

September 22, 2022. Re: Letter of Intent for Fall 2022 CTSI **Multidisciplinary Pilot Grant**

Proposal: "The neuroscience and engineering of ocean wave surfing as a therapy for chronic pain"

Dear Executive Review Panel,


According to the CDC, 20 million Americans have high-impact chronic pain that can destroy employment prospects, family relationships, and a critical sense of self-worth. The opioid crisis has made the need for new non-pharmacologic interventions for pain more pressing than ever. As Principal Investigator on 2 R01s and a U01 grant from the National Institute of Diabetes and Digestive and Kidney Diseases (NIH/NIDDK), my research group has been at the forefront investigating one of the most devastating forms of chronic pain, the Chronic Overlapping Pain Condition (COPC) complex. COPCs include multiple diagnoses that are highly likely to co-occur, including migraine headache, endometriosis, irritable bowel syndrome, temporomandibular joint disorder, low back pain, and pelvic pain. Our work has shown that COPCs may be related to early life trauma, upregulating brain threat networks that monitor critical body areas for potential damage. The result is a dizzying array of symptoms: pain in abdomen, genitalia, and head/neck, as well as impairments in mood, cognition, and sleep. In the last few years, there has been a tremendous interest in approaching trauma-related disorders with surf therapy. This interest is exemplified in the Netflix documentary *Resurface* and Wallace J. Nichols' bestselling book *Blue Mind*. The underlying theory is that the immersive environment of ocean wave surfing creates a strong external focus of attention and allows brain threat networks to disengage from internal body monitoring. Symptom improvement appears to be striking, but several core problems need to be addressed to make this approach viable for the large-scale extramural funding required for definitive science and implementation.

Project Goal 1: Does a 6-week ocean surf therapy program improve chronic pain symptoms, brain network markers, and peripheral biomarkers in patients with COPCs? (Program Goal A: Collection of initial clinical data). **Project Goal 2:** Can the surf therapy experience be appropriately engineered in a virtual reality (VR) environment to address the scalability problems inherent in ocean access? (Program Goal B: Development and testing of new approach to health implementation research).

Project Team: I have assembled a new interdisciplinary team to accomplish these Goals. **Jason Kutch, PhD** (corresponding PI) is an associate professor of Biokinesiology and Physical Therapy at USC and expert in brain function and biomarkers of COPCs. **Heather Culbertson, PhD** (PI) is an assistant professor of Computer Science at USC and an expert in haptics including ground/foot interaction. **James Finley, PhD** (PI) is an associate professor of Biokinesiology and Physical Therapy at USC and director of the USC SMART-VR Center and an expert in VR rendering and system integration. **Tracey Chester, LMFT** (consultant) is the founder of the Pain Trauma Institute and a provider of surf therapy in Southern California. **Adam Fincham, PhD** (consultant) is research associate professor of Aerospace and Mechanical Engineering at USC, an expert in surfing wave dynamics, and designer of the only artificial wave on the World Surf League Championship Tour.

Team Science: As corresponding PI, Dr. Kutch will coordinate the expertise of the team members. The full study team will meet regularly to ensure cross-communication between the surf therapy goal (Kutch and Chester) and the VR goal (Culbertson, Finley, Fincham). This communication is essential so that the development of VR solutions is informed by chronic pain patient needs.

Extramurally-funded research: Team members have separately received substantial previous NIH, NSF, and industry funding. This project will provide preliminary data for an NIH R01 that defines the biology of chronic pain recovery facilitated by surf therapy, and utilizes the developed VR platform to identify the key therapeutic elements. The project will enable developmental milestones for an immersive VR surfing experience, which will also allow us to apply for follow-up SBIR and industry funding.

Thank you for your consideration,  Jason J. Kutch, PhD



Kutch



Culbertson



Finley



Chester



Fincham