of an athlete's body rather than solely relying on measures such as body weight or body mass index. GSSI scientists test body composition by using a BOD POD®, which can determine the amount of fat mass and fat-free mass of an athlete.



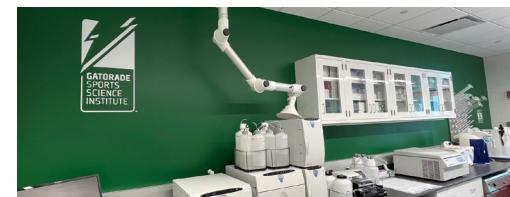
## METABOLISM

By using indirect calorimetry to measure gas exchange, we can determine the amount of energy athletes use during exercise and determine whether the fuel source is mainly fats or carbohydrates. Our metabolic testing capabilities also allow us to calculate an athlete's maximal oxygen uptake ( $VO_{2max}$ ), a gold standard for assessing aerobic fitness.



## BIOCHEMISTRY

The GSSI biochemistry lab is well equipped for analyses of biofluids, including sweat, urine, saliva, and blood samples. Capabilities of the lab include testing biomarkers associated with both physical and mental performance and testing sweat composition using high performance liquid chromatography.



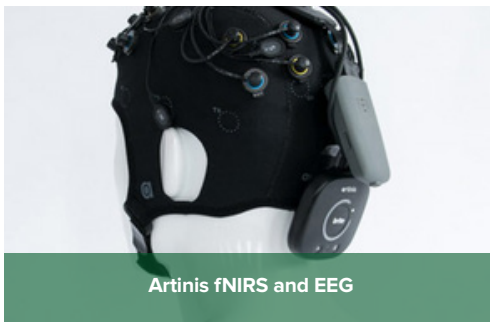


# MENTAL PERFORMANCE

**GSSI Valhalla also has the capability to assess how nutrition and hydration impact mental performance. These capabilities include:**

## BRAIN FUNCTION AND MORPHOLOGY

The Artinis Brite Enobio20 is a functional near-infrared system and electroencephalogram that can measure changes in brain blood flow and electrical activity in various parts of the brain.



## SLEEP AND PHYSICAL ACTIVITY

Significant evidence exists that sleep, physical activity, and sedentary behavior impact mental performance. The Actigraph Storm will be used to assess these factors in a non-invasive way for participants in our research studies.

## HUMAN MOVEMENT

Recently, evidence has emerged that mental energy and mental fatigue influence human movement, which will be measured using the BCI Emotibit and Intel RealSense D-457 RGB-D cameras in the lab and the ActiGraph Storm when participants are outside the lab.

## REAL WORLD TASKS TO ASSESS MENTAL PERFORMANCE

Oculus Quest Pro 2 will be used to assess mental performance by simulating real world tasks.



## OBJECTIVE MEASURES OF MENTAL PERFORMANCE

PsychoPy will be used to measure multiple aspects of cognitive function, while syncing the physiological measures that will be concurrently collected.

## SUBJECTIVE MEASURES OF MENTAL PERFORMANCE

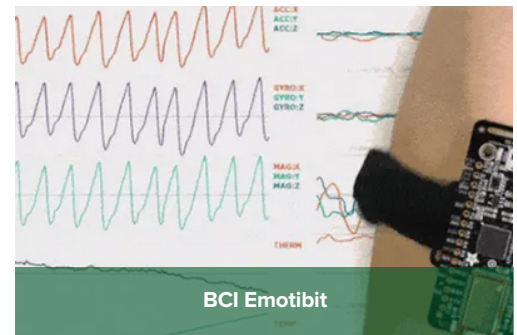
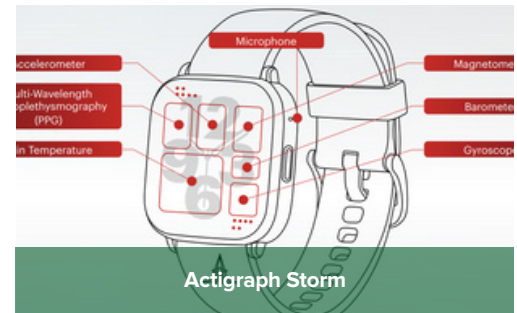
These will include Profile of Moods Survey-Short Form, the trait-state mental and physical energy and fatigue survey, and the motivation survey.

## OCULOMOTOR ACTIVITY

Changes in mental energy and mental fatigue result in changes in oculomotor activity, which will be measured using the eye tracking feature of our Lenovo P1 Gen 3 laptop, Intel RealSense D457 RGB-D camera, and the Oculus Quest Pro 2.

## PHYSIOLOGIC MEASURES

Changes in mental performance also result in changes in physiological networks such as the interaction between skin temperature, heart rate, heart rate variability, blood pressure, SpO2, breathing rate, and other physiologic variables, which will be measured using the BCI Emotibit and the Actigraph Storm.



## ALGORITHMIC DEVELOPMENT

One of our long-term goals is to create algorithms that can be deployed to identify mental energy, mental fatigue, dehydration, and other factors of interest. To collect data to generate these algorithms we will use a combination of iPhone 14s, iPad Pros, Oculus Quest Pro, BCI Emotibit, and Intel RealSense D-457 RGB-D cameras.

