



Industry:

Neuromodulation, Healthy Aging

Team Background: Our team has worked together for six years using brain-machine interfaces, behavioral paradigms, and computational modelling to investigate how neuromodulatory systems affect sensory processing and perception.

Management:

Charles Rodenkirch, PhD

- Biomedical engineer, systems and computational neuroscientist
- Experienced with technology transfer from working for Columbia Technology Ventures

• Second-time entrepreneur

Qi Wang, PhD

- Holds doctorates in electrical engineering and robotics
- Assistant Professor of Biomedical Engineering at Columbia University
- Head of Neural Engineering Lab

Scientific Advisory Board:

Jason Carmel, MD, PhD

- Assistant Professor of Pediatric Neurology at Columbia University
- Expert in clinical neural stimulation and sensorimotor neural circuitry

Business Advisory Board:

John Sullivan, MBA

- Leader in healthcare innovation with extensive business experience
- BioHealth Innovation Entrepreneur In Residence

Incorporation:

Delaware C-Corp by WSGR (3/2020)

Intellectual Property: Columbia Technology Ventures has filed multiple patent applications. Sharper Sense has an exclusive option to negotiate a license agreement.

Funding Sought: Sharper Sense is raising \$1M that will be used to produce a clinical proof of concept confirming our technology improves sensory acuity and can be used to treat age-related sensory loss. Further, this funding will be used to produce first generation hardware.

Sharper Sense is developing wearable neuromodulation technology that can enhance perceptual acuity and reduce the probability of tactile, visual, and auditory misperception.

Problem/Opportunity: The accuracy of perceived details in visual, auditory, and tactile stimuli heavily affects performance on tasks required for independent living, employment, and recreation. Unfortunately, many factors can degrade sensory acuity including aging, fatigue, injury, and multiple neurological disorders. Sensory loss causes communication breakdown and stress in relationships. Age-related sensory loss is strongly linked with dementia and increased risk of falls. The combined effects of sensory loss are so disruptive and isolating they often lead to depression, anxiety, and withdrawal from social situations.

Breakthrough Research: The brain naturally enhances senses during periods of increased attention and arousal. Our research revealed the neural circuitry underlying arousal-linked improvement of sensory processing (Nature Neuro, 2019). We then optimized a noninvasive method of activating this circuitry to enhance sensory acuity (J Neural Engr, 2020).

Our Product: A noninvasive stimulation patch that heightens users' sensory acuity upon application. The lightweight, disposable device, easily taken on and off, can be comfortably worn during tasks which could be better performed with enhanced perception. The device sharpens senses by delivering a pattern of transcutaneous vagus nerve stimulation (VNS) our team has shown induces neuromodulation which improves the brain's ability to process sensory information. A patent covers this novel use of VNS and the required parameters.

Size of Potential Markets (Global):

1. Age-Related Sensory Loss (elderly/disabled assistive devices, \$35B by 2026; neuromodulation, \$9B by 2025), Neurological Disorders (neurology devices, \$17B by 2026).
2. Augment healthy perception to improve performance and minimize human error. Military (human augmentation, \$207B by 2024; military wearables, \$6B by 2025), Sports and E-Sports (fitness wearables, \$15B by 2021), Workforce (nootropics, \$5B by 2025).

[Data from MarketsandMarkets, Wintergreen Research, Grand View Research, and Allied Market Research]

Current Standard: There are many treatments for sensory receptor damage, including glasses and hearing aids, yet these devices fail to treat the commonly co-occurring loss of sensory processing quality. Stimulants heighten senses ~30 minutes after ingestion but cause insomnia, anxiety, cardiac damage and are addictive. Various nootropics come with unverified claims they improve brain function but are largely ineffective and often unsafe.

Our Competitive Advantages: A noninvasive, safe, nonaddictive bioelectronic method of instant sensory enhancement that can be switched on and off at will. Sharper Sense's founding team are experts on the underlying mechanism of action. Full strength of effect occurs seconds after activation and remains steady and constant until deactivation.

Competition: Sharper Sense expects to be the first neuromodulation device for enhancement of perceptual acuity. Existing VNS devices do not deliver stimulation patterns that will improve sensory processing (e.g. ElectroCore, LivaNova, tVNS Technology). However, we anticipate future competition from current VNS companies as well as other companies in the field of neuromodulation (e.g. Medtronic, NeuroSigma, NeuroMetrix).

Financial Projections (Unaudited):

Initial Target Market: The 64M elderly with age-related sensory loss in the United States

	<u>2025</u>	<u>2026</u>	<u>2027</u>	<u>2028</u>	<u>2029</u>
Percent of Market Captured:	0.06%	0.2%	0.7%	1.5%	3.3%
Revenue:	\$26M	\$106M	\$241M	\$503M	\$1.59B
Gross Profit:	\$16M	\$66M	\$153M	\$328M	\$1.07B
Gross Margin:	60%	62%	63%	65%	68%