Sharper Sense

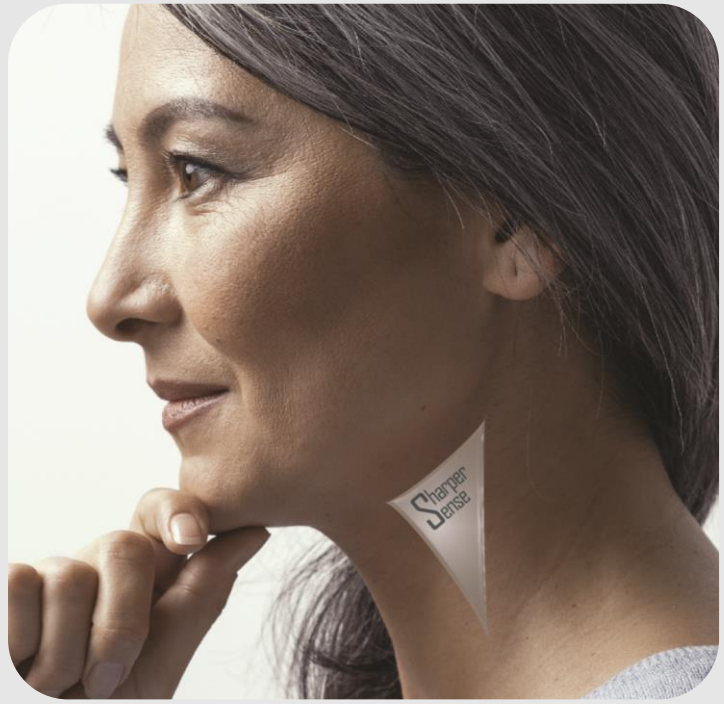
Instant sensory processing enhancement

www.SharperSense.com

Charles Rodenkirch, PhD
Charles@SharperSense.com
(646) 470-3040

Sharper Sense

Enhance your senses

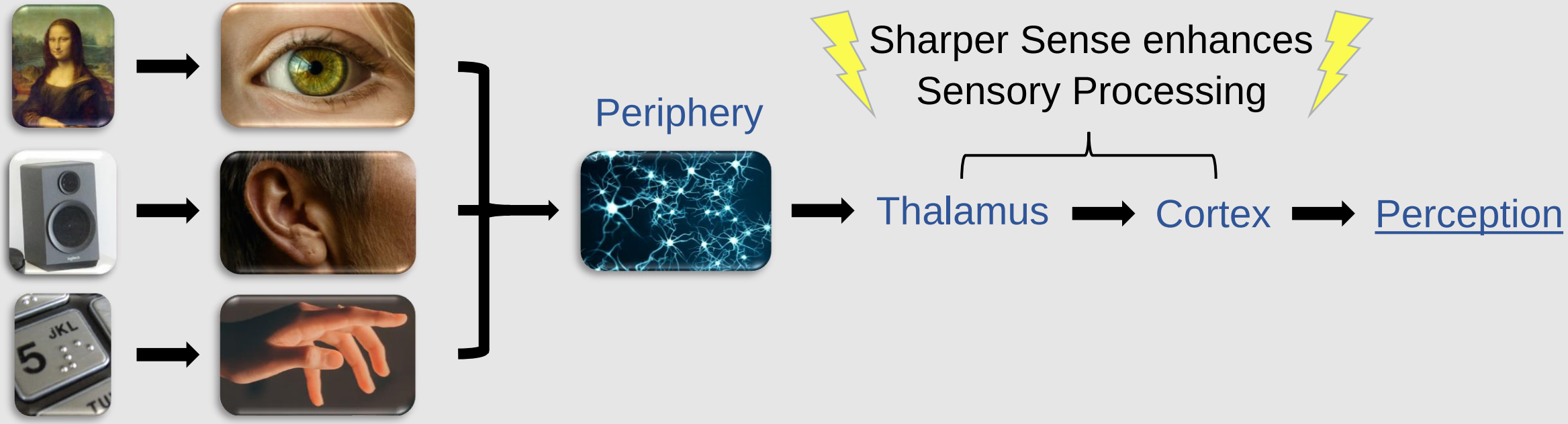


The Problem:

- The brain's ability to accurately process sensory information received from the eyes, ears, and skin can be impaired by aging, numerous neurological disorders, fatigue, inattention, and brain injury
- Impaired sensory processing reduces sensory acuity, makes it difficult to understand written and spoken words, increases risk of fall and injury, and decreases performance at work, school, or play

Our Solution:

- A noninvasive nerve stimulation patch that restores sensory processing clarity via neuromodulation



Perceptual acuity depends on accurate sensory processing

Aging, fatigue, injury, and neurodisorders can greatly impair sensory processing

Suboptimal sensory processing introduces noise that degrades acuity

Existing methods of improving sensory processing are less than ideal

Stimulants are not safe and cause insomnia, anxiety, loss of appetite, and cardiac damage

Externally processing audio/video unnaturally distorts sensory stimuli

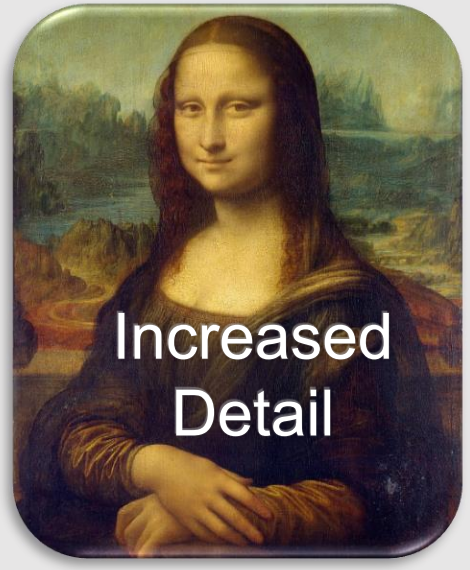
Therapy promoting neuroplasticity requires extensive time and money before any benefit

Nootropics are not effective and rarely tested for safety

The brain naturally optimizes sensory processing when alert/attentive

Attention/Arousal

Low ⟷ High



Vagus nerve stimulation

⬇

LC-NE activation

⬇

Enhanced sensory processing & acuity

⬇

Enhanced performance

Our team Identified neural circuitry responsible for arousal-linked enhanced sensory processing

We confirmed direct activation of this circuitry in awake rats enhances perceptual acuity

We then optimized a peripheral nerve stimulation method of indirectly activating this circuitry

Charles Rodenkirch, Yang Liu, Brian J Schriver, and Qi Wang. *Locus coeruleus activation enhances thalamic feature selectivity via norepinephrine regulation of intrathalamic circuit dynamics*. **Nature Neuroscience**, 2019.

Charles Rodenkirch and Qi Wang. *Rapid and transient enhancement of thalamic information transmission induced by vagus nerve stimulation.* **Journal of Neural Engineering,** 2020.

Our technology: a noninvasive neuromodulation patch that improves sensory acuity by enhancing sensory processing

Externally worn vagus nerve stimulation (VNS) patch

- Easy to take on and off
- Proprietary VNS pattern enhances sensory processing
- Enhancement occurs within seconds of activation
- No unnatural distortion of vision, hearing, or touch
- Less than 3 mm thick with 6-8 hours of battery life
- Doesn’t obstruct eyes or ears
- Transcutaneous stimulation is noninvasive and pain-free
- Target price is $15 per patch
- Expected COGS at volume is less than $5 per patch

Our stimulation pattern differentiates Sharper Sense from existing VNS devices

	Application	VNS Pattern	Form Factor	VNS Location
Sharper Sense	Sensory processing	Continuous	Wearable	Neck
LivaNova (formerly Cyberonics)	Epilepsy, depression, hypertension	Cycled on/off	Implanted	Neck
Setpoint	Autoimmune	Brief session	Implanted	Neck
Microtransponder	Stroke, tinnitus	Brief session	Implanted	Neck
Electrocore	Migraine	Brief session	Handheld	Neck
Innovative Health Solutions	Pain, opioid withdrawal	Cycled on/off	Wearable	Ear
tVNS Tech (formerly Cerbomed)	Epilepsy	Cycled on/off	Handheld	Ear
Spark Biomedical	Opioid withdrawal	Brief session	Handheld	Ear
Parasym	Depression, tinnitus	Brief session	Handheld	Ear

Sharper Sense's technology has many potential applications
First target market: age-related sensory processing deficits

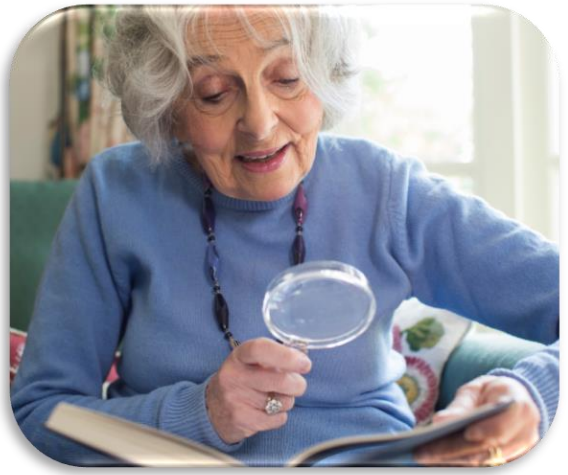
Age-degraded sensory processing is isolating and dangerous

- Affects the vast majority of seniors
- Interferes with communication
- Increases likelihood of falls
- Accelerates dementia onset and progression
- Precludes employment and recreation
- Leads to depression and anxiety

Restoring high-fidelity sensory processing in seniors is at the intersection of multiple growing markets

	Market size (global)	CAGR
Neuromodulation:	$6B	9%
Human augmentation:	$71B	24%
Elderly and disabled assistive devices:	$23B	6%
Hearing aids:	$9B	7%
Vision care :	$52B	4%

[Data from Allied Market Research, Imarc, and MarketsandMarkets]



We will leverage our solid science to gain de novo clearance as a prescription treatment for age-degraded sensory processing

Using our networks and future marketing team we will drive adoption by prescribing physicians

	2024	2025	2026	2027	2028	2029
Revenue:	$0.9M	$2.5M	$24M	$55M	$134M	$287M
Gross Profit:	$0.1M	$1M	$13M	$37M	$103M	$220M
Gross Margin:	13%	40%	53%	67%	77%	77%

[Revenue projections from age-degraded sensory processing only, other applications not included]

Aggressively pursuing eligibility for reimbursement by 3rd party payers is key to our success, we expect a favorable likelihood of approval due to our strong value versus existing treatments

Abundant potential for future expansion into multiple markets

Clinical Applications
(Class 2 nonsignificant risk medical device)

Sensory Processing Degradation

Age-related, Parkinson's, Multiple sclerosis

Sensory Processing Disorders

ADHD, Autism, Dyslexia, Language impairment, Audiovisual disorders

Performance Enhancement Applications
(General wellness device)

Demanding & Hazardous Jobs

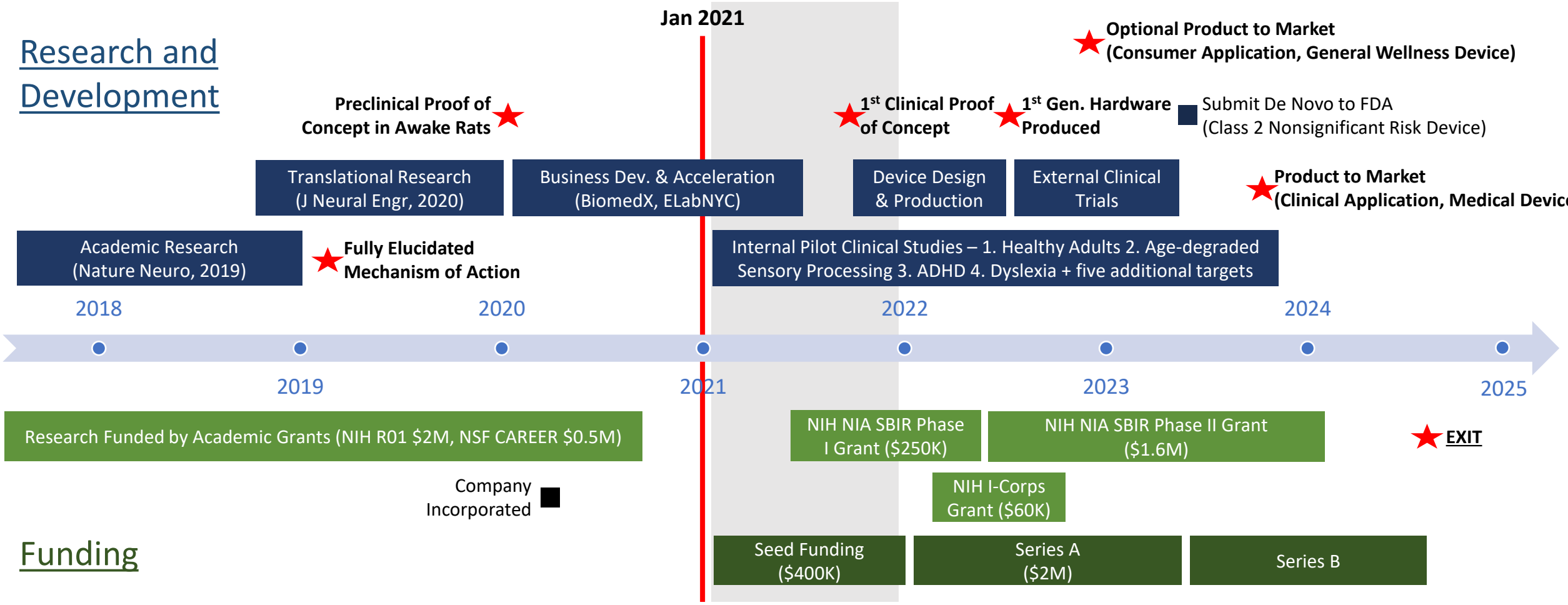
Sports & E-Sports

Those suffering from impaired sensory processing are in **dire need of a safe and effective way to restore sensory clarity**

Sharper Sense has spoken to **multiple military groups interested in testing our technology** as soon as it is available

We have received **similar interest from athletes and e-athletes** we've spoken with

Translating technology from academia to industry



We are actively raising $400K in seed funding to conduct pilot clinical studies

Our proposed pilot clinical study plan will validate our technology's beneficial effect in humans as well as prove its clinical value

Sensory stimuli:

- Visual (LCD screen)
- Auditory (headphones)
- Tactile (haptic feedback)

Transcutaneous nerve stimulation:

- Vagus nerve
- Sham location

Experimental subject:
Seated at computer

Measure sensory performance:

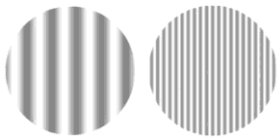
- With and without nVNS

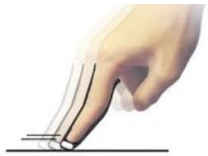
Measure physiology:

- Pupil dilation (index of target circuitry activation)
- Galvanic skin response
- Heart rate variability

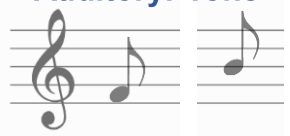
nVNS will be delivered with a programmable, desktop size, medical stimulator FDA cleared for human use

Vision: Gratings **Tactile: Vibration**





Auditory: Tone

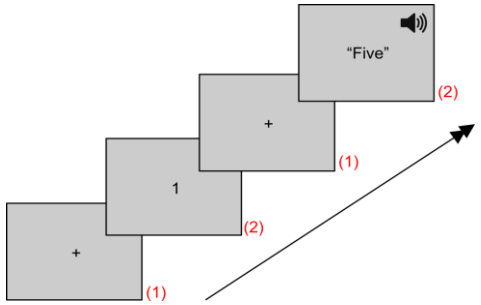


1. Tactile, auditory, and visual frequency discrimination testing in **healthy adults**

Snellen Chart **QuickSIN**

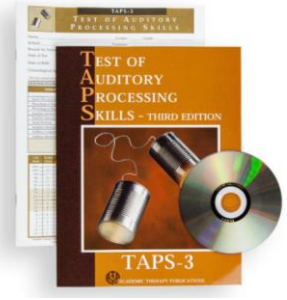
2. Standardized visual acuity and speech intelligibility testing in **seniors with impaired audiovisual ability**

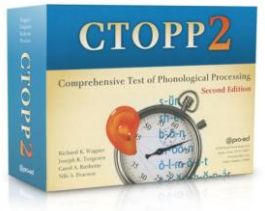
IVA-AE2



3. Continuous performance tests (CPT, audiovisual discrimination) in **adults with ADHD**

TAPS-3 **CTOPP-2**

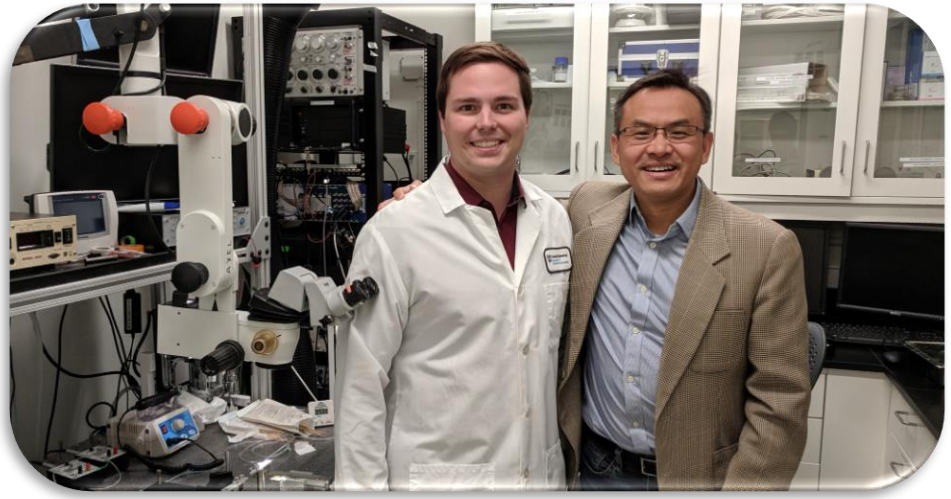




4. Visual (reading) and auditory (speech) processing tests in **adults with dyslexia**

5. Subsequently test **five additional clinical targets**

Our Founding Team



Charles Rodenkirch, PhD

President of Sharper Sense (full-time)

- Biomedical engineer, systems neuroscientist
- Worked for Columbia Technology Ventures
- Second-time entrepreneur

Professor Qi Wang, PhD

Consultant to Sharper Sense (part-time)

- Columbia Professor of Biomedical Engineering
- Head of Neural Engineering Lab
- Doctorates in electrical engineering & robotics

Scientific Advisory Board

Professor Jason Carmel, MD, PhD

- Columbia Professor of Pediatric Neurology and practicing neurologist
- Expert in clinical neural stimulation & sensorimotor neurology

Business Advisory Board

John Sullivan, MBA

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

Supporting preclinical research was conducted at:

COLUMBIA | ENGINEERING
The Fu Foundation School of Engineering and Applied Science

Biomedical Engineering

Laboratory for Neural Engineering and Control

Intellectual property protected by:

PCT patent application filed 6/2020, additional provisional patent application filed 9/2020
IP covers novel VNS application, proprietary VNS pattern, device aspects, and accurate application methods
Sharper Sense is in the process of converting our exclusive option agreement to an exclusive license

COLUMBIA | TECHNOLOGY VENTURES

Honored to have been accepted and participated in:

ENTREPRENEURSHIP LAB
BIO AND HEALTH TECH NYC

COLUMBIA | BIOMEDX
Biomedical Technology Accelerator

Legal counsel:

WILSON SONSINI

We are actively raising a seed round of $400K

$50K of this round has been raised as of Jan. 2021

This funding will be efficiently spent to generate **clinical proof of concept for multiple applications**, protect our IP, and validate our hardware development plan

At our current lean burn rate, the requested funding could conduct 18 months of pilot clinical studies

We expect to produce our first clinical proof of concept within 6-9 months, at which point we can slowly accelerate burn to build our team for a series A raise

Contact: Charles Rodenkirch, PhD
Charles@SharperSense.com
(646) 470-3040