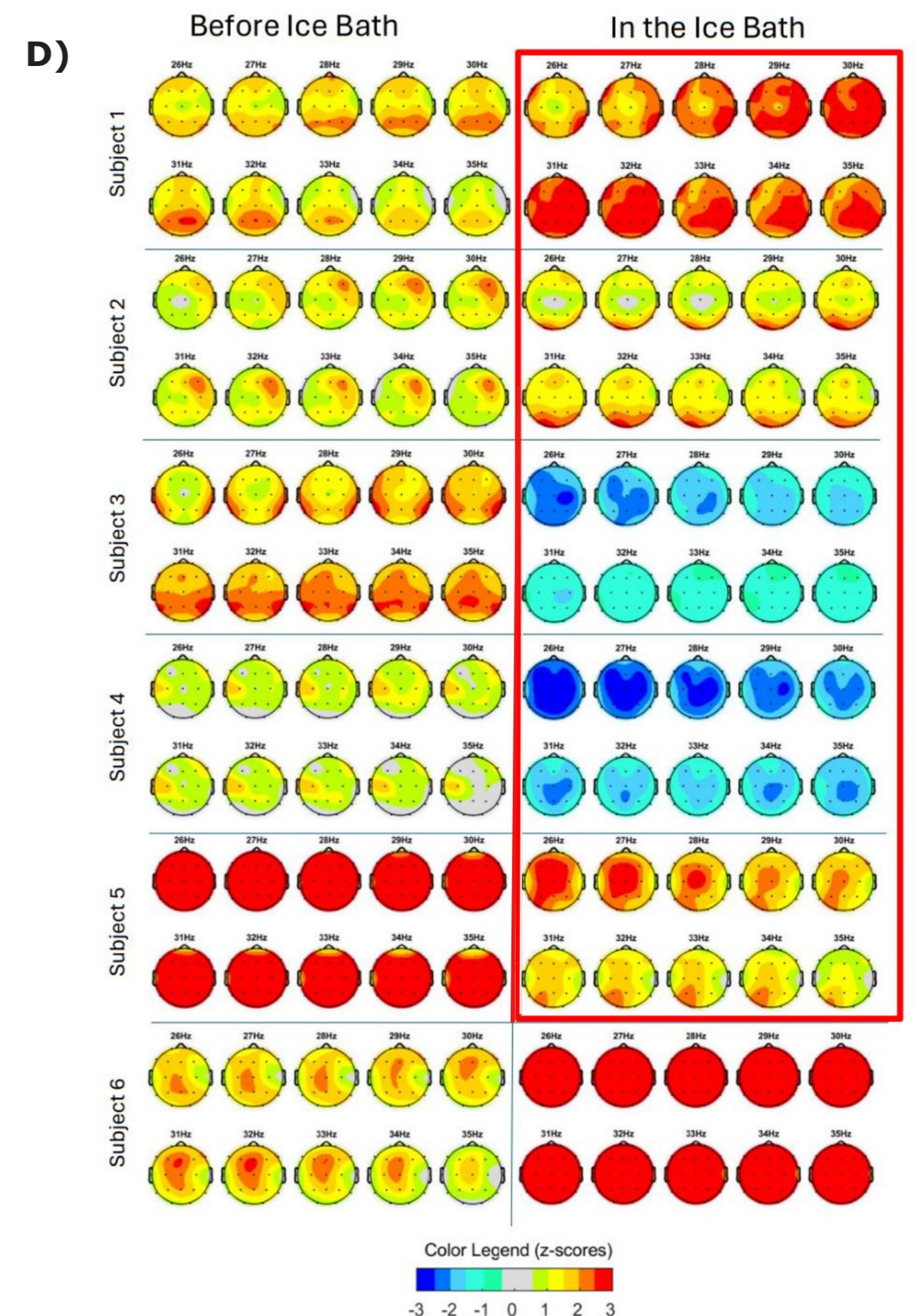
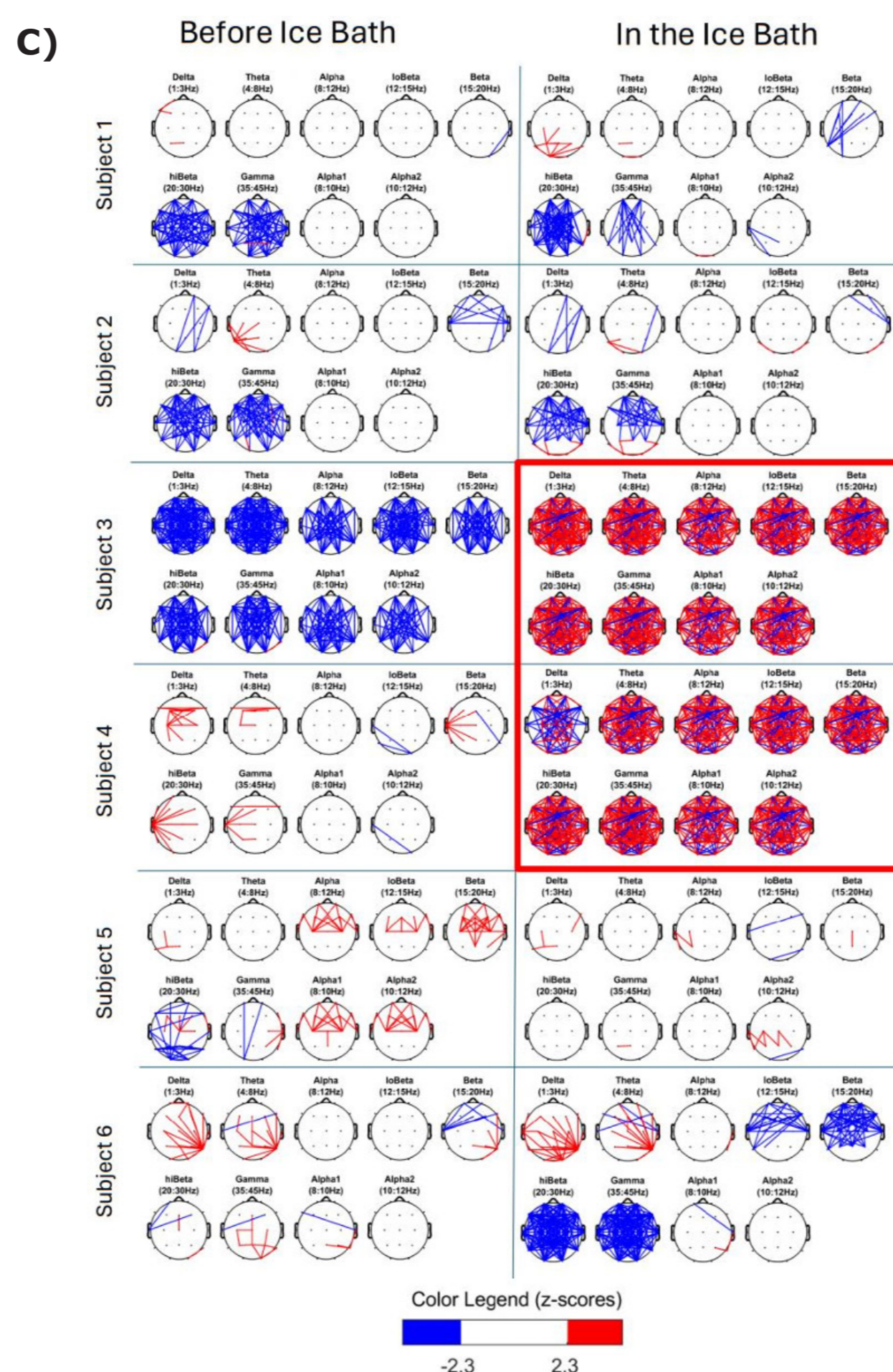
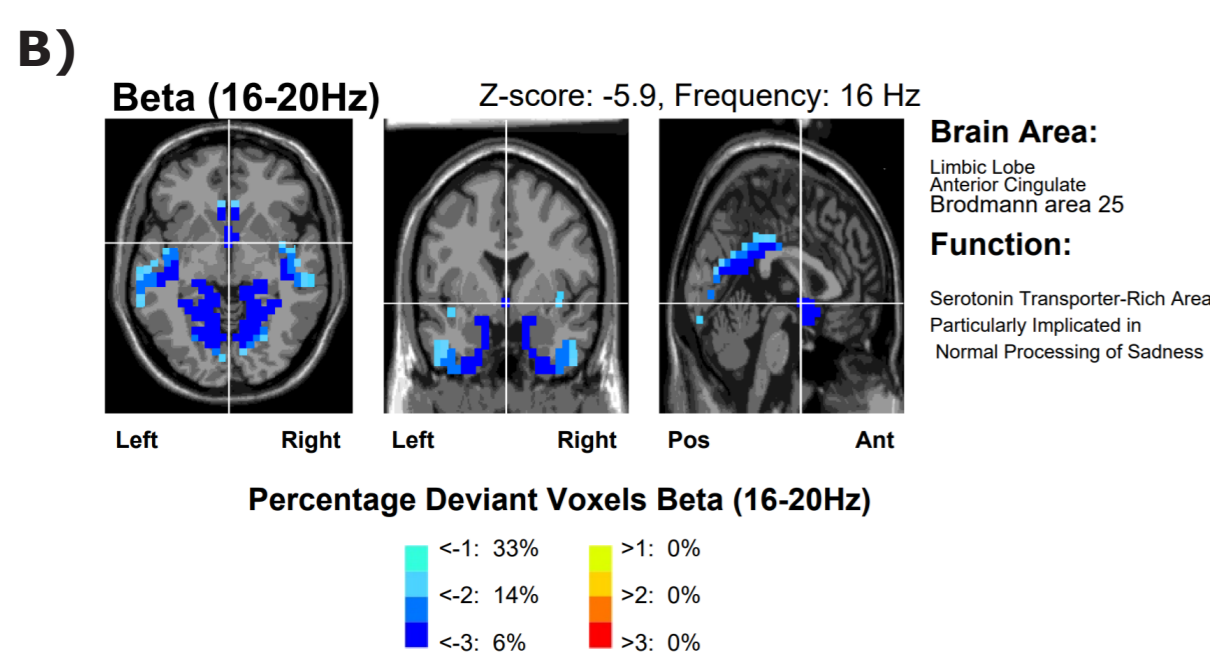
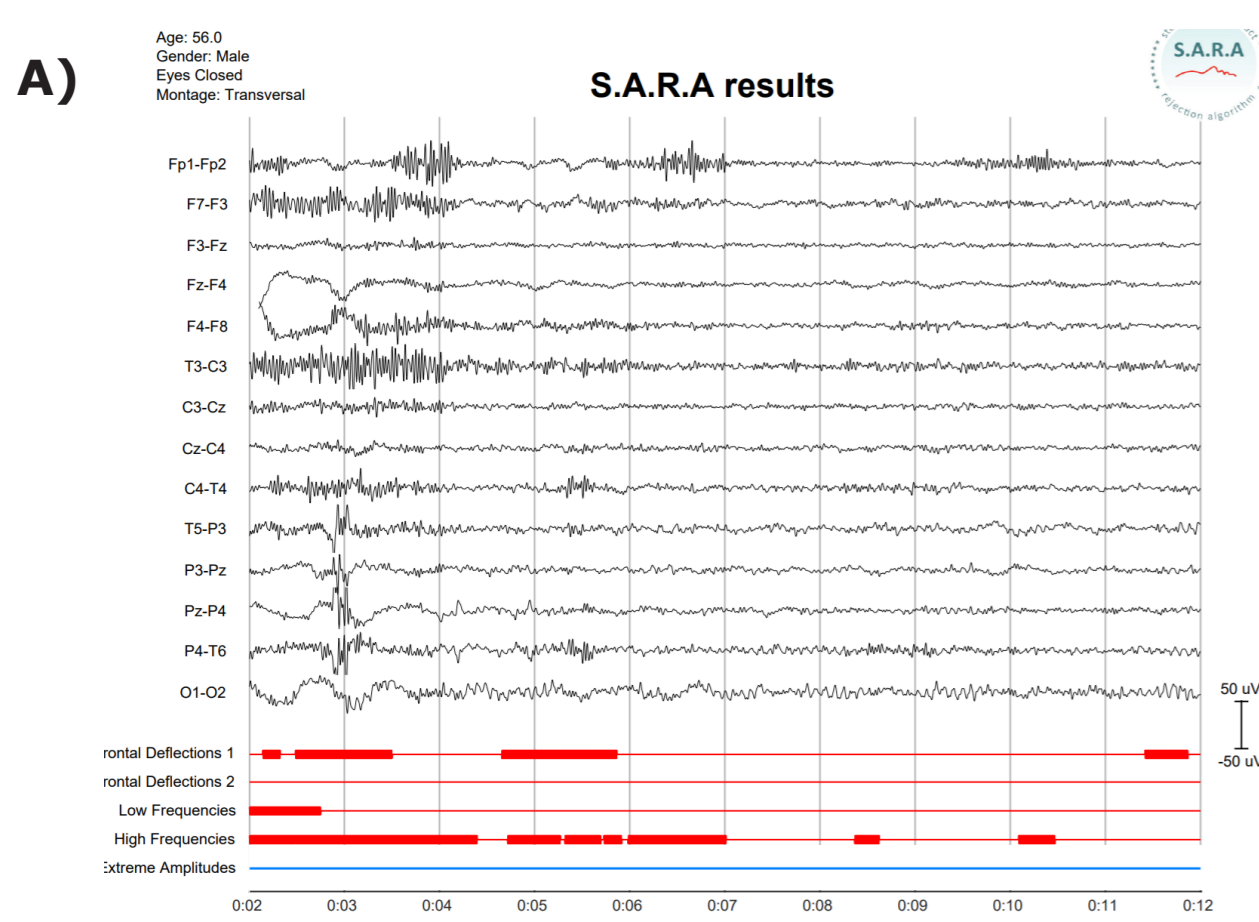


Master-Thesis FS 2024

Exploring Cognitive Responses to Cold Stress: qEEG Analysis

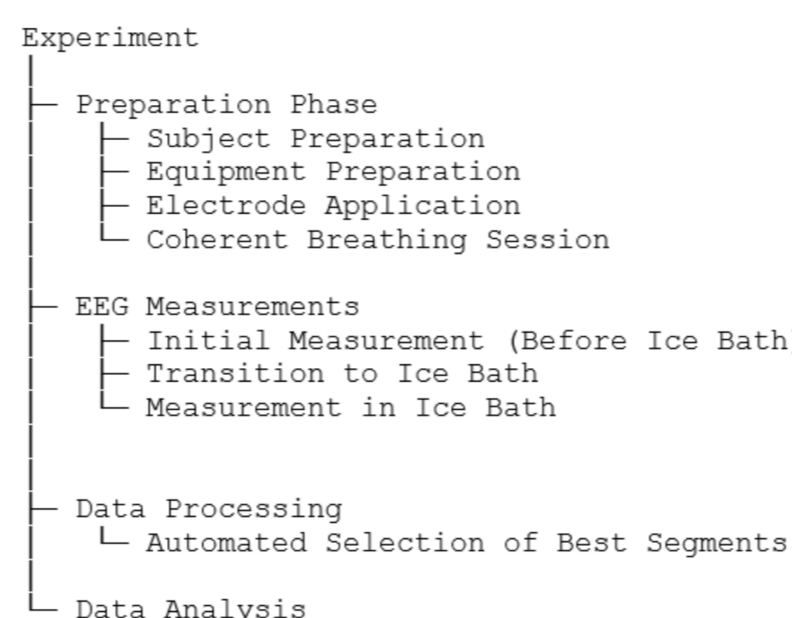


Introduction

This study investigates the cognitive responses to cold stress through quantitative electroencephalogram (QEEG) analysis, focusing on brainwave dynamics before and during icebath exposure. Cold stress activates the sympathetic nervous system, triggering physiological adaptations aimed at immediate survival. However, its impact on cognitive processes on the effects of ice baths still leaves some open questions. By employing QEEG, this study examines neural oscillations across different brain regions and frequency bands to elucidate the neurophysiological mechanisms underlying cognitive adaptation to cold stress. Insights gained from this research could enhance our understanding of stress-induced cognitive modulation and inform potential therapeutic interventions for stress-related disorders. As an example, depression stands as a prominent illness globally, with controlled external stressors such as ice baths potentially influencing its course. One theory suggests that the absence of certain short-term physiological stressors in daily life may compromise brain function, potentially leading to mental health issues like depression. It's noteworthy that depression ranks high among the leading causes of disability worldwide, projected to become the foremost contributor to years lost due to disability globally by 2030.

Methods

EEG measurements were conducted before and during icebath exposure, assessing brain activity with closed eyes. An Ice bath with temperatures ranging from 0 to 3 degrees Celsius were used. EEG caps and BrainMaster Discovery 24E systems facilitated data collection.



Results

The outcome of the study has shown that some subjects had the mental capacity to control the fight-or-flight reflex and were able to calm themselves down to a lower level of stress than before the ice bath. This ability to regulate the body's stress response has promising implications. It could serve as a therapeutic approach to enhance mental resilience, not only in the context of cold exposure but also as a strategy to cope with other external stressors. As subjects learn

to navigate discomfort and maintain composure seen in **D)** by Subject 3 and 4, their capacity to handle life's challenges may expand, ultimately contributing to improved well-being and mental health. Mental resilience is not about avoiding stress, it's about developing the inner strength to thrive despite adversity. Cold water immersion, when approached mindfully, might just be one of the keys to unlocking that resilience.

A) Showcases the recorded brainwaves of a subject and filtering.

B) Showcases the different regions' activities of the brain that were compared.

C) Showcases the phase lag and the communication between brain regions, and the impact of meditation and mental control of subjects 3 and 4.

D) As seen by the different reactions of subjects 3 and 4 in blue in the ice Bath, the subjects were able to reduce heightened alertness and stress reactions through meditation and mental resilience which is showcased in the reduction in Beta and Gamma brainwaves.

Marco Giger

Supervisor:
Joseph Dituri, Ph.D
Prof. Dr. Marcel Egli

Cooperation partner:
University of South Florida (USF)

