

LEADING MEDICINE: **A TOWN HALL CONVERSATION** WITH DR. MARC BOOM

Town Hall Conversation LIV

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MethodistSM
LEADING MEDICINE

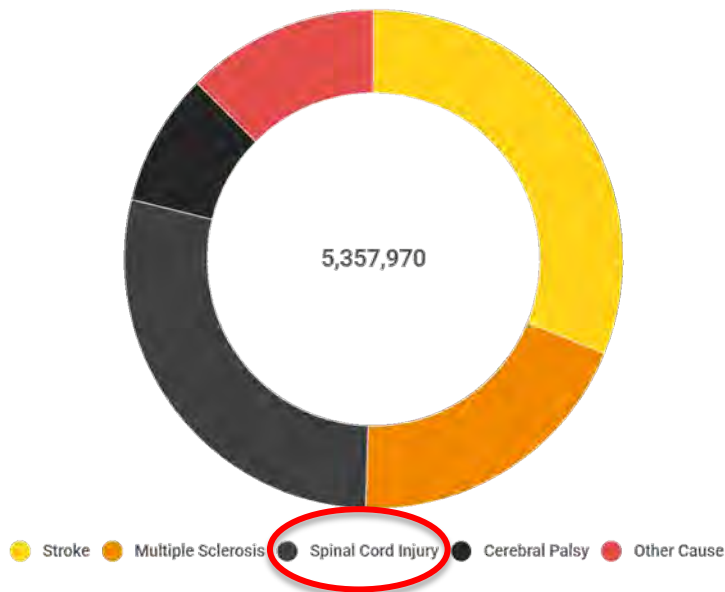


Restoring Function After Paralysis with Epidural Spinal Stimulation

Dimitry G. Sayenko, MD, PhD

Paula and Joseph C. “Rusty” Walter III Chair in Neuromodulation
Scientist, Associate Professor, Houston Methodist Academic Institute
Director of Spinal Cord Injury Research, Department of Neurosurgery
Director of Research for the Division of PM&R
Center for Neuroregeneration
Center for Neural Systems Restoration
Weill Cornell Medicine

Paralysis: Causes and Effects



- Paralysis is a central nervous system disorder resulting in difficulty or inability to move the upper or lower extremities.
- Approximately 1.7 percent of the U.S. population reported they were living with some form of paralysis.
- The leading cause of paralysis was stroke (33.7 percent), followed by spinal cord injury (27.3 percent) and multiple sclerosis (18.6 percent).
- On the employment front, 15.5% of individuals living with paralysis are employed versus 63.1% who are not living with a disability. Additionally, 41.8% of those living with paralysis indicated they were unable to work.
- **The average remaining years of life for persons with SCI have not improved since the 1980s.**

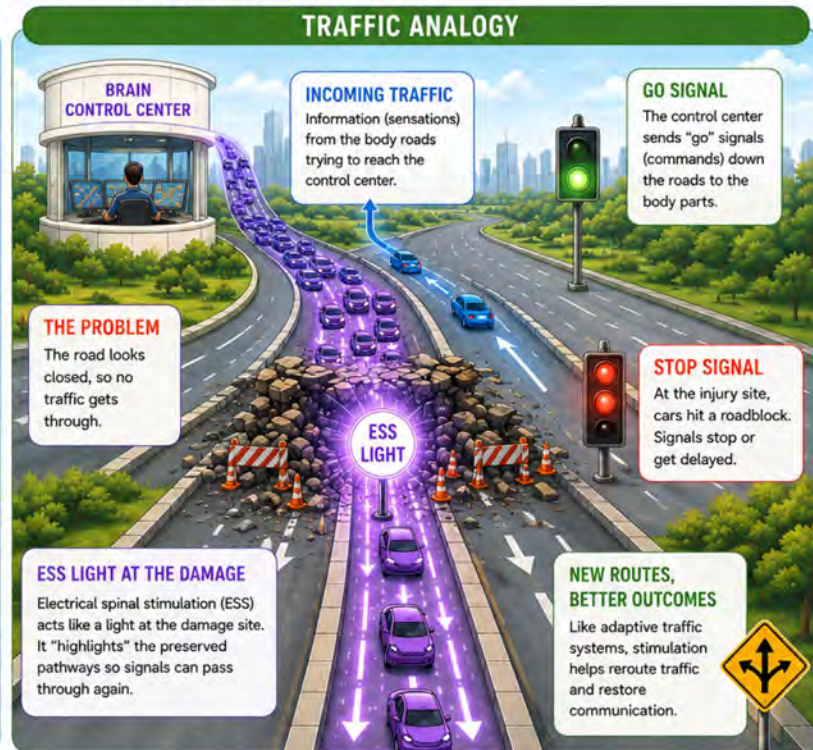
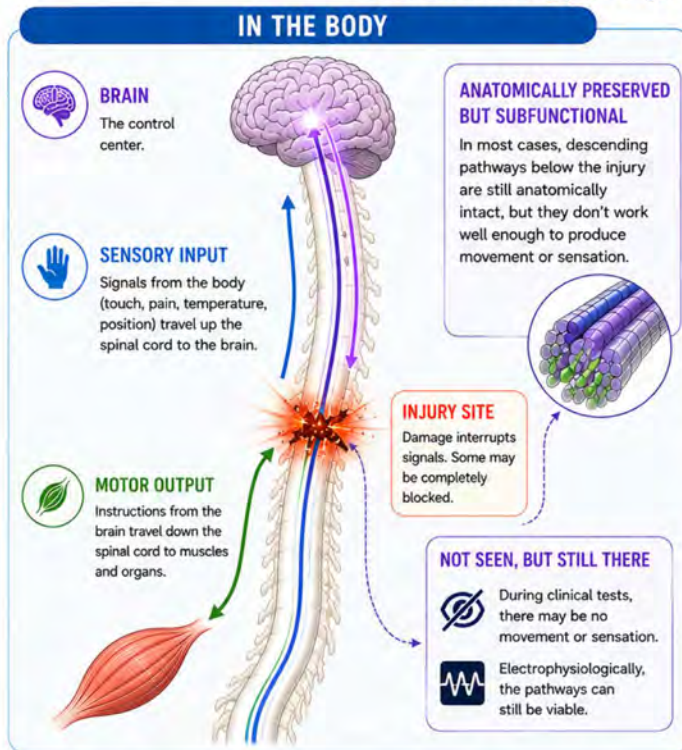
<https://www.christopherreeve.org/>

Spinal cord injuries alone cost roughly \$40.5 billion annually -- a 317 percent increase from costs estimated in 1998 (\$9.7 billion).

SPINAL CORD INJURY: THE BODY'S DAMAGED HIGHWAY

Injury damages the spinal cord—the main communication highway between the brain and the body.

*Most descending pathways are anatomically preserved, but **subfunctional**.*



TAKEAWAY:

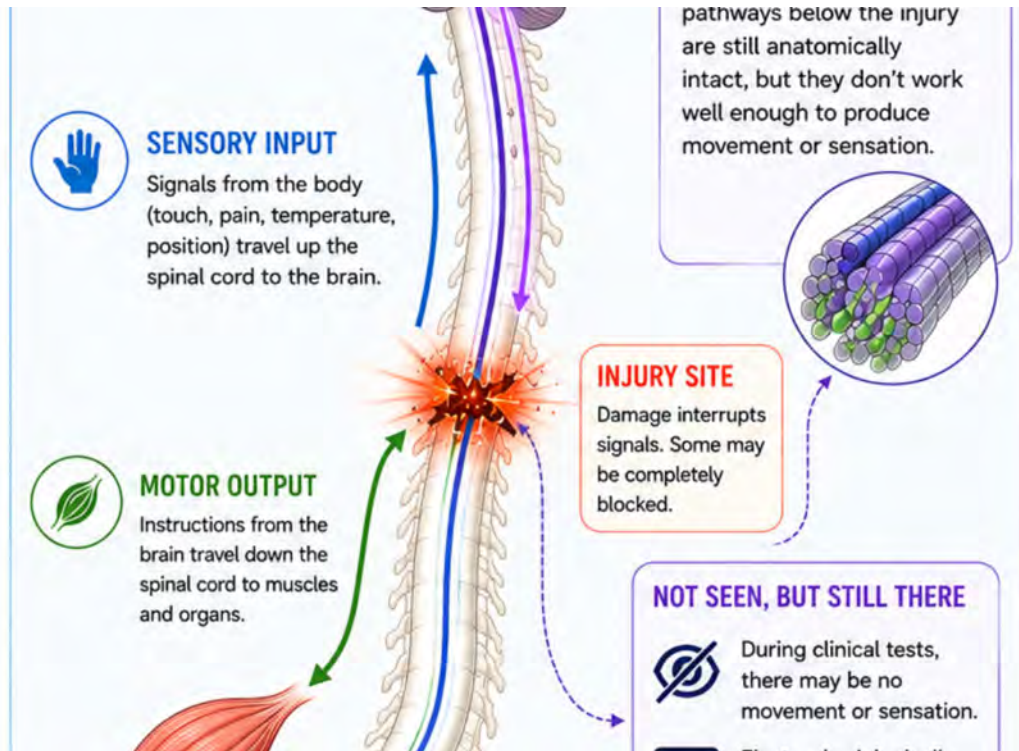
In spinal cord injury, the pathways are usually still there—just not working well enough.

Spinal stimulation can reveal and enable these hidden connections, helping to restore function.

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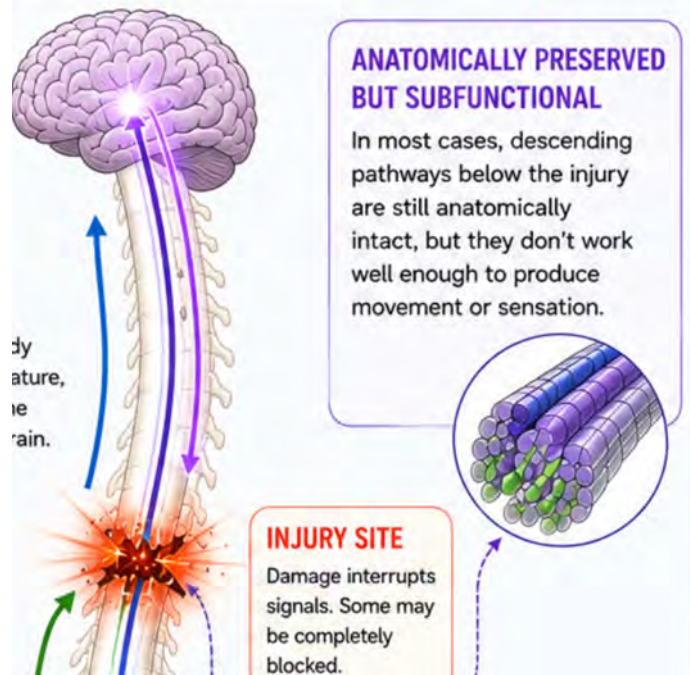
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IN THE BODY



TAKEAWAY:

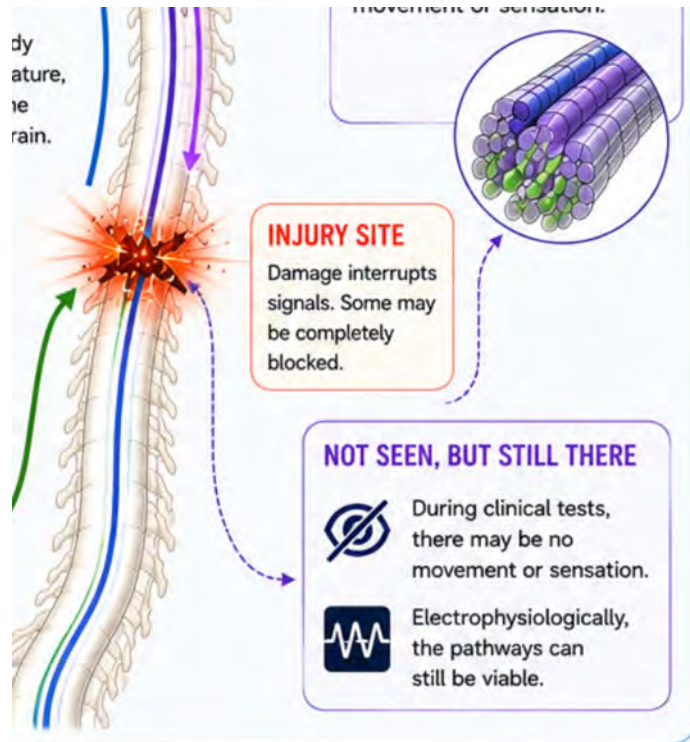
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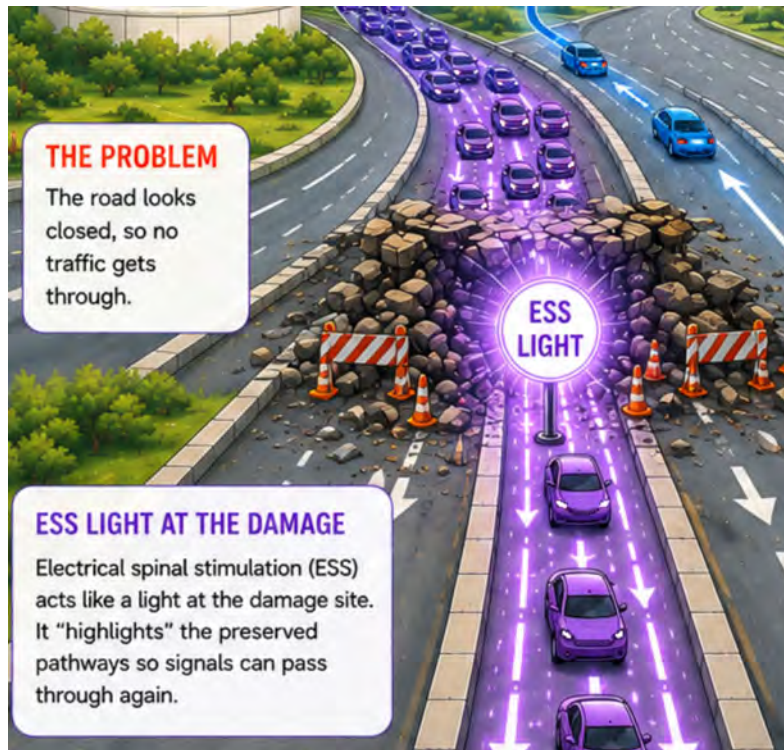
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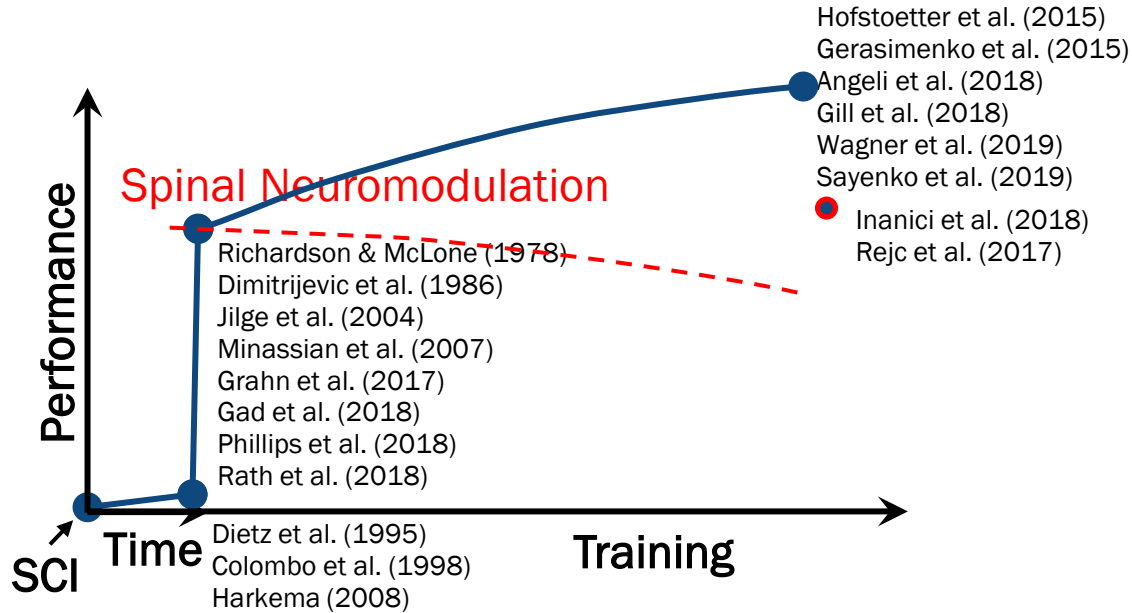
Functional responses of spinal stimulation



Becca Martin



Meegan Van Straaten



Harnessing neuroplasticity of postural sensorimotor networks using spinal neuromodulation to maximize functional recovery after spinal cord injury



Sean Barber



Amir Faraji



Teresa Kaldis



Philip Horner



Catherine Martin



Alex Steele



Jony Sheynin



Peter Grahm



Devon Dollahon



Jenny Dinh



Michelle Scheffler



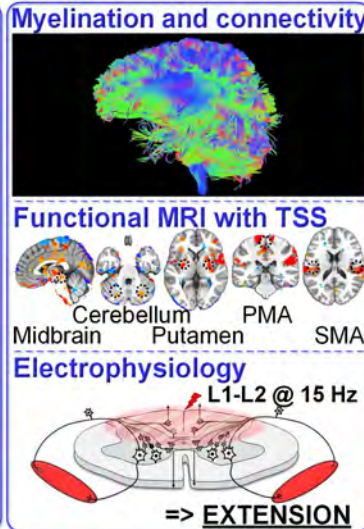
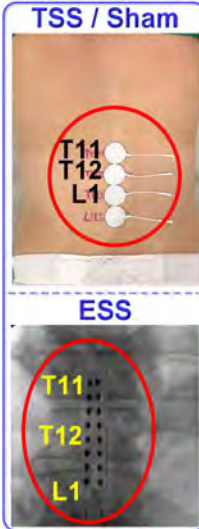
Jeonghoon Oh



Amanda Howes-Keith



Gracie Hufft



Christof Karmonik



Argyrios Stampsas

NLI T6, AIS A, 8 years post-injury

Without ESS, the participant had no sensation or voluntary muscle control below the chest



Transcutaneous Spinal Stimulation

Self-Assisted Standing



Epidural Spinal Stimulation

Regaining of Lower Limb Function



Amir Faraji



Philip Horner



Alexander Steele



Jeonghoon Oh



Michelle Scheffler



Catherine Martin



Jenny Dinh



Gracie Hufft



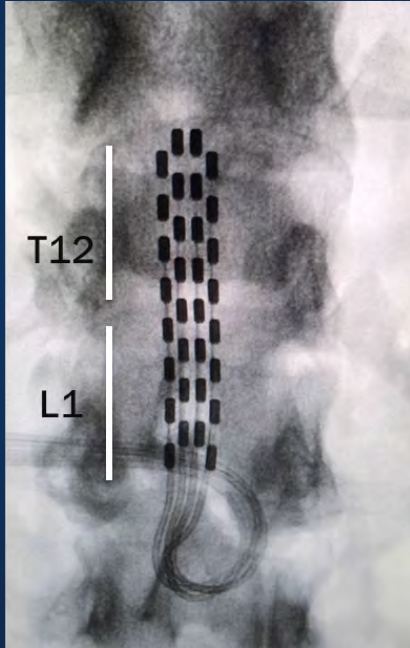
Milton Candela



Amanda Howes-Keith

NLI T7, AIS A, 20 years post-injury

Without ESS, the participant had no sensation or voluntary muscle control below the chest



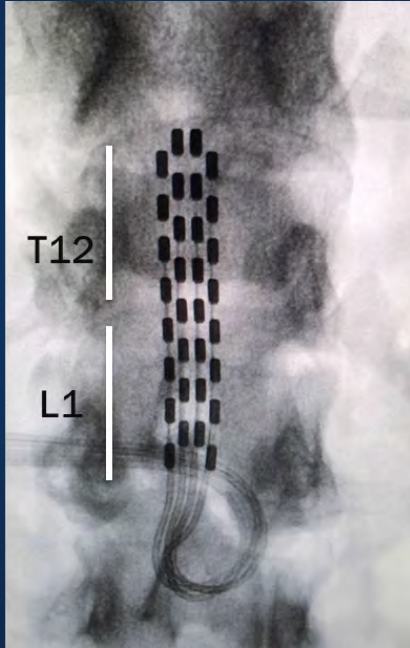
Epidural Spinal Stimulation

Volitional Movements after “Complete” Paralysis



NLI T7, AIS A, 20 years post-injury

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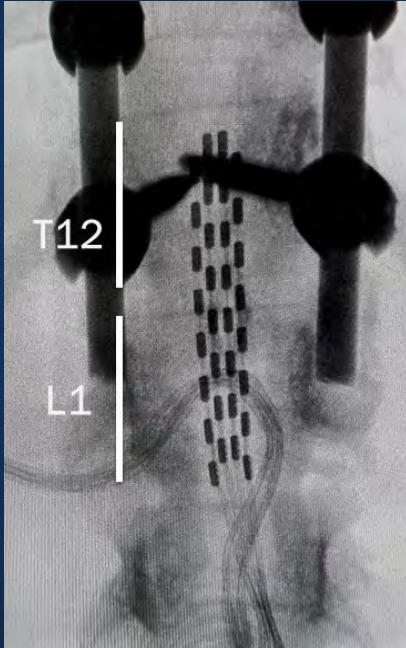
Epidural Spinal Stimulation

Regaining of Trunk Control during Sitting



NLI T10, AIS A, 7 years post-injury

Without ESS, the participant had no sensation or voluntary muscle control below the chest

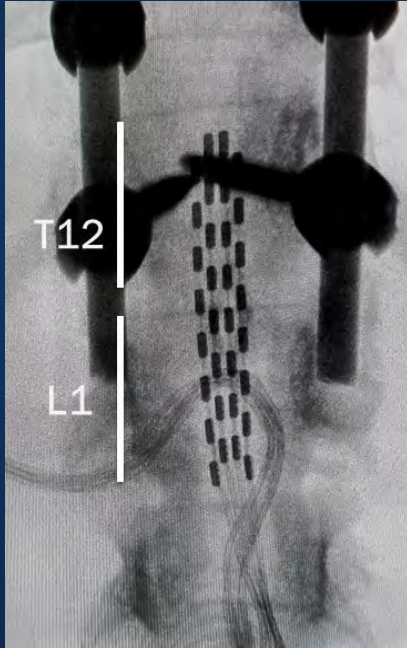


Epidural Spinal Stimulation



NLI T10, AIS A, 7 years post-injury

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Epidural Spinal Stimulation



Epidural Spinal Stimulation

Regaining of Upper Limb Function



Amir Faraji



Philip Horner



Alexander Steele



Jeonghoon Oh



Michelle Scheffler



Catherine Martin



Jenny Dinh



Gracie Hufft



Milton Candela



Amanda Howes-Keith

NLI C4, AIS A, 10 years post-injury

Without ESS, the participant had limited voluntary control, reduced range of motion, absence of grasp, heavy reliance on compensatory strategies



Epidural Spinal Stimulation

Enables Volitional Functional Grasp

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Optimized ESS Enables Soda Can Grasp

P01, Injury Level C5, AIS-A, 9 Years Post Injury

NLI C4, AIS A, 10 years post-injury

Without ESS, the participant had limited voluntary control, reduced range of motion, absence of grasp, heavy reliance on compensatory strategies



Epidural Spinal Stimulation

Enables Volitional Functional Grasp

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Optimized ESS

Enables Personal Grooming

P01, Injury Level C5, AIS-A, 9 Years Post Injury

NLI C4, AIS A, 10 years post-injury

Without ESS, the participant had limited voluntary control, reduced range of motion, absence of grasp, heavy reliance on compensatory strategies



Epidural Spinal Stimulation

Enables Volitional Functional Grasp

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Optimized ESS Enables Grip in Bench Press

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Epidural Spinal Stimulation

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Optimized ESS

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Epidural Spinal Stimulation

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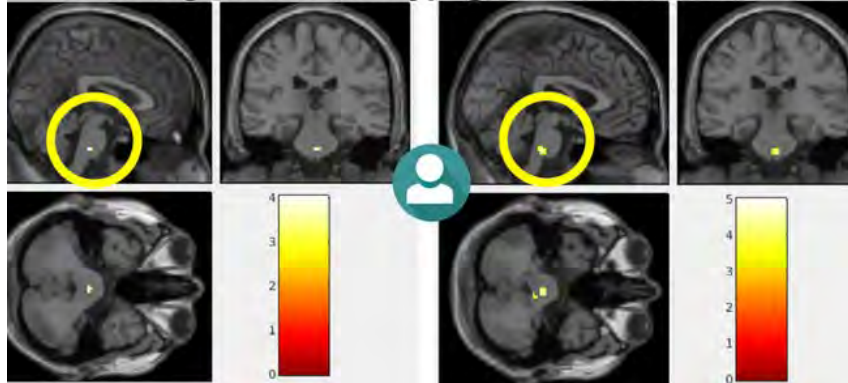


Optimized ESS Enables Grip in Bench Press

P01, Injury Level C5, AIS-A, 9 Years Post Injury

What else can we treat?

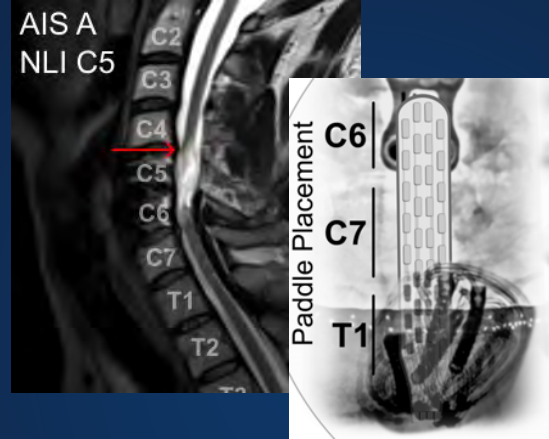
Cervical ESS after cSCI (AIS A, C4) increases activation in the region near the hypoglossal motor nucleus



Hypoglossal Motor Nucleus is responsible for:

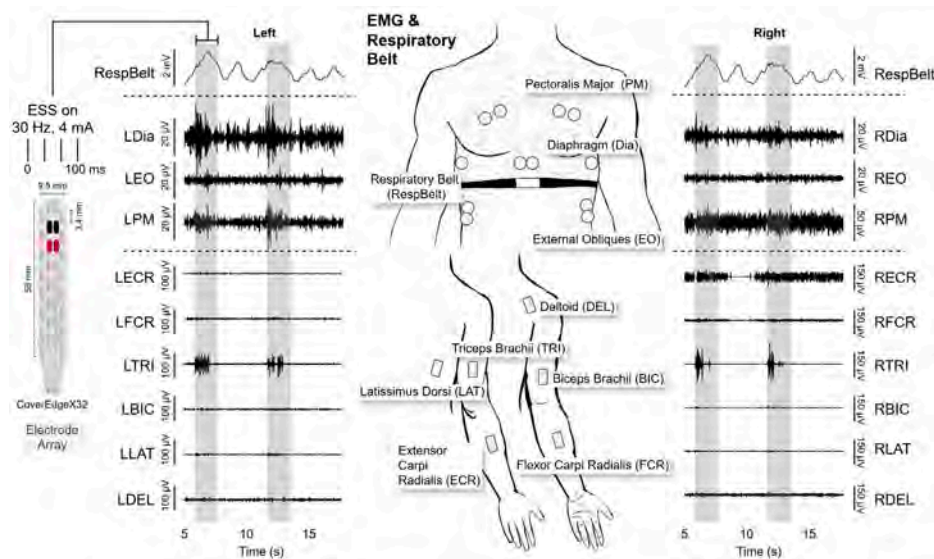
- Tongue movement
- Speech articulation
- Swallowing
- Chewing
- Airway control

NLI C4, AIS A, 10 years post-injury

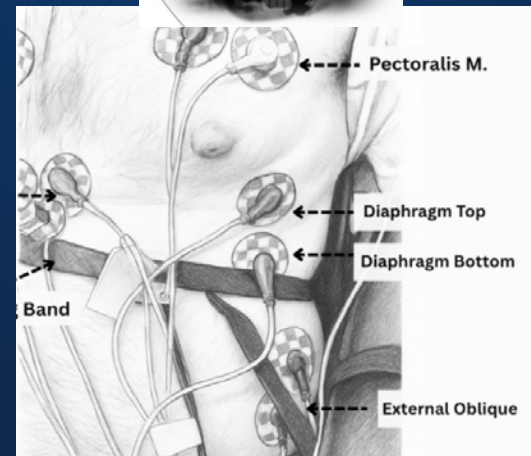
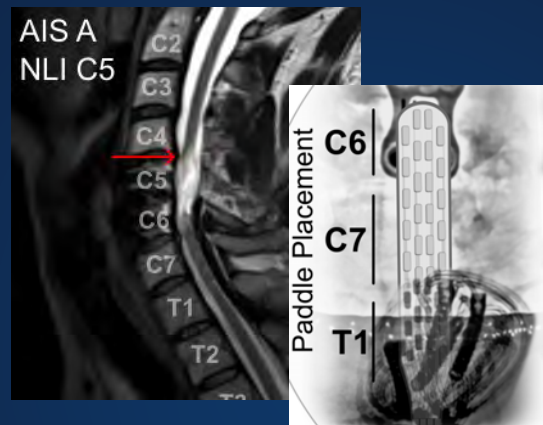


What else can we treat?

- Respiratory Recovery



NLI C4, AIS A, 10 years post-injury



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Erica A. Dale



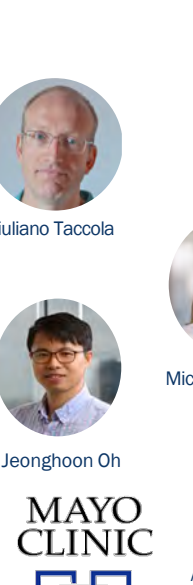
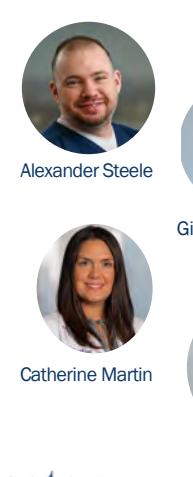
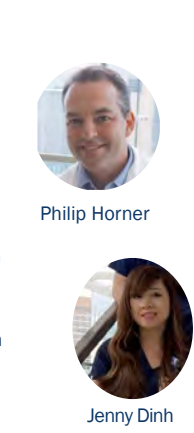
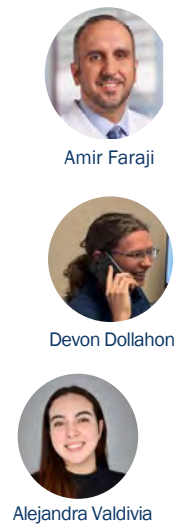
Alejandra Valdivia



Milton Candela



Jeonghoon Oh



Participant Recruitment Ongoing

We are currently recruiting individuals with SCI for clinical trials investigating non-invasive and epidural spinal stimulation targeting upper- and lower-limb function.

- The Jerry Johnston Andrew Spinal Cord/Mission Connect Award
- Houston Methodist Specialty Physician Group Award
- Paula & Joseph C. “Rusty” Walter III Neurorestoration Program
- Wings for Life Foundation
- C. Neilsen Foundation
- NIH R01 NS119587

dgsayenko@houstonmethodist.org
<https://sayenko.hmailabs.org/>

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Replacement Parts for Your Brain:

How Lab-Engineered Neural Circuits Could Transform Repair and Recovery

Philip J. Horner, PhD

Professor and Vice Chairman, Research, Department of Neurosurgery
Professor and Scientific Director, Center for Neuroregeneration
Director of Graduate Studies, Houston Methodist Academic Institute
Professor, Weill Cornell Medicine, Graduate Program in Neuroscience/Houston
Co-Director, NIH T32, NeuralCODR Post-doctoral Training Program

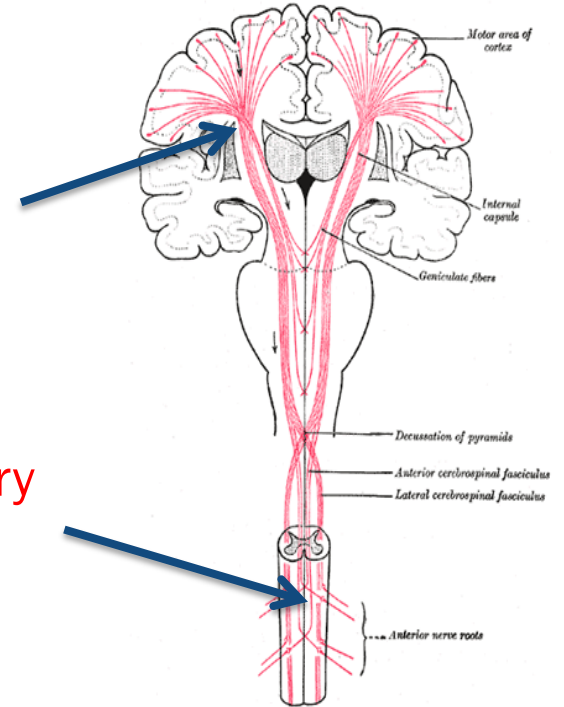
The Challenge



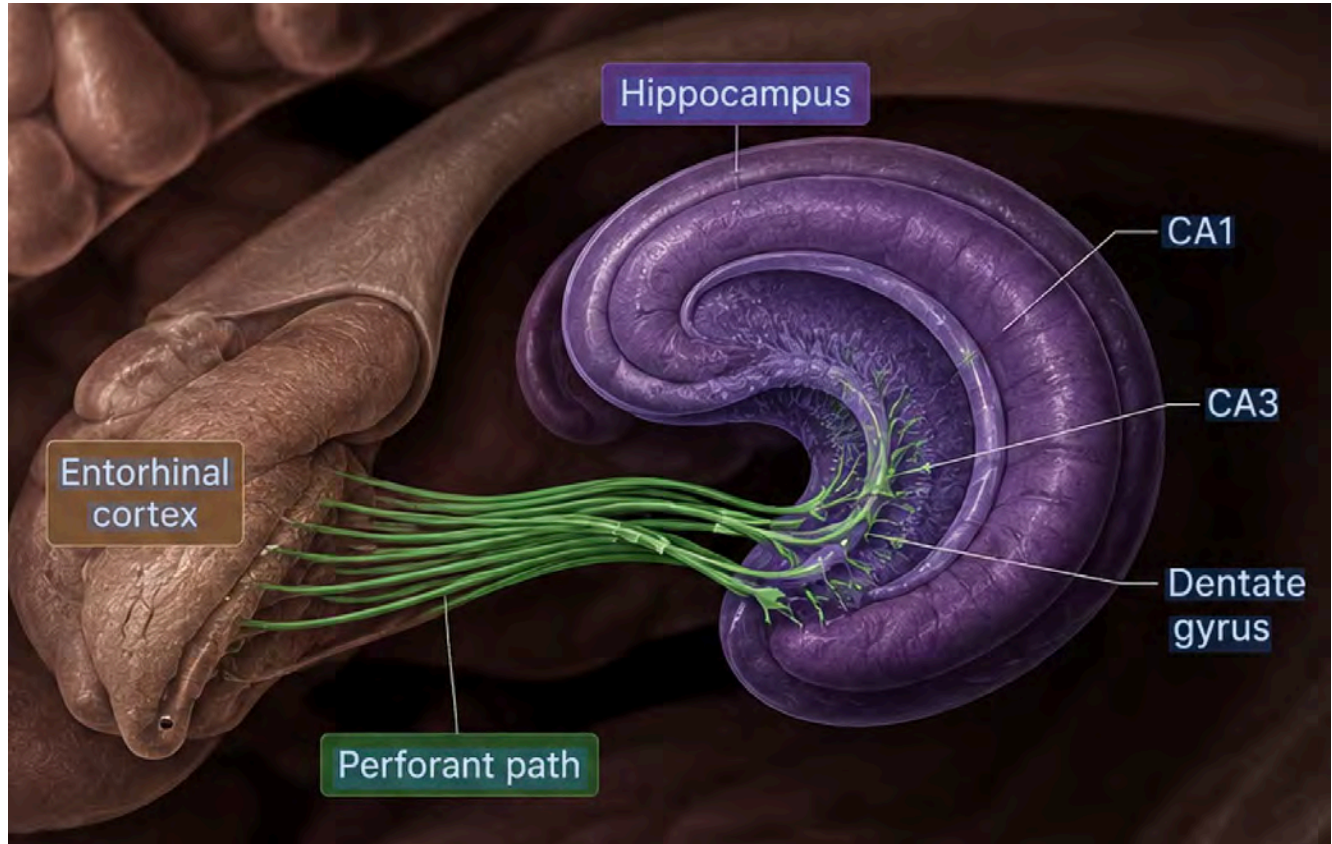
100 billion neurons
500 trillion synapses or
connections

Stroke

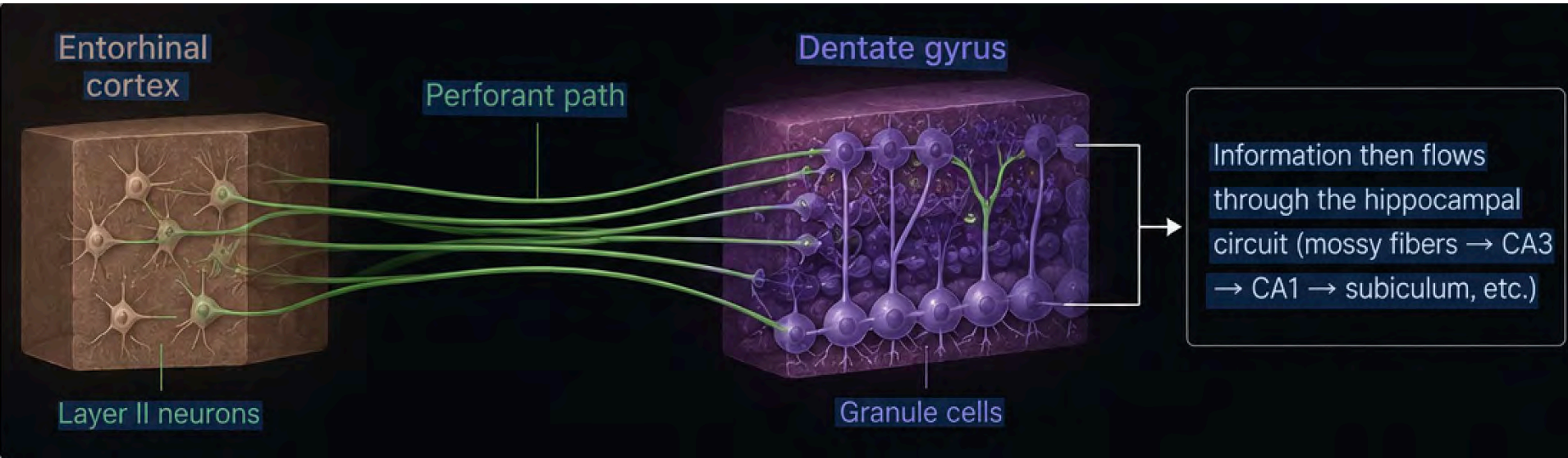
Spinal Cord Injury



Inside a Memory

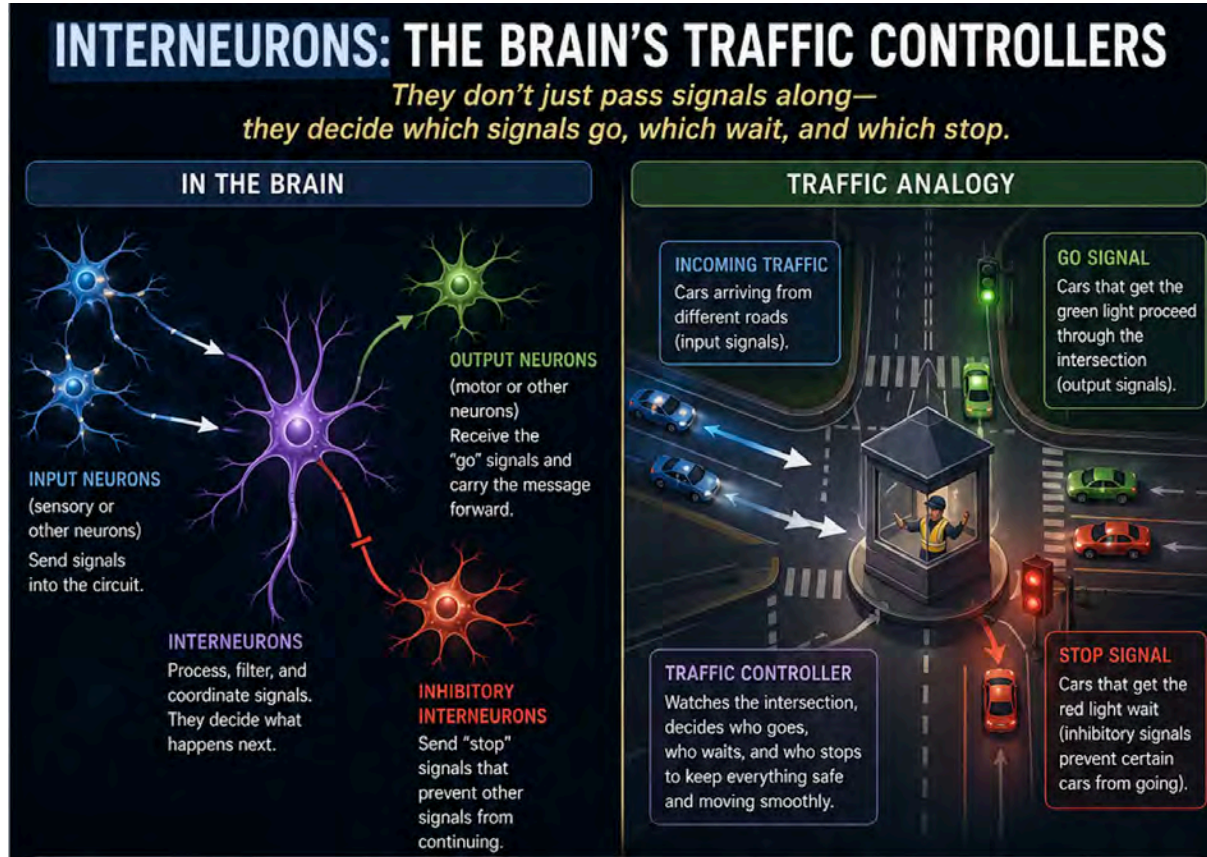


Brain Relay Circuit: Inside a Memory



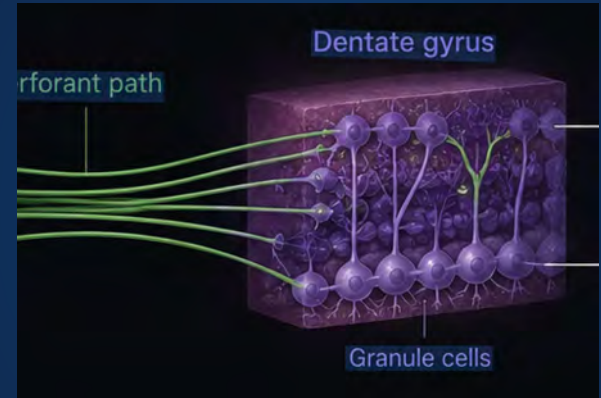
Microprocessor

What is an Interneuron Circuit?



What can we treat?

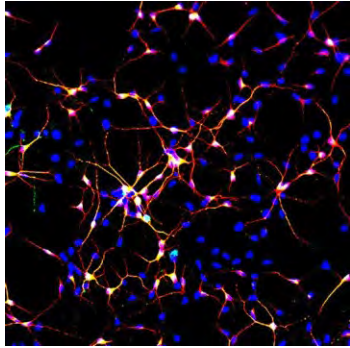
- Trauma
- Stroke
- Alzheimer's Disease
- Age-related Dementia



What if we could make the interneuron circuits?

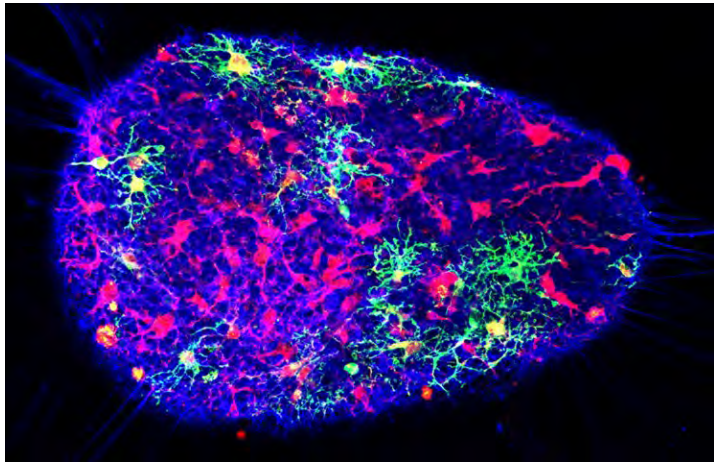
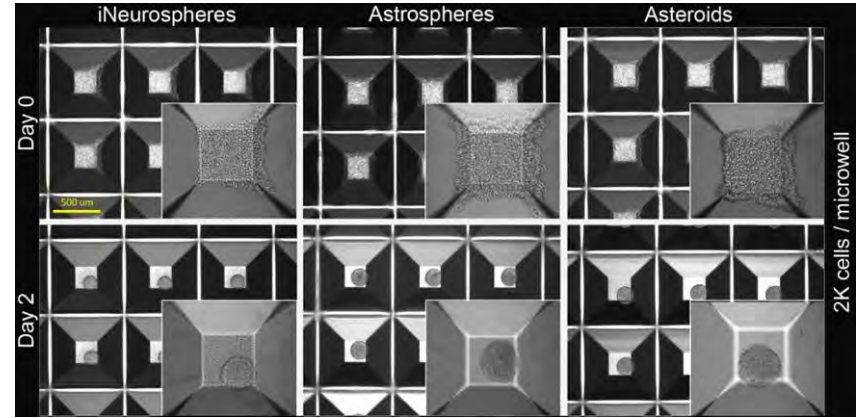
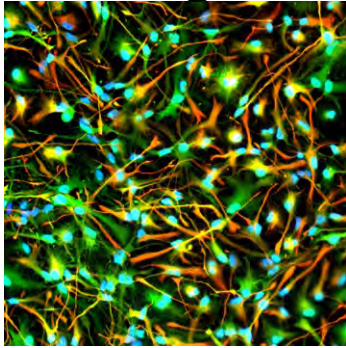
The air traffic controllers

Neurons



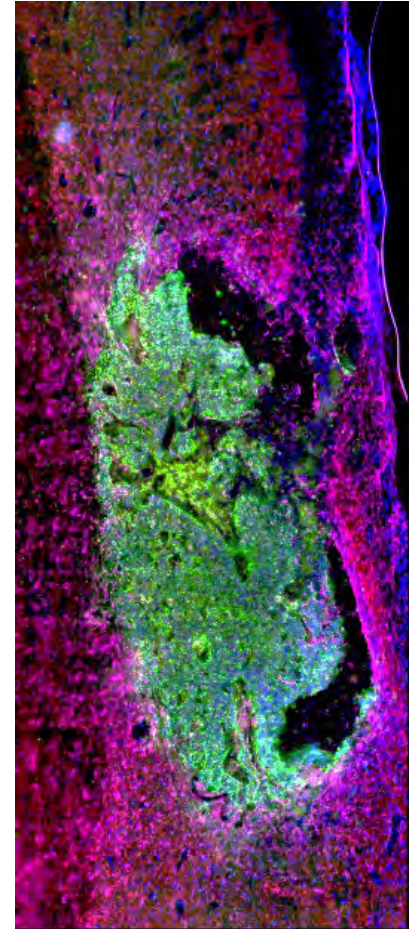
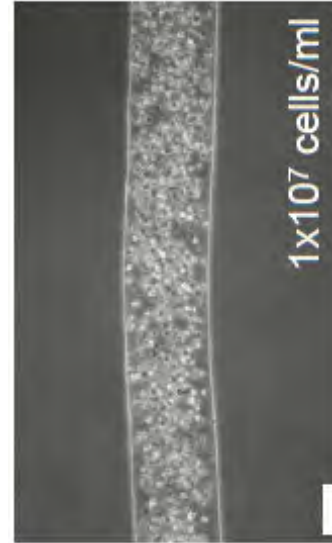
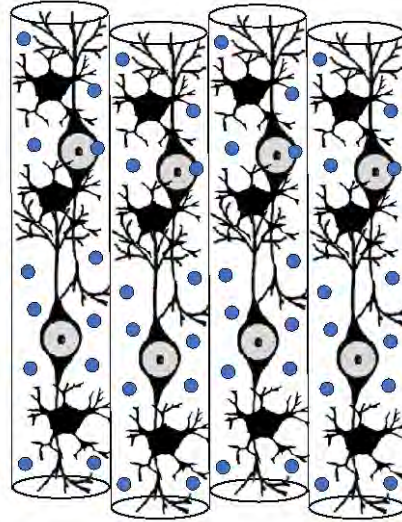
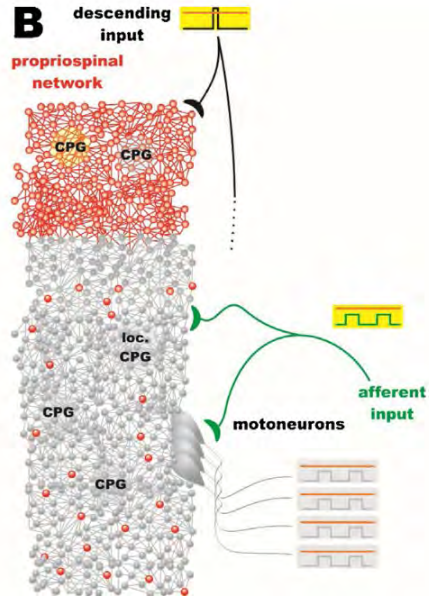
+

Astroglia



= Human
Asteroids

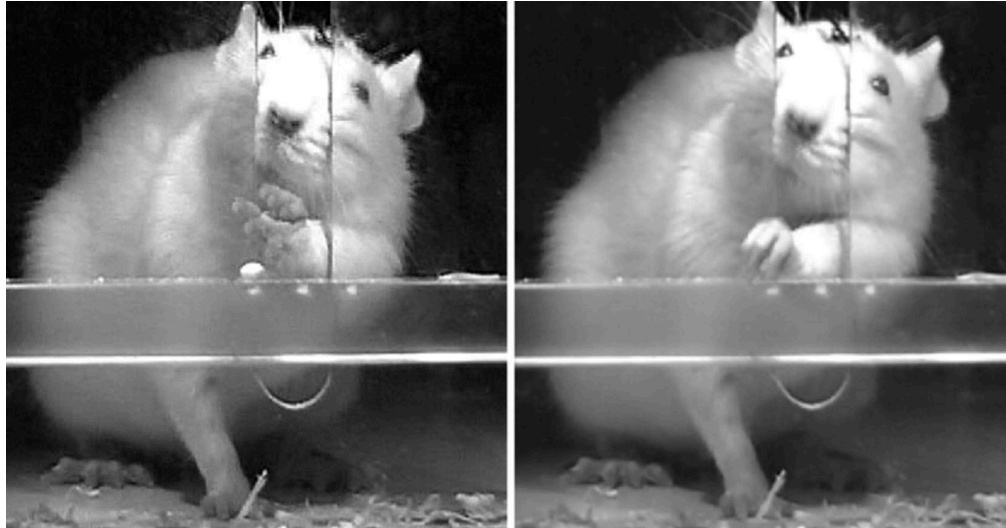
Center for Neuroregeneration



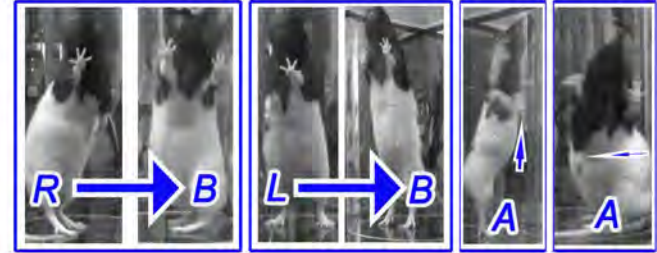
Transplantation – Spinal Relay Circuit

Krencik and Horner Labs

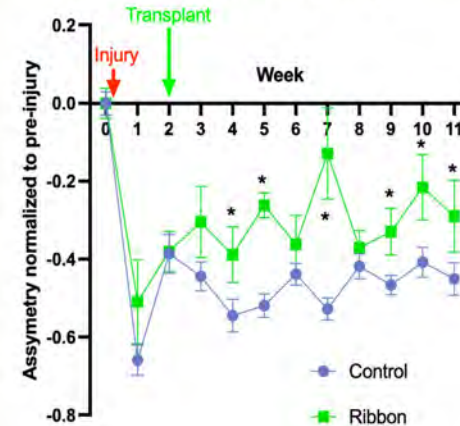
Pre-Clinical Trial: Hand Function



(a) *Limb Use Assymetry Test (LUAT)*



Limb Use Assymetry



Is a neural circuit transplant feasible?



- Regulatory challenges
- Safety
- Cost
- Standardization

Moore's Law

Moore's Law is the observation that the number of transistors on a microchip doubles approximately every two years, leading to exponential increases in computing power and performance at lower costs.

Moore's Law: The number of transistors on microchips doubles every two years

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.

Transistor count

50,000,000,000

10,000,000,000

5,000,000,000

1,000,000,000

500,000,000

100,000,000

50,000,000

10,000,000

5,000,000

1,000,000

500,000

100,000

50,000

10,000

5,000

1,000

Year in which the microchip was first introduced

Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)

OurWorldinData.org – Research and data to make progress against the world's largest problems.

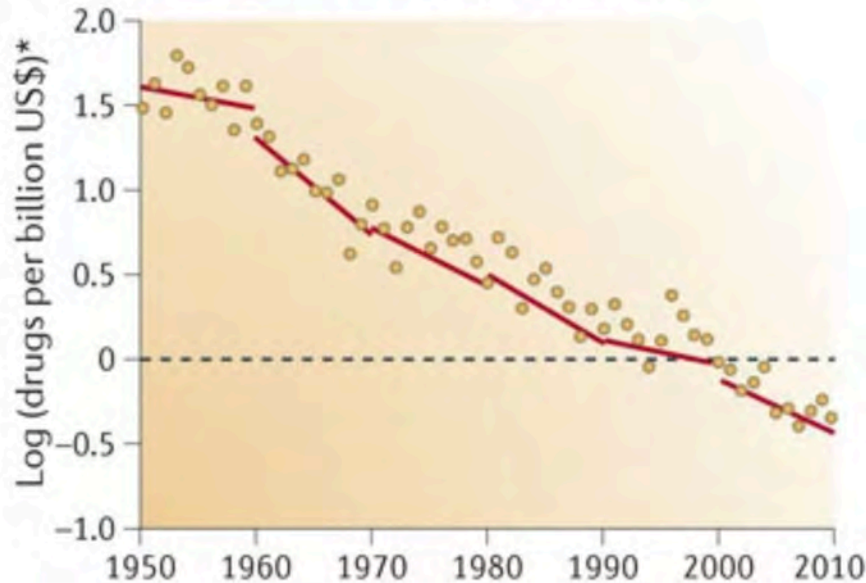
licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

Our World
in Data

Eroom's Law

What's needed?

b Rate of decline over 10-year periods



- ❖ Biologics
- ❖ Biomaterials Combined with Organoids
- ❖ Closed-Loop Systems: “smart” implants and Metabolic Support
- ❖ Plasticity Inducing Small Molecules Combined with Rehab

The FDA is no longer approving only cell therapies — ***FDA is approving increasingly sophisticated tissue-engineered products***, establishing a regulatory foundation for future organoid- and engineered organ-based therapies

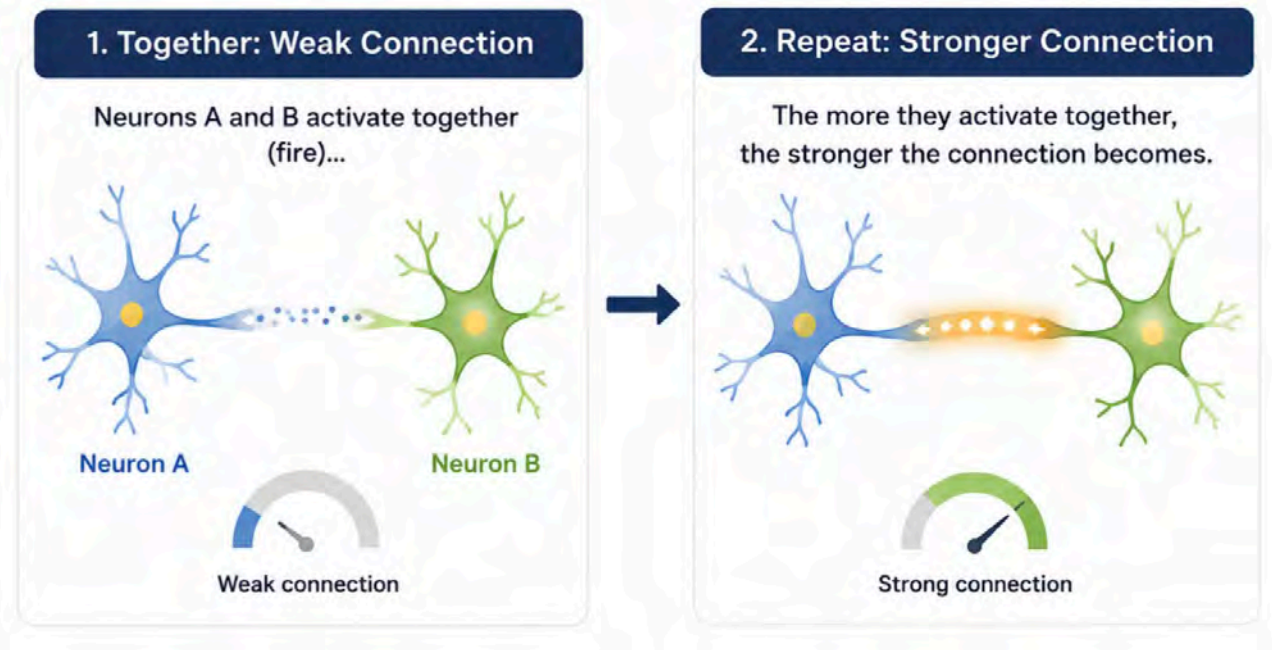


FDA Approval	Tissue Engineered Product	Therapeutic Concept	Milestone
2016	MACI	Autologous chondrocytes seeded onto a collagen scaffold	First widely adopted tissue-engineered cartilage replacement (U.S. Food and Drug Administration)
2021	STRATAGRAFT	Living engineered human skin substitute	First allogeneic engineered skin replacing full-thickness tissue (U.S. Food and Drug Administration)
2021	RETHYMIC	Allogeneic cultured thymus tissue	First FDA-approved functional organ tissue for immune reconstitution (U.S. Food and Drug Administration)
2024	SYMVESS	Acellular bioengineered human blood vessel	First FDA-approved tissue-engineered vascular conduit (U.S. Food and Drug Administration)
2025	ZEVASKYN	Autologous gene-corrected epidermal sheets	Personalized engineered tissue with durable genetic correction (U.S. Food and Drug Administration)

How to integrate a circuit into the injured brain?

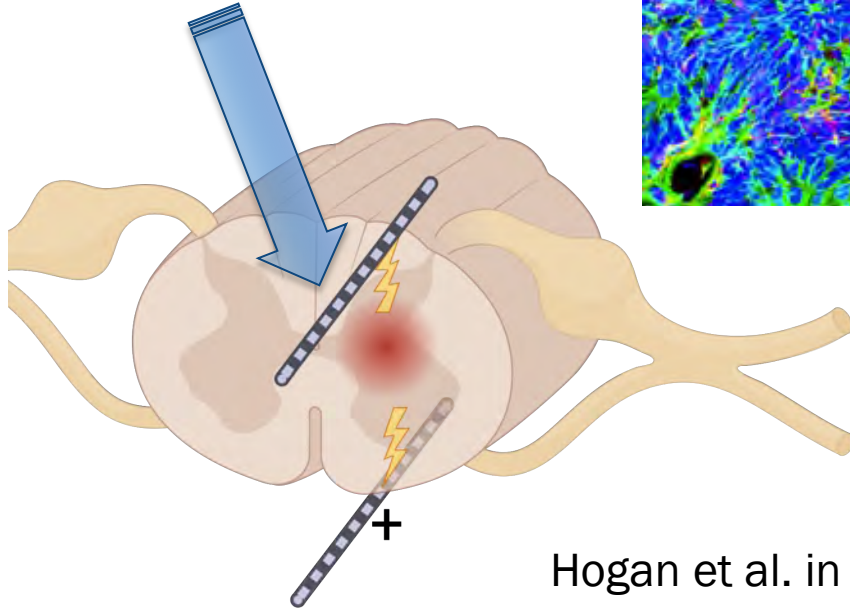
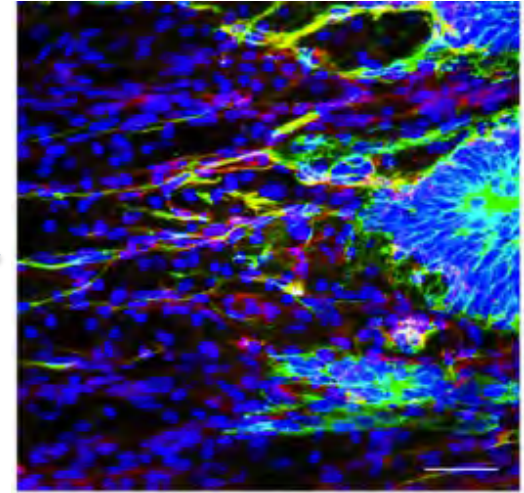
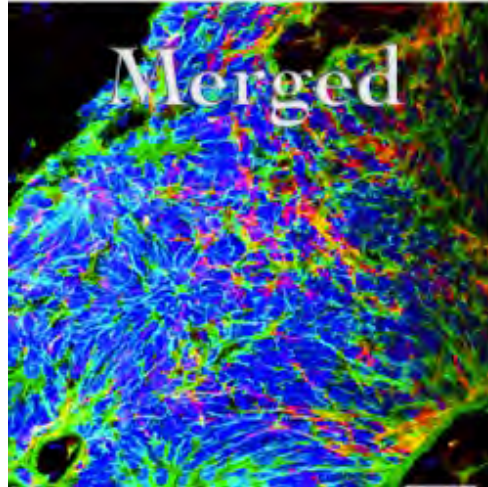
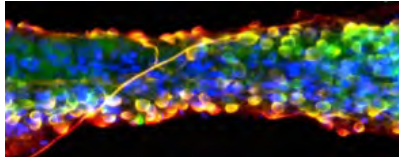


100 billion neurons
500 trillion synapses or
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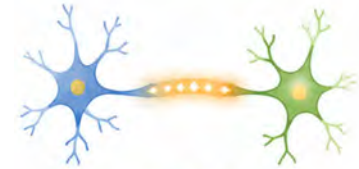


Hebbian Plasticity, Donald Hebb 1950

How to integrate a relay circuit into the injured spinal cord?

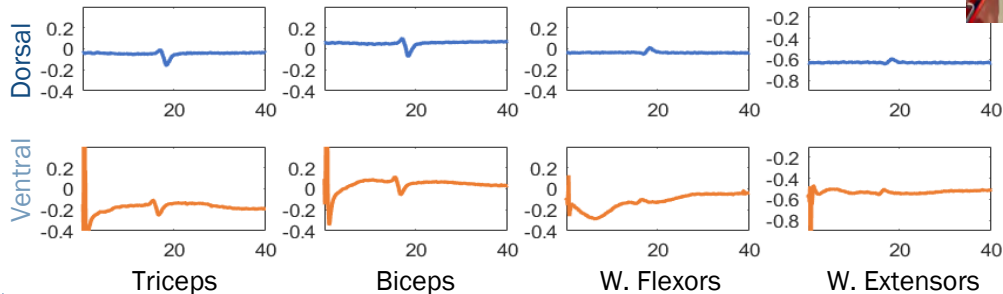
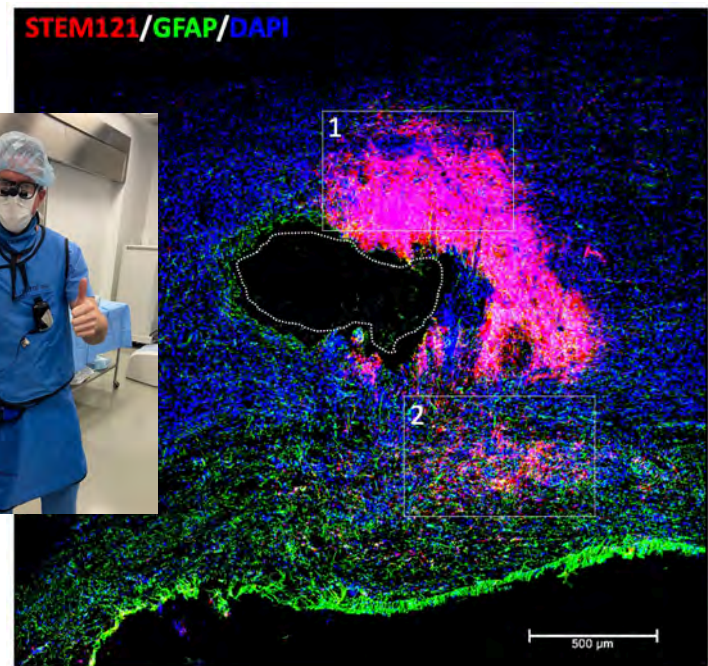
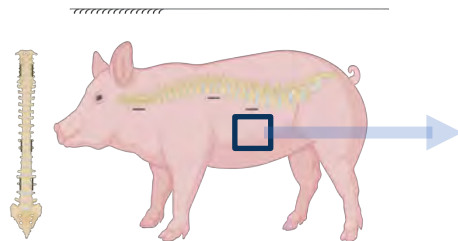
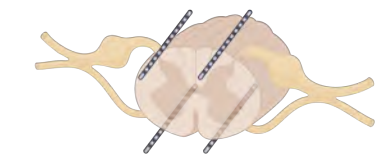


Stimulated



Hogan et al. in preparation

The Future: Translation



Neuromodulation

Porcine Model of SCI

Horner Lab

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Supported By

NINDS, Wings for Life, Paralysis Project, Department of Defense, The Nielsen Foundation, Paula and Rusty Walter and Walter Oil & Gas Corp Endowment

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Houston Methodist Update

Marc L. Boom, M.D.

June 18, 2026

Donate Life Month: Celebration of Life Event



Kidney Swap



Lizzie Yoshida (right) with Alice Swift (left), whom Lizzie donated in honor of. Alice is the mother of Alicen Swift (center), who works for the Houston Methodist Hospital Foundation.

Nine-Way Kidney Swap



Leadership Announcement



**Dr. Faisal Masud named chair of the
Department of Anesthesiology
& Critical Care**

Leadership Announcement



Malcolm K. Brenner, MD, MB, PhD, FRCP, FRCPPath
Director of the Cell and Gene Therapy Center
at Houston Methodist

EnMed Graduation Class of 2026



2026 GME Graduation



National Recognitions

Named Director of
American Board of
Otolaryngology-Head and
Neck Surgery



Masayoshi Takashima, MD, FACS

Sylvia and James E. Norton
Distinguished New Century Chair
Chair and Professor, Department
of Otolaryngology

Received American Society
of Echocardiography
Physician Lifetime
Achievement Award



Sherif Nagueh, MD

The Levant Foundation Chair
in Cardiovascular Diseases
Professor, Department of Cardiology

Awarded the 2026 Norman
Geschwind Prize in
Behavioral Neurology from
the American Academy of
Neurology



Juan B. Toledo, MD, PhD

Ann and Billy Harrison Centennial Chair
in Alzheimer's Research
Assistant Professor, Stanley H. Appel
Department of Neurology

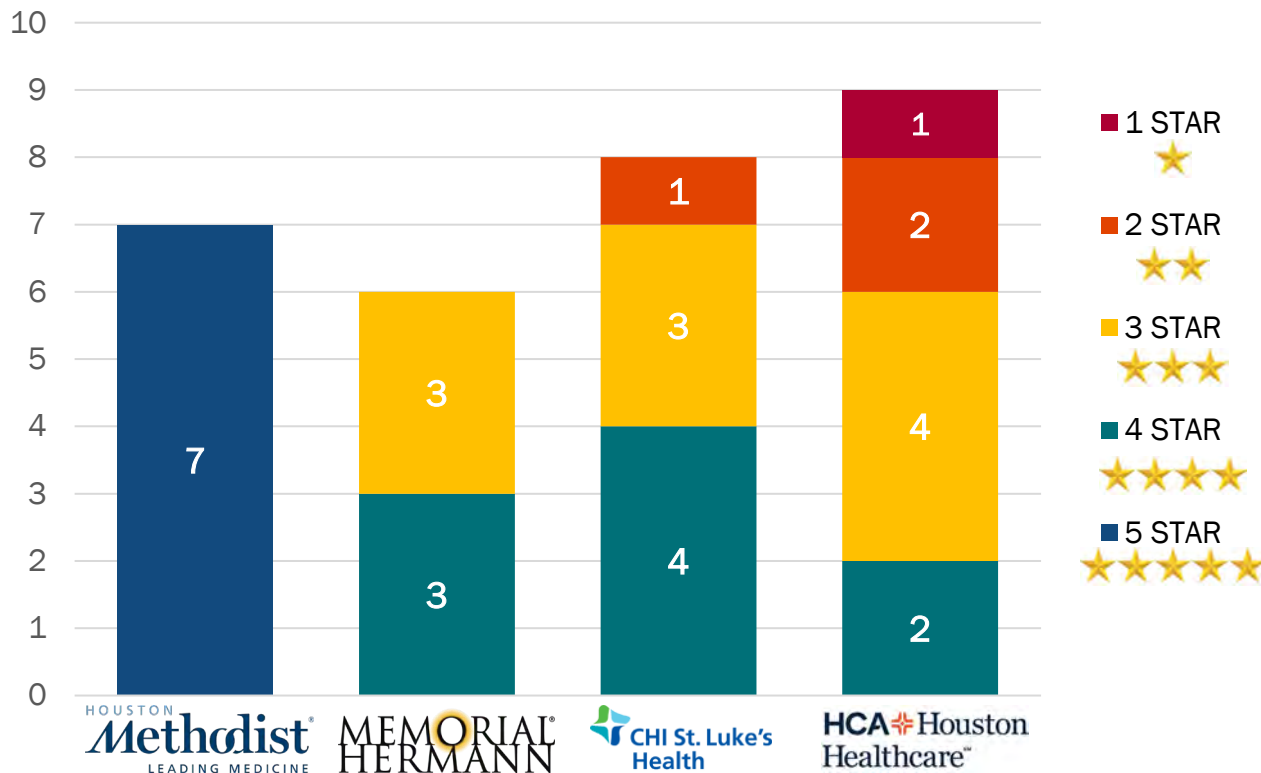
Awards & Accolades



**Houston Methodist is
the only health system
in Houston with a
5-star rating**



CMS Star Ratings of Hospitals in Houston



Awards & Accolades



Houston Methodist Ranked #1
“Large Health System”
in the U.S. by Premier

Awards & Accolades

Houston Methodist Hospital's Centennial Tower has received the 2026 "Future Healthcare Design (Unbuilt Projects) Award" from European Healthcare Design



CPAM Celebrates 30 Years



HM Comprehensive Care Center in Cinco Ranch



9th Annual System Quality and Patient Safety Symposium



National Nurses Week



Celebrating Hospital Week



Please join us for Houston Methodist's Hospital Week. We have fun activities planned for each day to celebrate all that you do. Be sure to email your pictures from this week's activities to OfficeofRobertaSchwartz@houstonmethodist.org and they could be featured in an upcoming newsletter.

MONDAY, May 11 | 6:30-8:30 a.m.

Donut Underestimate the Difference You Make

Make plans to stop by the 2nd floor of Walter Tower, Crain Garden, OPC (next to Starbucks) or the Scurlock Crosswalk to pick up a donut and juice in appreciation of you!

TUESDAY, May 12 | 11 a.m. - 1 p.m.

Hospital Week Field Day

Visit Jones Neurosensory Building patio to enjoy an ice cream, play yard games and take a photo with an Astros player.

Night Shift: Visit Crain Garden to pick up treats from 8:30-9:30 p.m.

WEDNESDAY, May 13

System-Wide BRAVO Day

Take a moment to recognize a colleague within your entity or across the system for their dedication, teamwork and positive impact. BRAVO Day brings us together across all entities to celebrate as one Houston Methodist.

THURSDAY, May 14 | 1-3 p.m.

Quick Think Trivia

Put your knowledge to the test and join us in Dunn Rio Grande for an afternoon of fun, friendly competition! Gather your coworkers or come solo as we dive into a variety of trivia categories—from pop culture to history.

Why Do You Do What You Do?

The Office of Culture & Engagement invites you to stop by one of our virtual interactive walls in Crain Garden, Walter Tower 2nd Floor or Smith Tower Lobby to reflect on why you do what you do.

FRIDAY, May 15 | 11 a.m. - 2 p.m.

The Ultimate Bingo Bash

Close out Hospital Week with one of our most popular events—Bingo! Stop by Dunn Rio Grande to join in the fun. Each round brings a new chance to win amazing prizes.





People

Texas Man Celebrates 100th Birthday After Defying Odds and Surviving Stage 4 Lung Cancer

Cecil McConnell shared what contributed to his longevity

By [Vanessa Etienne](#)

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6 COMMENTS



Cecil McConnell.
Credit : Houston Methodist

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THANK YOU FOR ATTENDING OUR **A TOWN HALL CONVERSATION** WITH DR. MARC BOOM

For more information about Neurorestoration,
please contact **foundation@houstonmethodist.org**

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