

What's Next in Parkinson's Research?

New Frontiers and Local Opportunities

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Community Neuroscience Initiative

Empower Parkinson's



THIS YEAR WITH EMPOWER PARKINSON'S

A year of learning together



Genetics

18+ attendees



Stroke

25+ attendees



Vision

30+ attendees



Stem cell therapy

50+ attendees

What's next in Parkinson's research?

- 1. Understanding: what changes in the brain and body?**
2. Identification: can we see these changes in the brain or body sooner?
3. Intervention: how do we reduce the burden of symptoms?



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1. Understanding: what changes in the brain and body?



1. Understanding: what changes in the brain and body?

Dopamine

A chemical messenger made in a few small regions but sent widely across the brain — a stop-and-start signal for behavior.

- **Movement.** Keeping you steady and in motion as you pedal, balance, and steer.
- **Motivation.** The drive to keep going out on the bike ride at all.

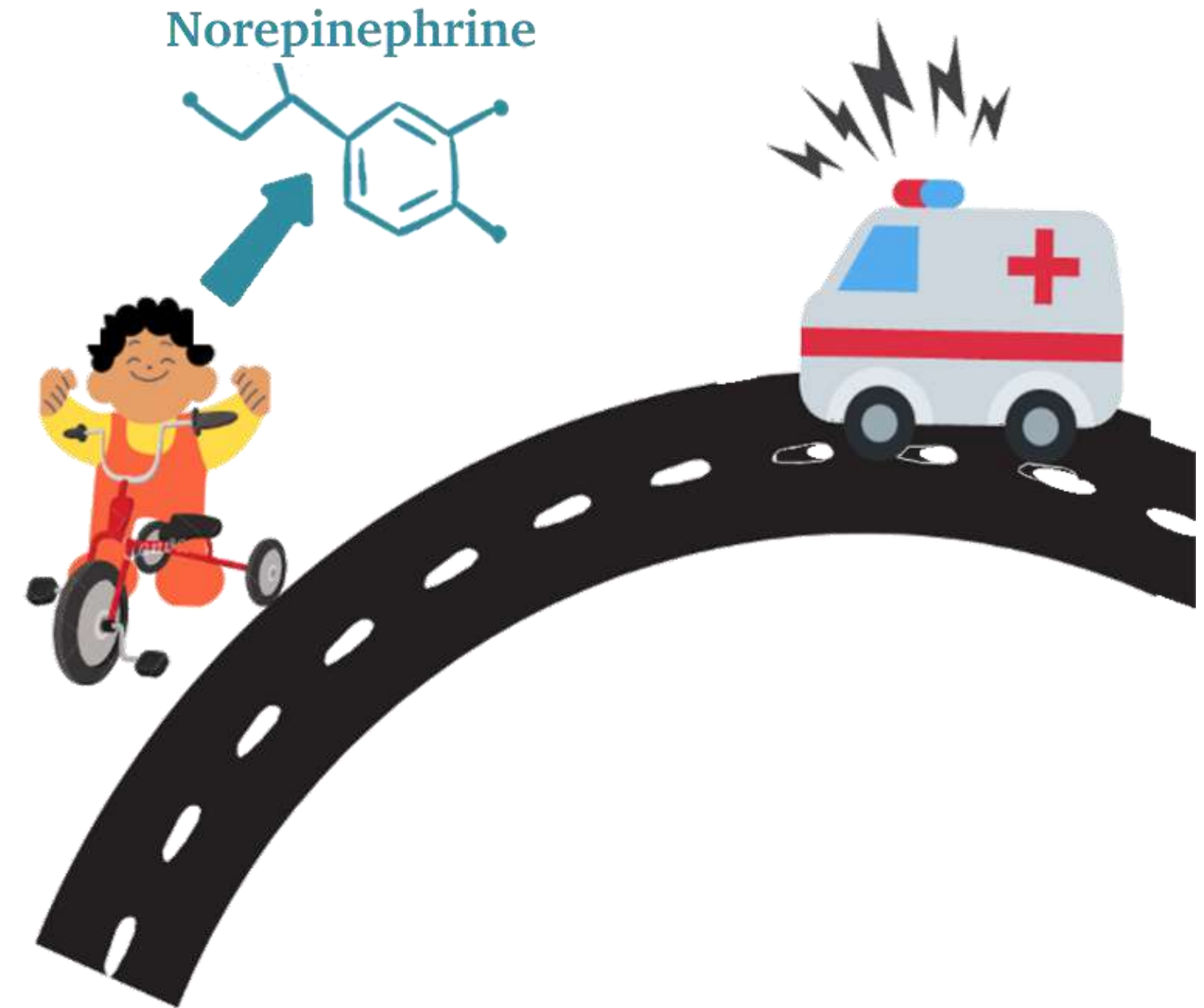


1. Understanding: what changes in the brain and body?

Norepinephrine

An ambulance comes around the corner. Attention snaps to it, and the body shifts into vigilance.

- Also made in a very small region and sent widely — regulating arousal, attention, learning, memory, and sleep.
- Often left out of the Parkinson's story, even though it is affected too.



1. Understanding: what changes in the brain and body?



Looking at the brain from the side.

Where these chemicals come from

- **Substantia nigra.** A major producer of dopamine, in the midbrain. A band only a few millimeters thick.
- **Locus coeruleus.** The brain's main source of norepinephrine, in the brainstem. About 2 mm across.
- **What they share.** Small, deep, and both lose cells in Parkinson's.

1. Understanding: what changes in the brain and body?

Different cells, different symptoms

Which cells are lost helps explain why Parkinson's looks different from person to person.

SUBSTANTIA NIGRA DOPAMINE

Tremor

Postural instability

Slowness of movement

Stiffness

BOTH DOPAMINE +
NOREPINEPHRINE

Depression

Cognitive difficulties

Apathy

Fatigue

LOCUS COERULEUS
NOREPINEPHRINE

Freezing of gait

Loss of smell

Anxiety

Sleep problems

BEYOND THE BRAIN

What about the body?

Does Parkinson's disease begin in the brain or the body?

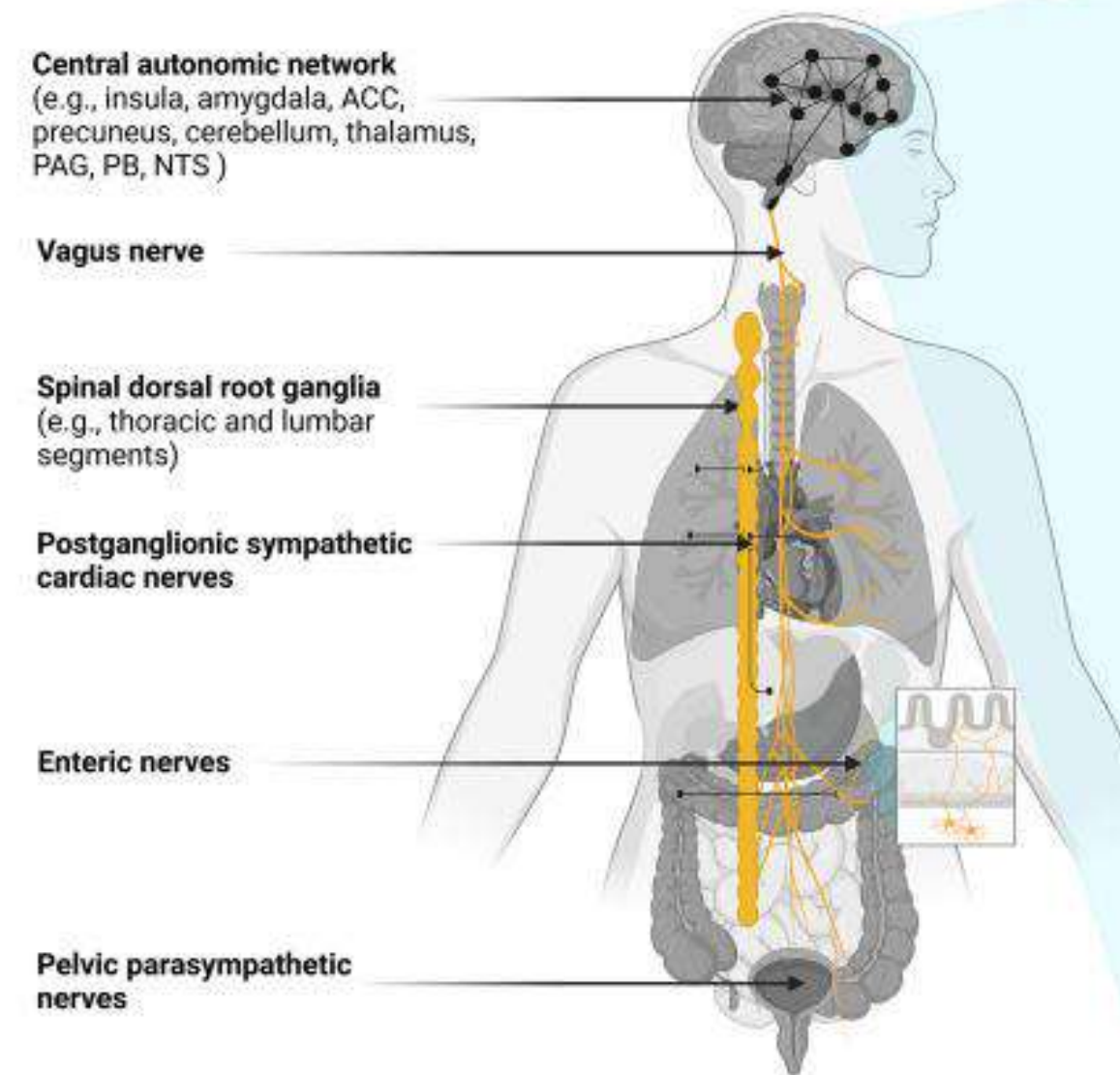
1. Understanding: what changes in the brain and body?

Parkinson's reaches the whole body

- The nerves that carry signals between brain and body are affected too.
- People may not notice signals from the heart, lungs, gut, or bladder.

Figure: Longardner et al.

A. Interoceptive neural circuit affected by Parkinson's disease



B. Interoceptive awareness impairments across autonomic domains

Cardiovascular



- Orthostatic hypotension unawareness
- Impaired heartbeat perception

Pulmonary



- Hypoxia without dyspnea
- Hypercapnea unawareness
- Reduced awareness of tussigenic stimuli

Gastrointestinal



- Dysphagia unawareness
- Delayed gastric emptying without gastrointestinal symptoms
- Increased colonic volume and transit time without symptoms of constipation

Urinary



- Irritative symptoms with minimal filling of bladder

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Today, Parkinson's is diagnosed by its movement symptoms.

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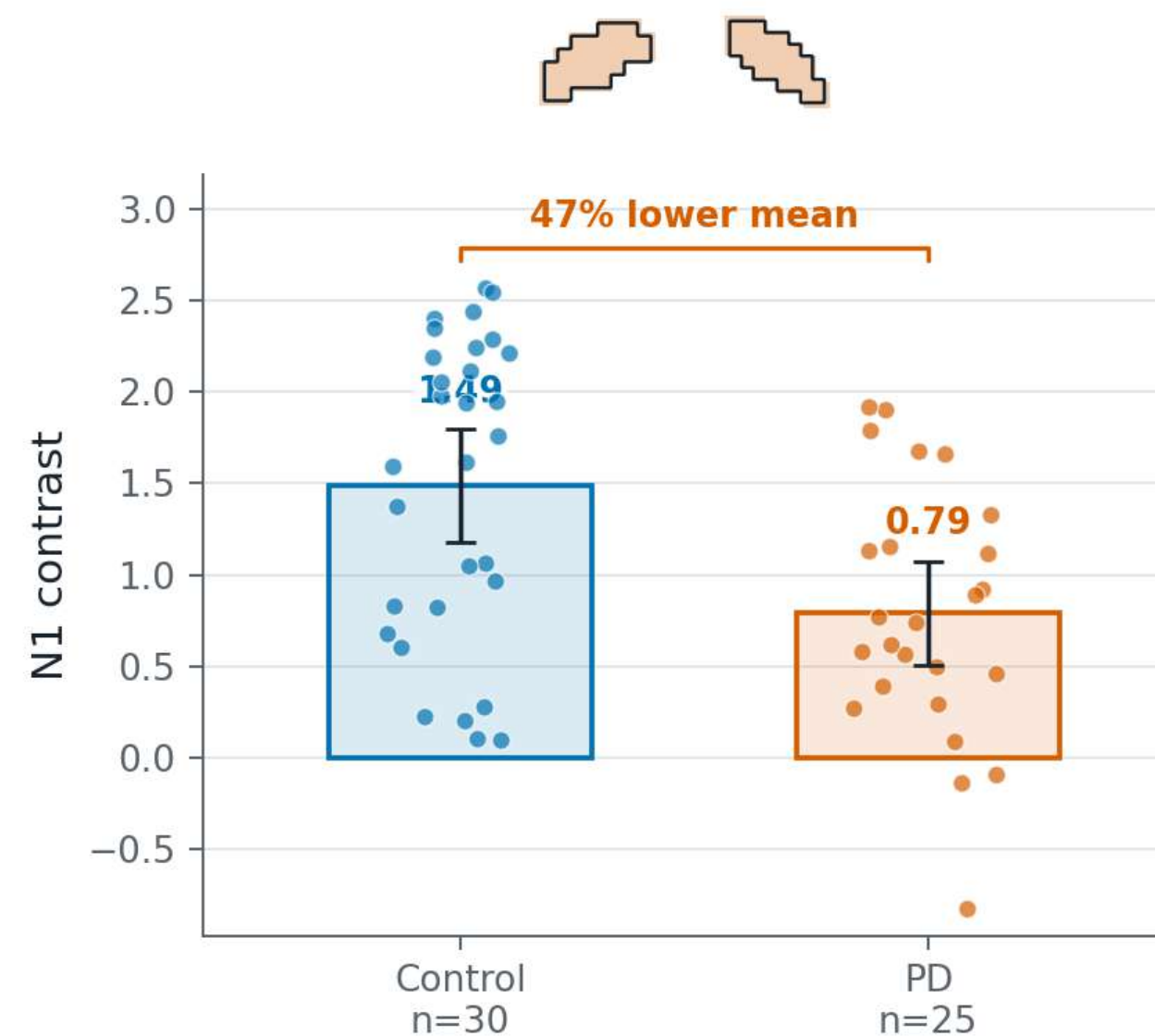
2. Identification: can we see these changes in the brain or body sooner?

OUR RESEARCH · SIGNIFICANT AFTER ADJUSTMENT

The substantia nigra signal is weaker in Parkinson's

- **Who.** 30 people without Parkinson's and 25 people with Parkinson's.
- **Where.** A small pocket of the substantia nigra called nigrosome 1.
- **Found.** The signal was 47% lower on average with Parkinson's, even after accounting for age.

Measured in the right place, the loss of dopamine cells shows up clearly on a scan.



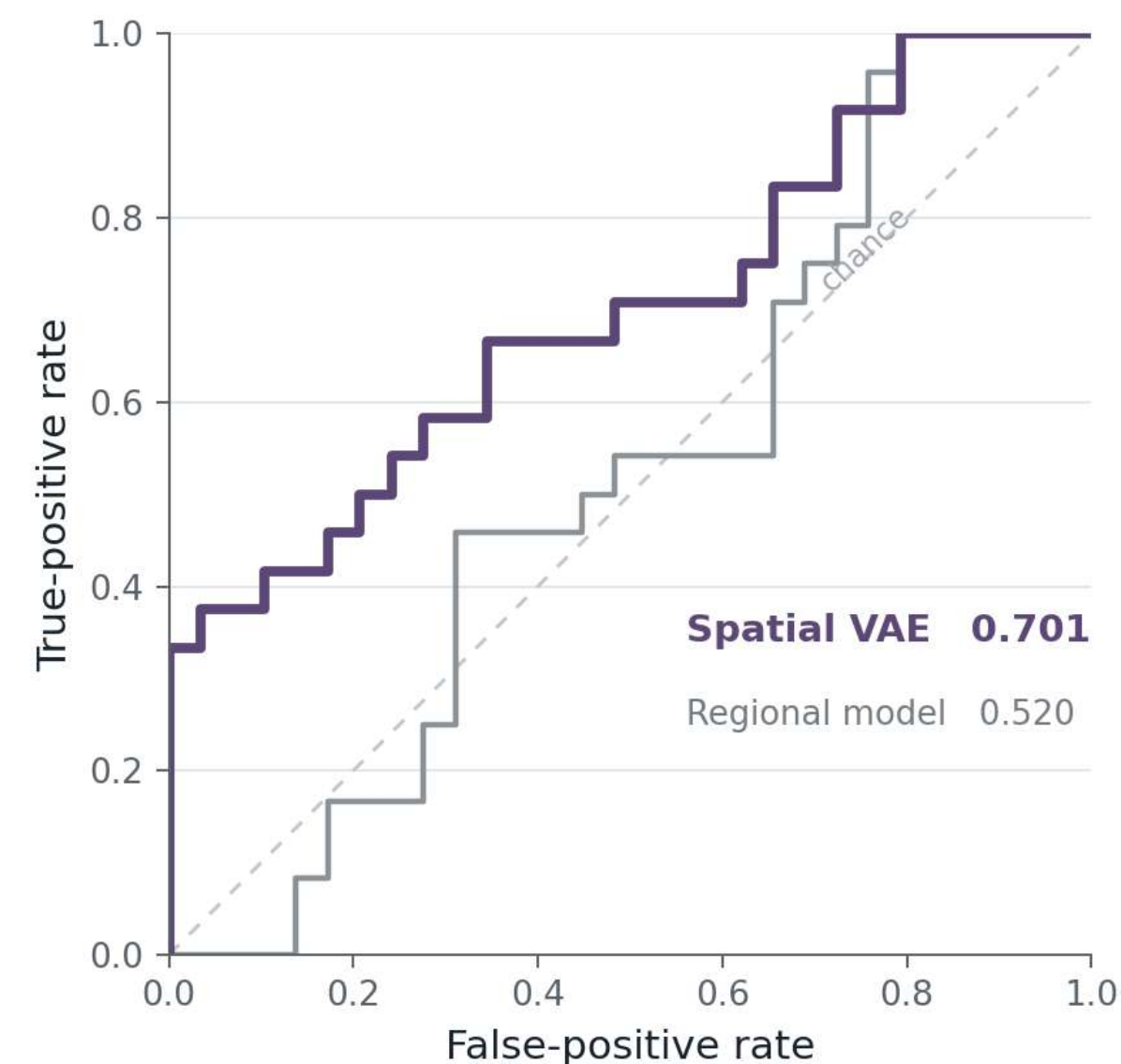
2. Identification: can we see these changes in the brain or body sooner?

OUR RESEARCH · PROOF OF CONCEPT

Can a computer see the pattern too?

- **The tool.** An AI model that learns the shape and pattern of the signal in each scan.
- **The curve.** The higher above the dashed line, the better it tells Parkinson's scans apart.
- **Result.** One average number for the region was close to a coin flip. The pattern did clearly better.

Not a diagnostic test yet. It shows the scan holds information we can build on.



2. Identification: can we see these changes in the brain or body sooner?

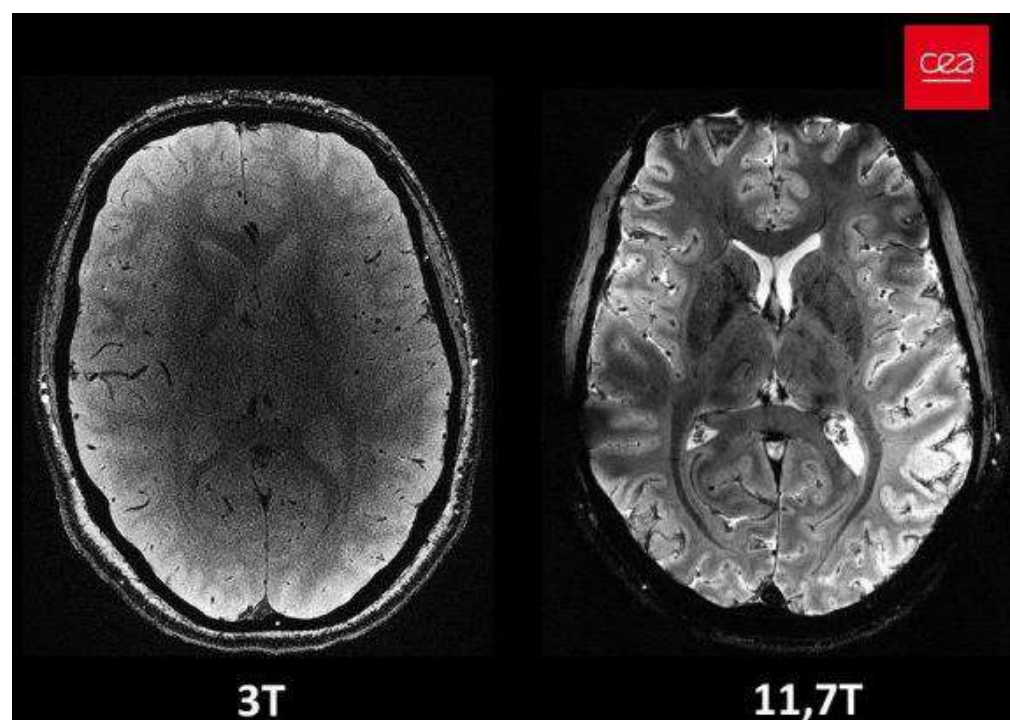
NEXT STEPS

Seeing more detail, and seeing it earlier

11.7T MRI · FRANCE

A far stronger scanner for these tiny regions

Higher resolution could show changes inside the substantia nigra and locus coeruleus that today's scanners blur together.



PRODROMAL PARKINSON'S · UBC

Looking before movement symptoms begin

Studying people with REM sleep behavior disorder (iRBD), who are at higher risk of developing Parkinson's.



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New frontiers, and people right here working on them.

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Focused ultrasound

1 Aim

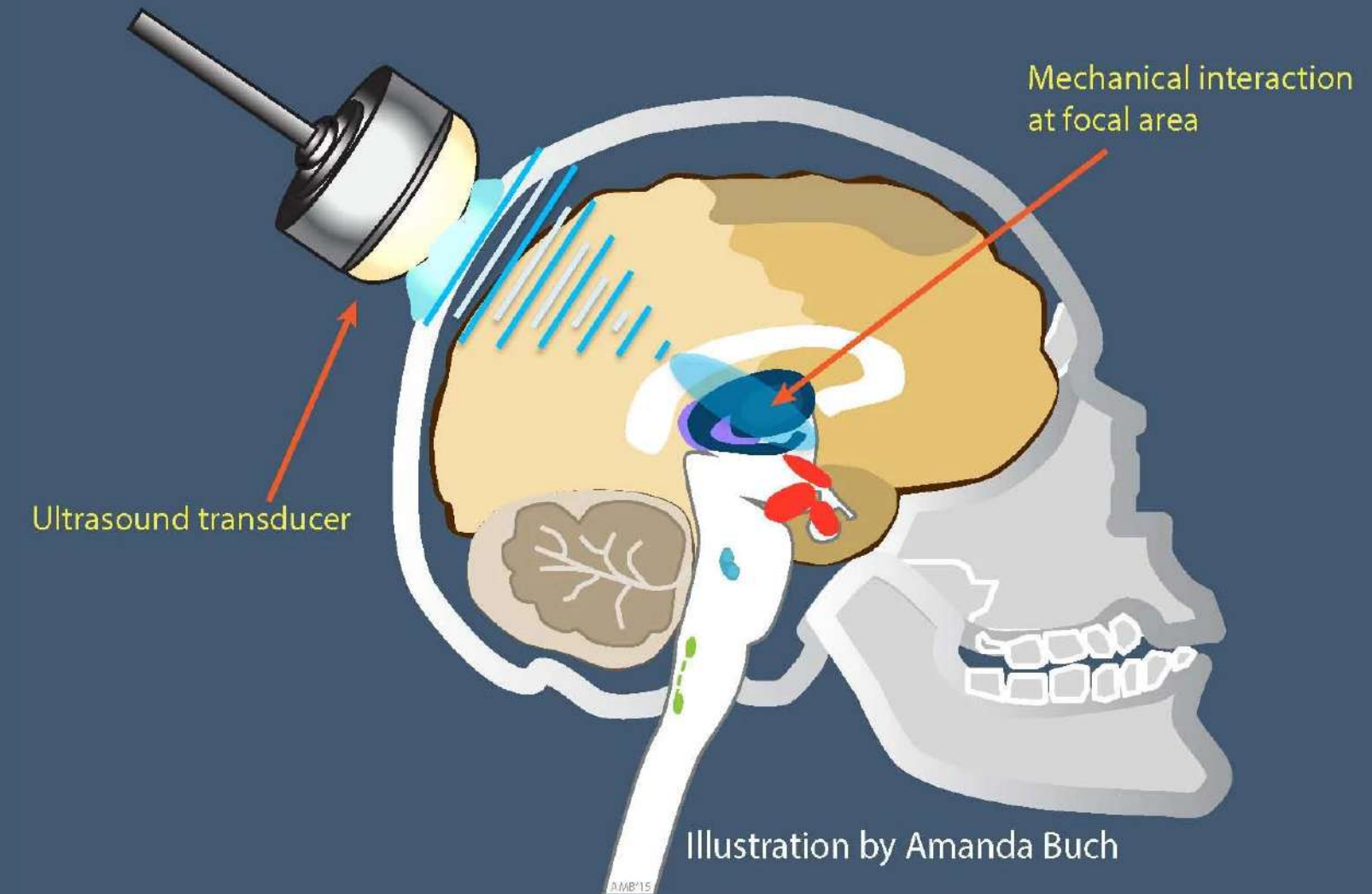
Sound waves pass through the skull to one tiny spot deep in the brain.

2 No incision

MRI guides the treatment the whole time.

3 Where it stands

People are receiving this treatment today. Researchers are testing whether it can target other symptoms.



LOCAL OPPORTUNITIES

Intervention, right here at home

Rochester



Mike Mooney

Brain Storm Studios: a see, hear, feel research platform

Cortland



Dr. Lara Shigo

SUNY Cortland: exercise that is easier to access

Liverpool



Drs. Stevenson Won, Lombardi & Gonzalez

Cornell: boxing in virtual reality

3. Intervention: how do we reduce the burden of symptoms?



LOCAL OPPORTUNITY · BRAIN STORM STUDIOS

Mike Mooney lives with Parkinson's and is building a research tool

With his daughter Ellie, Mike founded Brain Storm Studios in Rochester. A headset and fingertip wearables deliver signals together:

See

A signal appears in the headset

+

Hear

A tone plays

+

Feel

A gentle pulse on the fingertips

Why it matters. Cues like a beat, a light, or a touch can help people with Parkinson's start and keep moving. This platform lets researchers test which combinations help most.

Under development. Safety and potential benefits require testing. thebrainstormstudios.com

3. Intervention: how do we reduce the burden of symptoms?



LOCAL OPPORTUNITY · SUNY CORTLAND

Dr. Lara Shigo: exercise that is easier to access

Assistant professor studying exercise for people with Parkinson's. Leads the Cortland Parkinson's support group.

TREADMILL STUDY

One session of varied-speed walking on a standard treadmill improved hand function.

Now testing longer training: 6 visits over 2 weeks, 30 minutes of moderate walking.



Phone screening: 607-753-2275
Lara.Shigo@cortland.edu

EXERCISE SURVEY

Anyone with Parkinson's. About 20 minutes, online.



3. Intervention: how do we reduce the burden of symptoms?



Dr. Andrea Stevenson Won

Associate Professor, Department of Communication, Cornell University



Dr. Julie Lombardi

Assistant Professor, Physical Therapy, Upstate Medical University



Dr. Marlen Z. Gonzalez

Assistant Professor, Department of Psychology, Cornell University

LOCAL OPPORTUNITY · AT EMPOWER PARKINSON'S

Boxing in virtual reality

A Cornell team bringing VR exercise to the Parkinson's community.



THANK YOU

What more do you want to learn?



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Scan to answer

Your answers shape next year's series of conversations.