

Meet Our Members: Aravind Nehrujee, PhD

Aravind Nehrujee, PhD, is a Postdoctoral Research Fellow at Shirley Ryan AbilityLab and Northwestern University in Chicago. He joined ASNR shortly after moving to the U.S. because he wanted to be part of a like-minded community of neurorehabilitation professionals. He was particularly drawn to the opportunities for trainee mentoring, building collaborations, and learning how to navigate the U.S. research environment, from grants to scientific partnerships. In this interview, he shares more about his background, his research, and his career plans.



1) How did you get interested in science, and what steps did you take to get to your current role?

I have always loved problem-solving and building things, but I came to rehabilitation research by accident, quite literally and figuratively. My first exposure was when I injured my anterior cruciate ligament (ACL) and saw biomechanics from the patient's side. A few years later, almost on a whim, I interviewed for the Bioengineering master's program at Christian Medical College (CMC) Vellore in India, with little expectation. That decision changed my path.

At CMC, my first mentors, Dr. Suresh Devasahayam and Dr. Sivakumar Balasubramanian (BioRehab Group), showed me how meaningful it could be to bring engineering into healthcare. I spent time at the Mary Verghese Institute of Rehabilitation at CMC Vellore, the first Physical Medicine and Rehabilitation Department in India, working alongside people recovering from brain and spinal cord injuries. That was where neurorehabilitation truly captivated me: I got to watch the nervous system reorganize, and I saw how the right intervention at the right time can make a real difference.

Visits to secondary hospitals taught me, more than any classroom could, how heavily the burden of neurological impairments falls on those who can least afford care, and how much affordable, accessible technology could change that. For my master's thesis, I used a smartphone and Google Cardboard to build a low-cost virtual reality (VR) system for vestibular rehabilitation and pilot tested it with people with vestibular dysfunction. Designing it was fascinating, but the experience of testing it with real patients, and learning what worked and what did not, was what made me certain this was the work I wanted to do.

Towards the end of my master's, our group received a grant to develop an affordable hand rehabilitation robot, and I continued the project for my PhD at IIT Madras and CMC under Drs. Balasubramanian and Sujatha Srinivasan (R2D2 Lab). It became a full development arc: design from scratch, usability testing, four clinical trials, including the first home-based study of a

rehabilitation robot in India, and, eventually, technology transfer for clinical deployment. Living through every stage taught me what it really takes to build rehabilitation technology that reaches people. I could see the impact of the work, but I also began to feel the limits of what I could do as just a product developer. I wanted to deepen my understanding of the mechanisms behind impairment and recovery, and learn to design more effective, combinatorial interventions. That brought me to Shirley Ryan AbilityLab for my postdoc with Dr. Milap Sandhu, where I now work on using acute intermittent hypoxia to enhance motor recovery in people with neurological conditions.

2) What is the focus of your current research, and what are some of your findings?

My current research focuses on acute intermittent hypoxia, or AIH, as a way to enhance motor recovery in people with neurological conditions. AIH is a non-invasive intervention where a person breathes low-oxygen air for brief bouts, alternating with normal ambient air, for about 30 minutes. These short episodes of lower oxygen activate a pathway involving serotonin and brain-derived neurotrophic factor (BDNF) that primes the nervous system for plasticity. The approach has shown promise in spinal cord injury and stroke. But the safety and effects of AIH in multiple sclerosis (MS) were not known.

I led a multi-day AIH trial in people with MS: a randomized crossover study in 23 ambulatory adults. Participants received five consecutive days of either AIH or sham, with a four-week washout between conditions. Two findings stood out. First, repeated AIH was safe, well-tolerated, and feasible. Second, AIH produced meaningful improvements in ankle plantarflexion strength (about 25% increase). We also observed that walking endurance improved on the six-minute walk test, but the change was modest and did not reach a clinically meaningful threshold. This suggested that AIH alone is insufficient to drive walking recovery and that pairing it with task-specific training is the logical next step.

One thing that struck me during these assessments, both in the data and in conversations with participants, was just how much of their voluntary effort was affected by abnormal muscle coactivation. Around the same time, I learned about Myoelectric Interface Neurorehabilitation Training, or MINT, developed in Dr. Marc Slutzky's lab at Northwestern. MINT uses real-time electromyography feedback with gamified training to help people unlearn these pathological coactivation patterns. Putting those two observations together led to my current Paralyzed Veterans of America (PVA)-funded project: a randomized trial combining AIH-primed MINT to target both the neuroplasticity and the abnormal muscle control that limit walking recovery in MS. This is the work I'm most excited about right now, and it's where my two long-standing interests, in neuromodulation and in technology-driven rehabilitation, are finally coming together.

Beyond the motor system, I'm also curious about how AIH affects the sensory system, especially proprioception, which is closely tied to movement and is often impaired in neurological conditions. And a parallel question I'm working on is how to optimize AIH dosage -

the current protocols are largely standardized, but responses vary widely across individuals, and I think there's real room to make the intervention more personalized and more effective.

3) What are your longer-term career goals?

My training as a biomedical engineer, combined with clinical research experience in neuromodulation and rehabilitation device development, draws me to mechanistically-driven research and to building better tools to understand impairment and drive recovery. My goal is to continue this work in neurorehabilitation, focusing on assessments and interventions for sensorimotor impairments in people with neurological conditions, particularly stroke and multiple sclerosis. I want to keep developing solutions grounded in how the nervous system controls movement and recovers from impairment, combining neuromodulatory approaches, such as acute intermittent hypoxia, with task-specific rehabilitation. And I want this work to stay accessible and affordable, so that what we build in research can reach the clinics, homes, and communities where the need is greatest.

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