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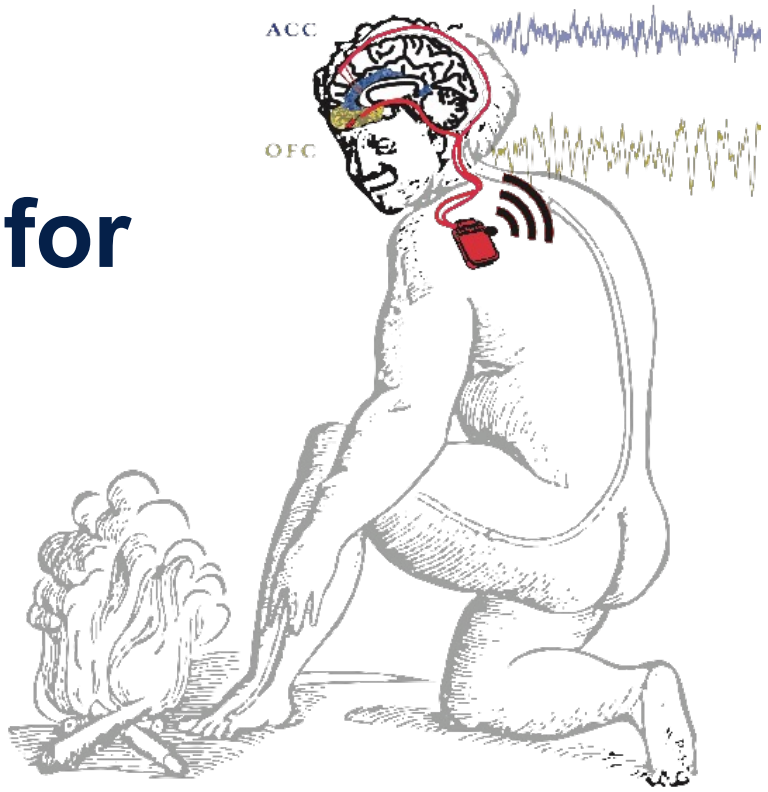
Deep Brain Stimulation for Chronic Pain

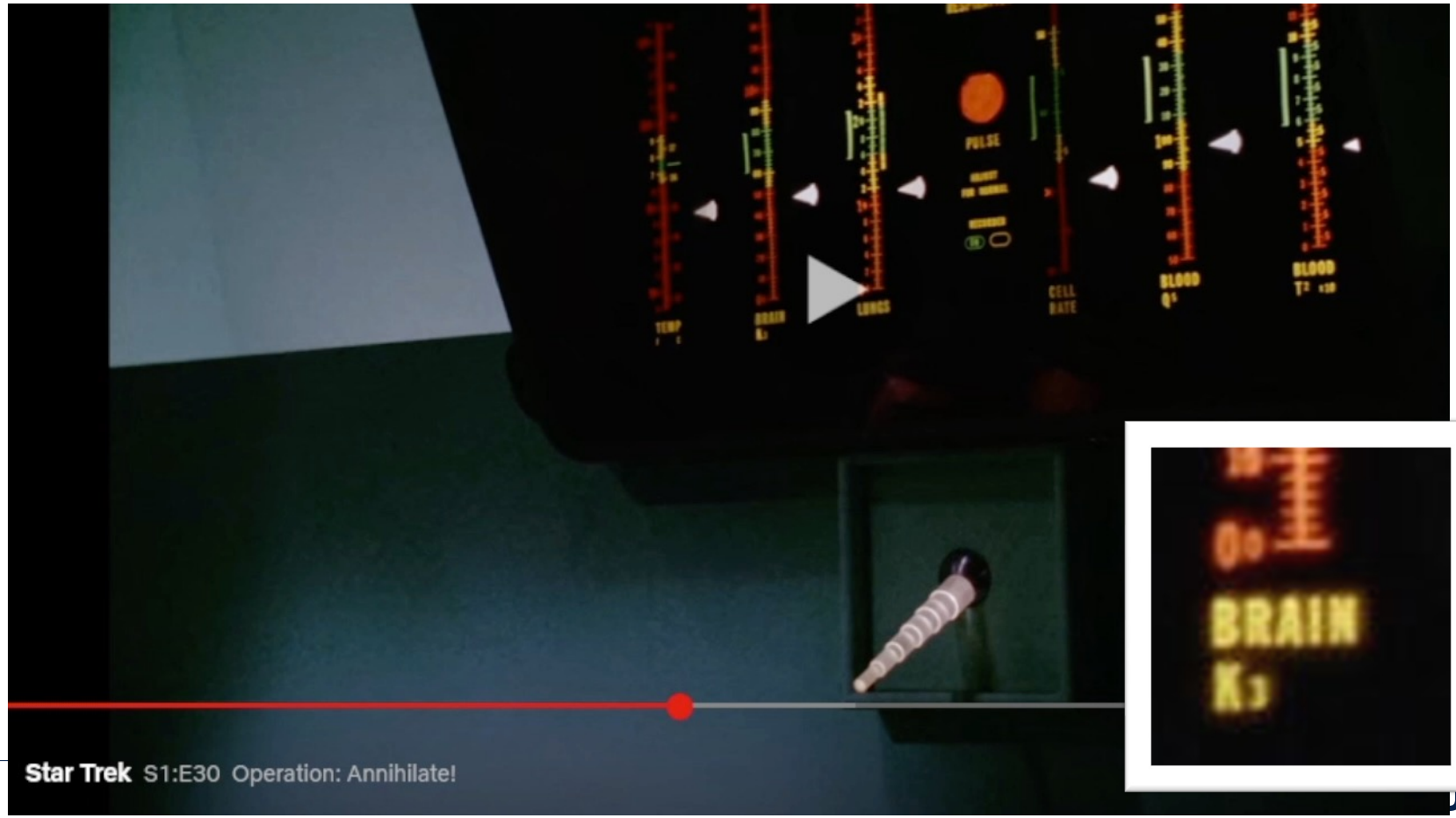


Prasad Shirvalkar MD, PhD
Associate Professor, Anesthesiology,
Neurology and Neurological Surgery

Pain as the 5th vital sign?

But there is no objective measure of pain!

Can we build a K3 indicator?

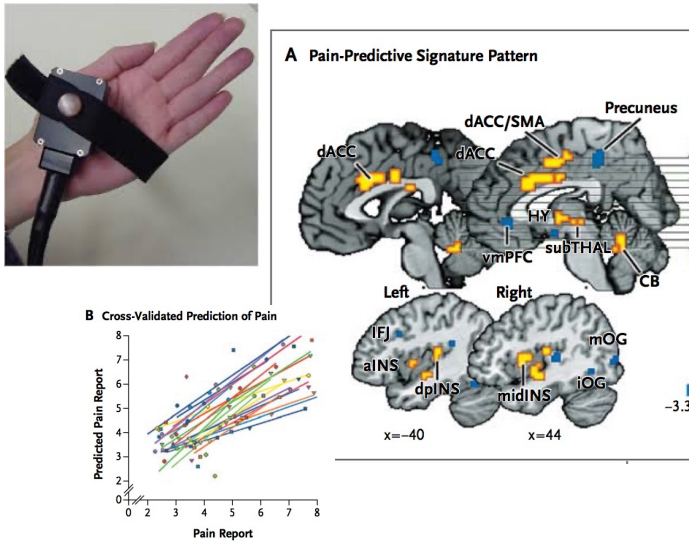


Credit: memory-alpha.fandom.com

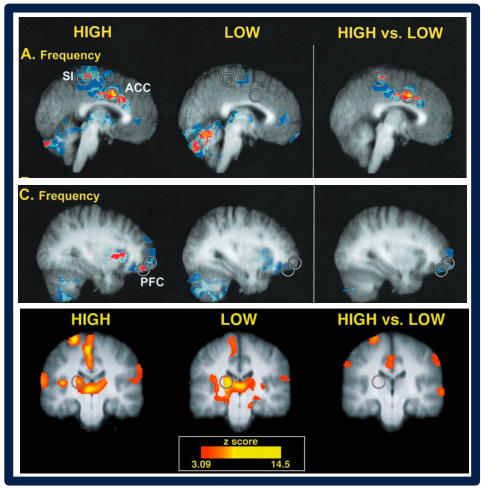
Pain is in the BRAIN.

But, prior evidence is mostly from experiments on healthy people in the lab.

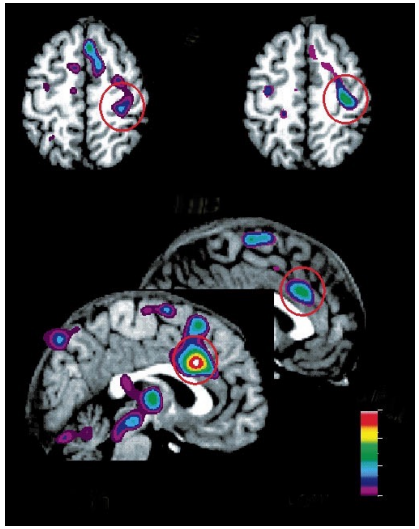
Heat pain testing



Wager et al., NEJM 2013

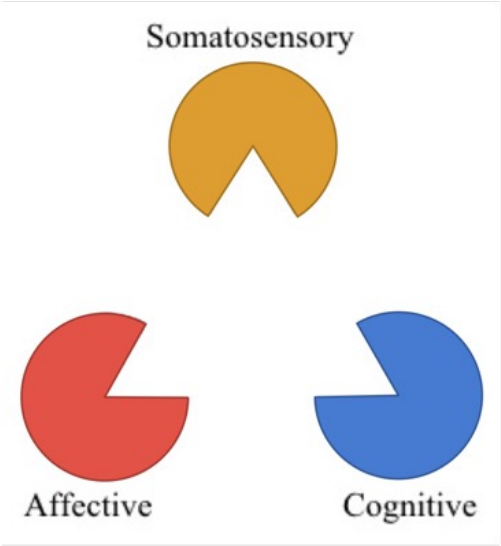


Coghill et al., PNAS 2003

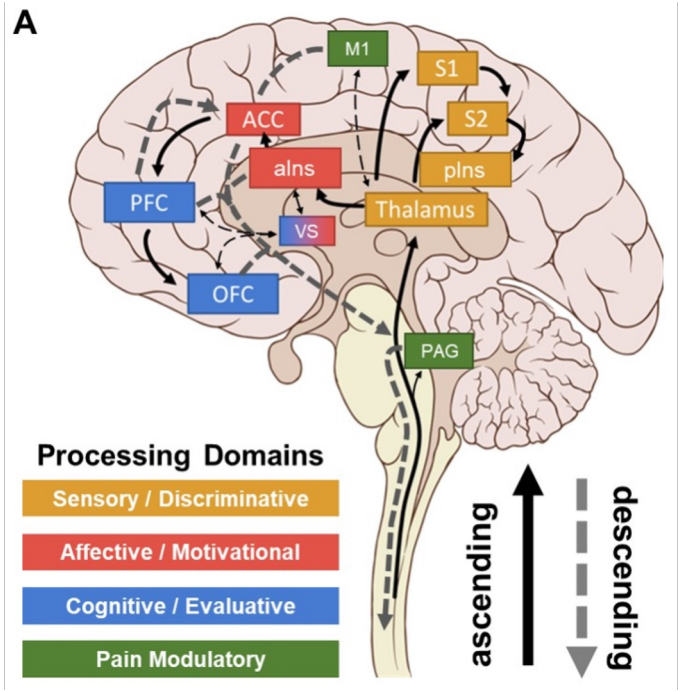


Rainville et al., Science 1997

Chronic Pain Has Multiple Dimensions distributed brain-wide



Inspired by Melzack and Wall (1965)



Motzkin J, Kanungo I, et. al., Frontiers in Pain Research, 2023

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Brain stimulation for pain over the years…

Stimulation of internal capsule for relief of chronic pain

JOHN E. ADAMS, M.S., YOSHIO HOSOBUCHI, M.D., AND HOWARD L. FIELDS, M.D.

Departments of Neurological Surgery and Neurology, University of California School of Medicine, San Francisco, California

Mazars et al. (*France*)

1960

1973

1974

1992, 1998

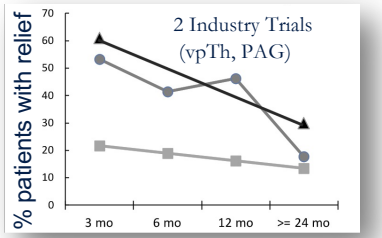
2014

2017

Chronic Thalamic Stimulation for the Control of Facial Anesthesia Dolorosa

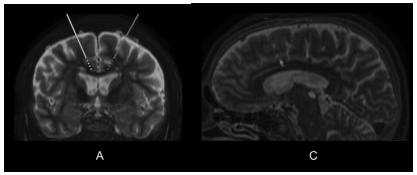
Yoshio Hosobuchi, MD; John E. Adams, MD; Burt Rutkin, MS,

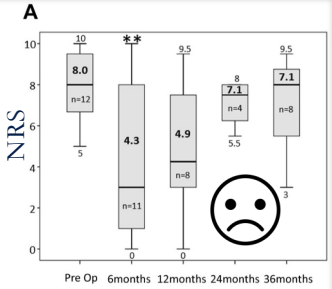
From the Department of Neurological Surgery, University of California, School of Medicine, San Francisco.



Coffey et al., 2011
Levy et al., 1986

ACC

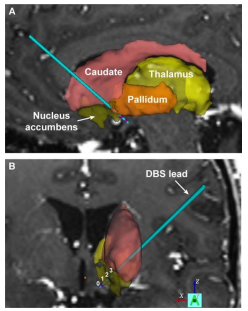




Boccard et al., 2014,2017

Randomized Clinical Trial of Deep Brain Stimulation for Poststroke Pain

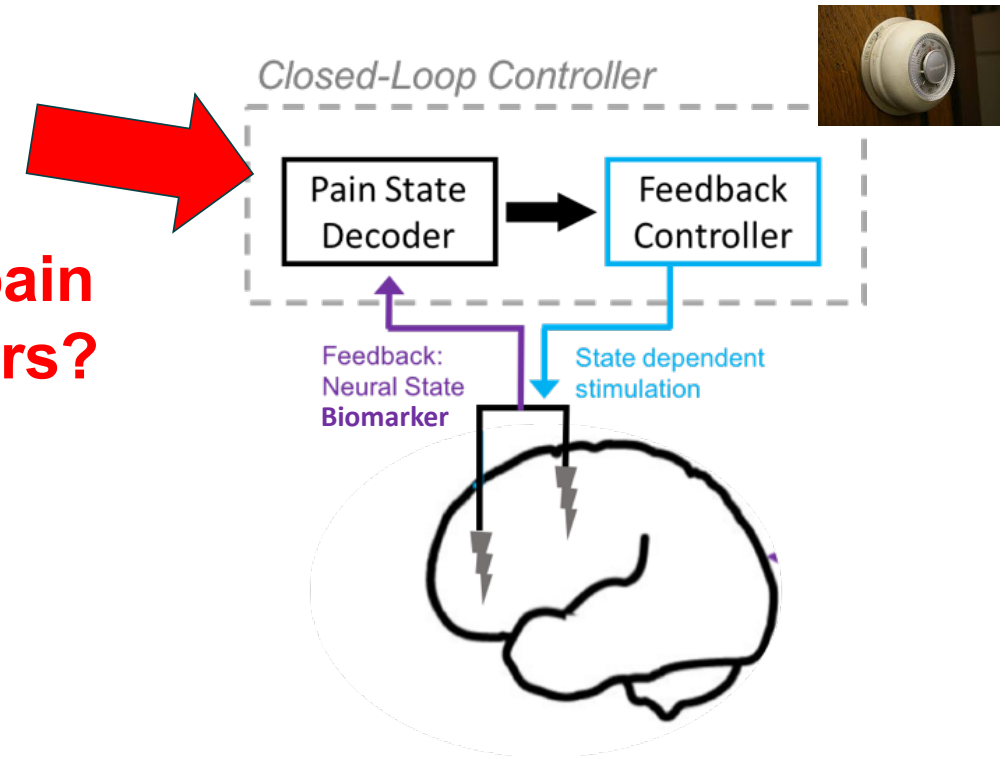
Good for depression
Bad for pain



Lempka et al., Ann. Neurol. 2017

Our Solution / Goal:

Can we identify chronic pain biomarkers?



nature neuroscience

Article

https://doi.org/10.1038/s41593-023-01338-z

First-in-human prediction of chronic pain state using intracranial neural biomarkers

Received: 13 April 2021

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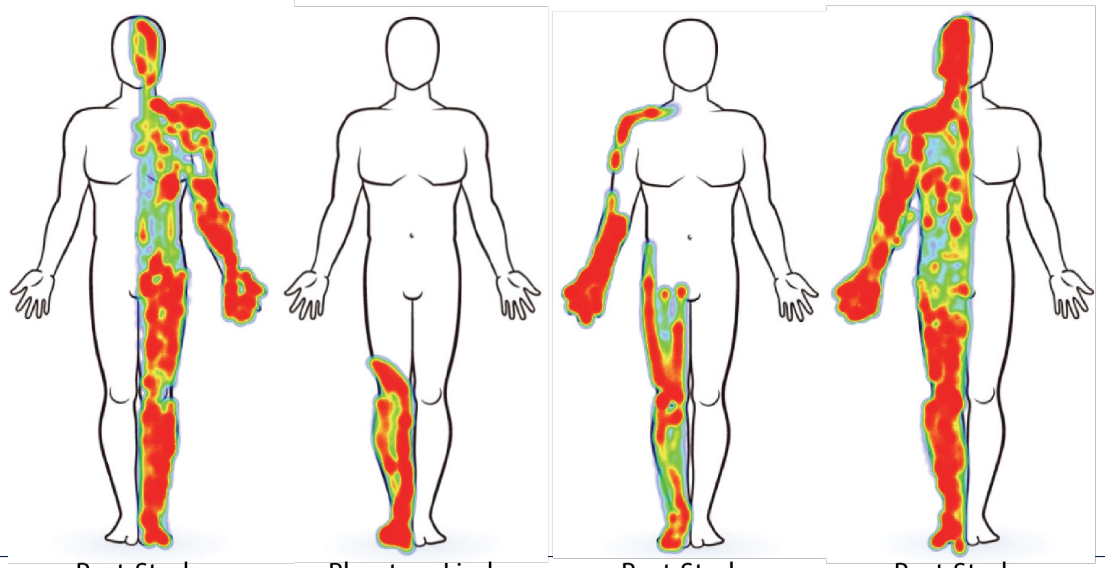
Prasad Shirvalkar[1,2,3,4] ✉, Jordan Prosky[3,4], Gregory Chin[3], Parima Ahmadipour[5], Omid G. Sani[5], Maansi Desai[6], Ashlyn Schmitgen[3,4], Heather Dawes[3,4], Maryam M. Shanechi[5], Philip A. Starr[3,4,7] & Edward F. Chang[3,4,7]



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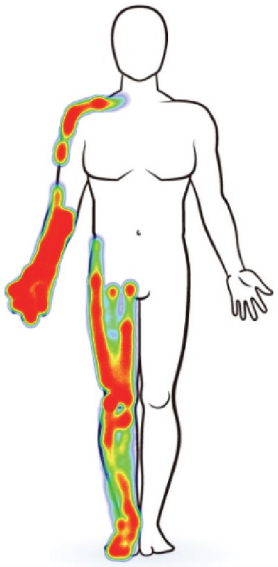
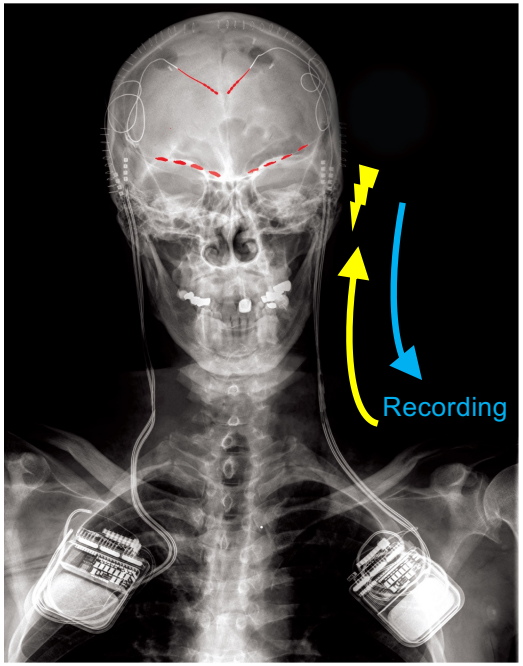
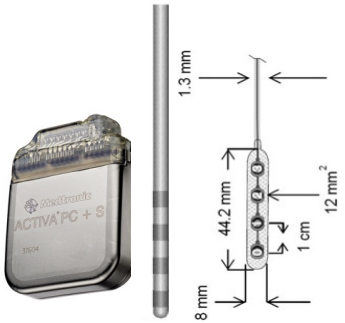
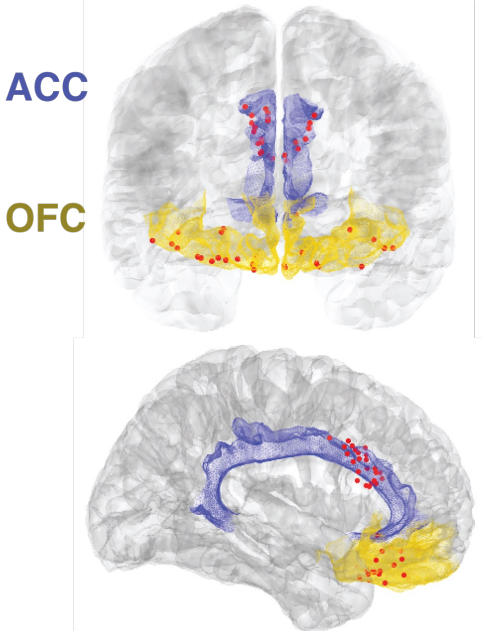
Electrode implants in the brain allow us to monitor and modulate brain signals at-home.



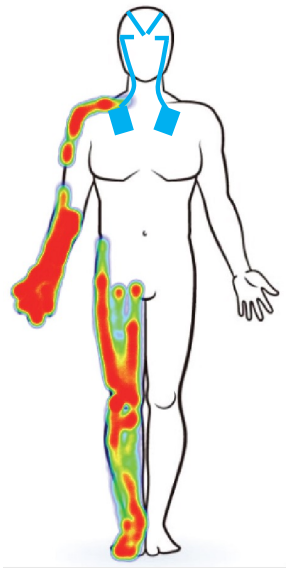
Post-Stroke Pain



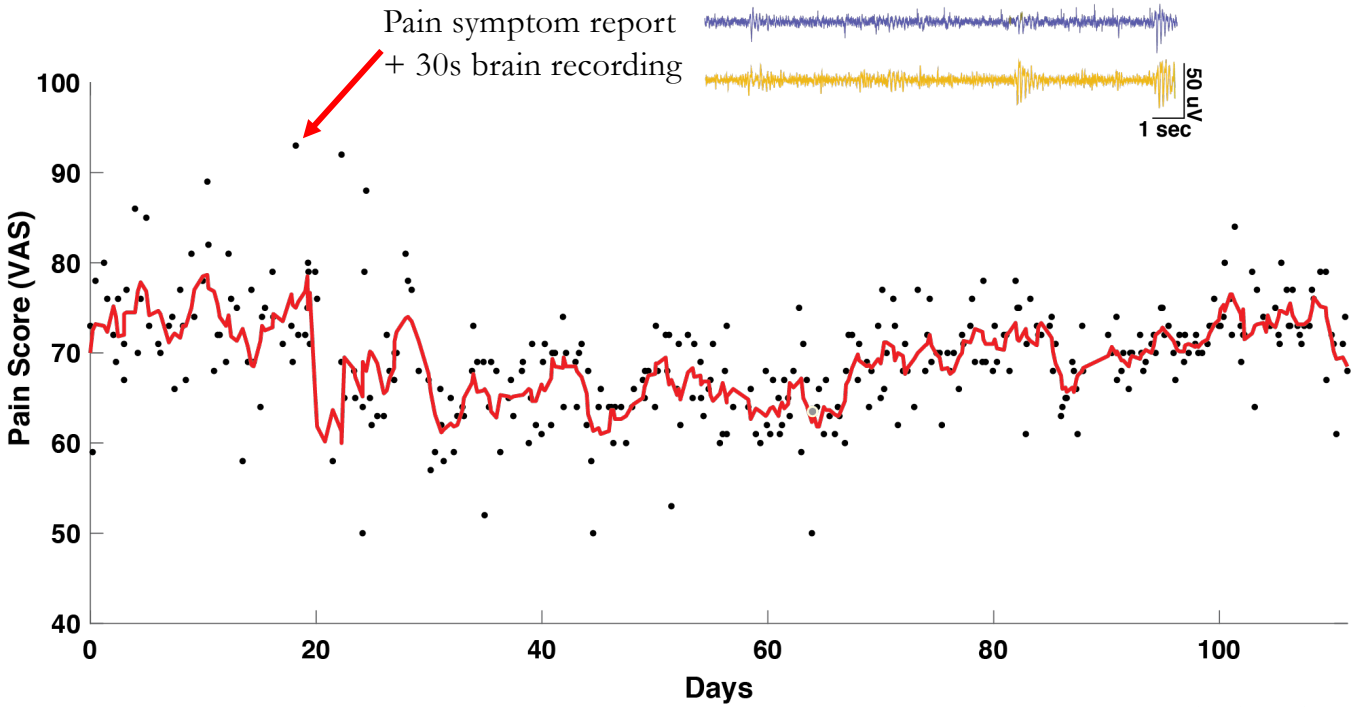




At-home measurements of real-world chronic pain symptoms and brain signals



Post-Stroke Pain



Shirvalkar et al.
2023 *Nat Neuro*

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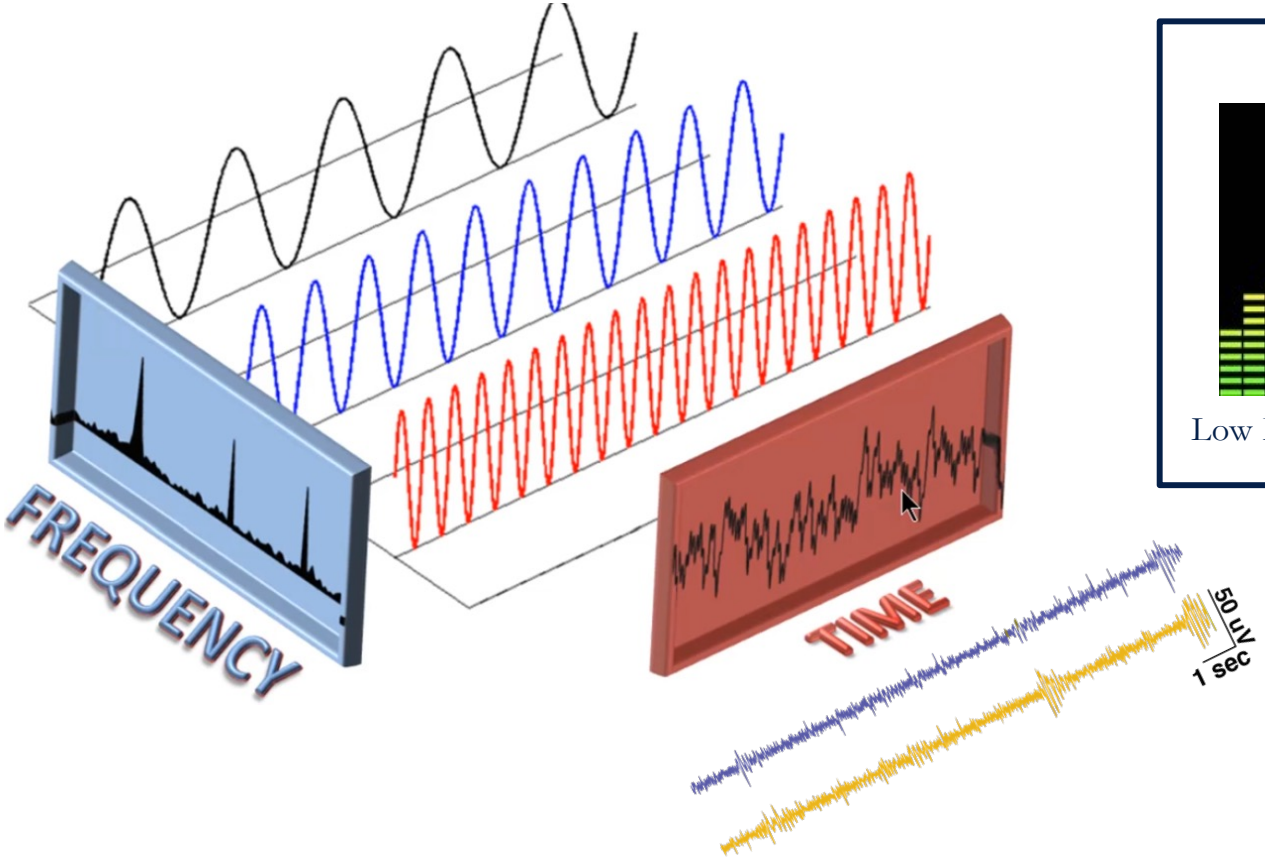
Analyzing Brain Signal Frequency Components



Like using a music equalizer

Low Freq. High Freq.

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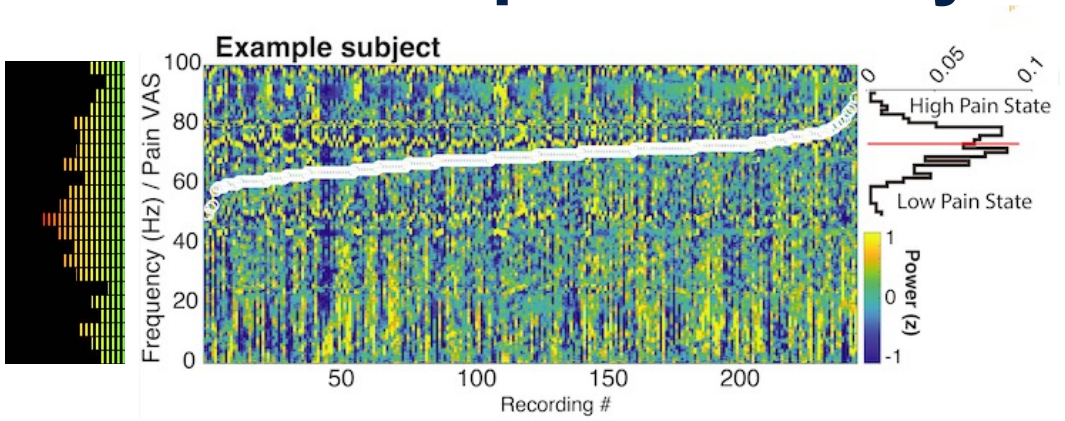
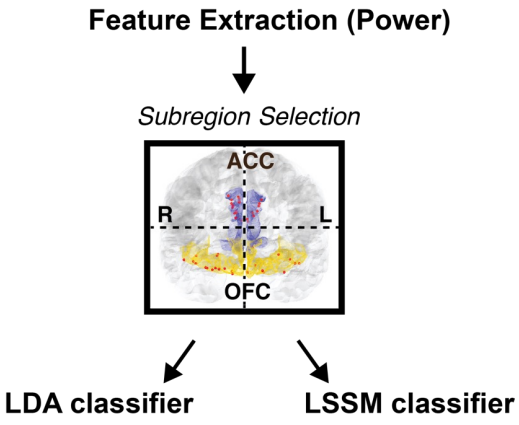
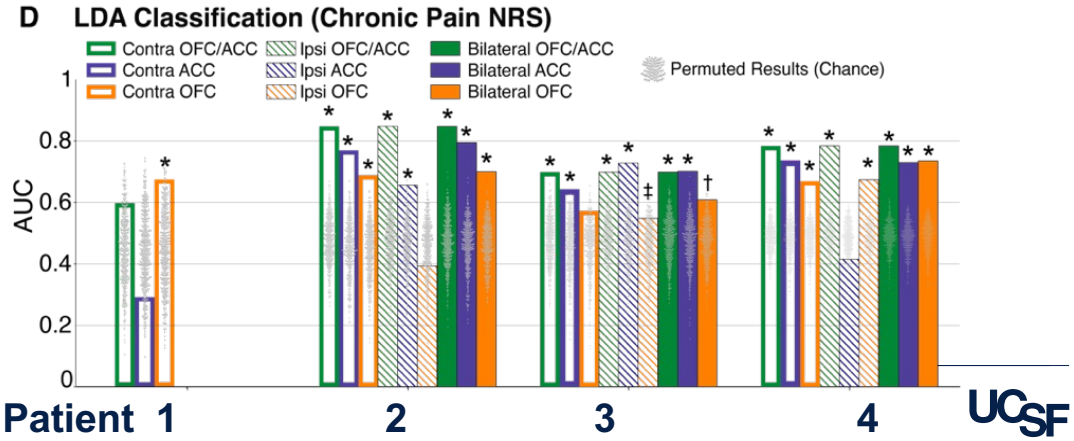
Direct brain signal measurements can track real-world pain severity







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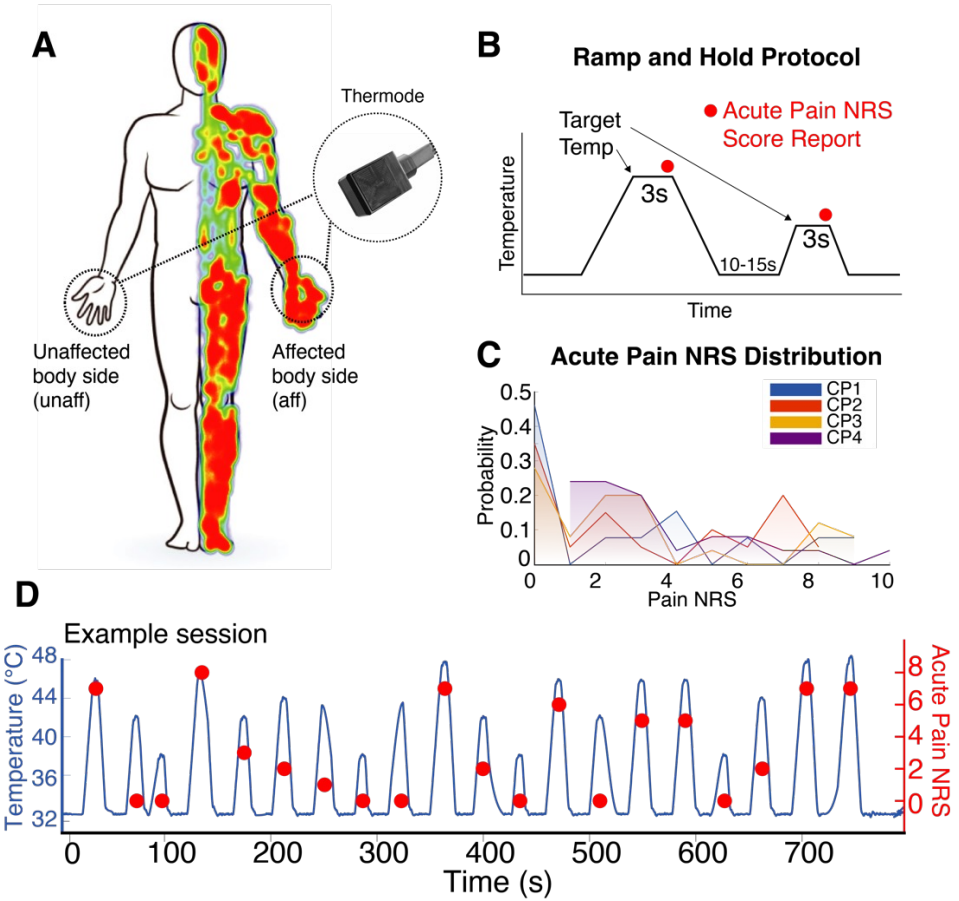
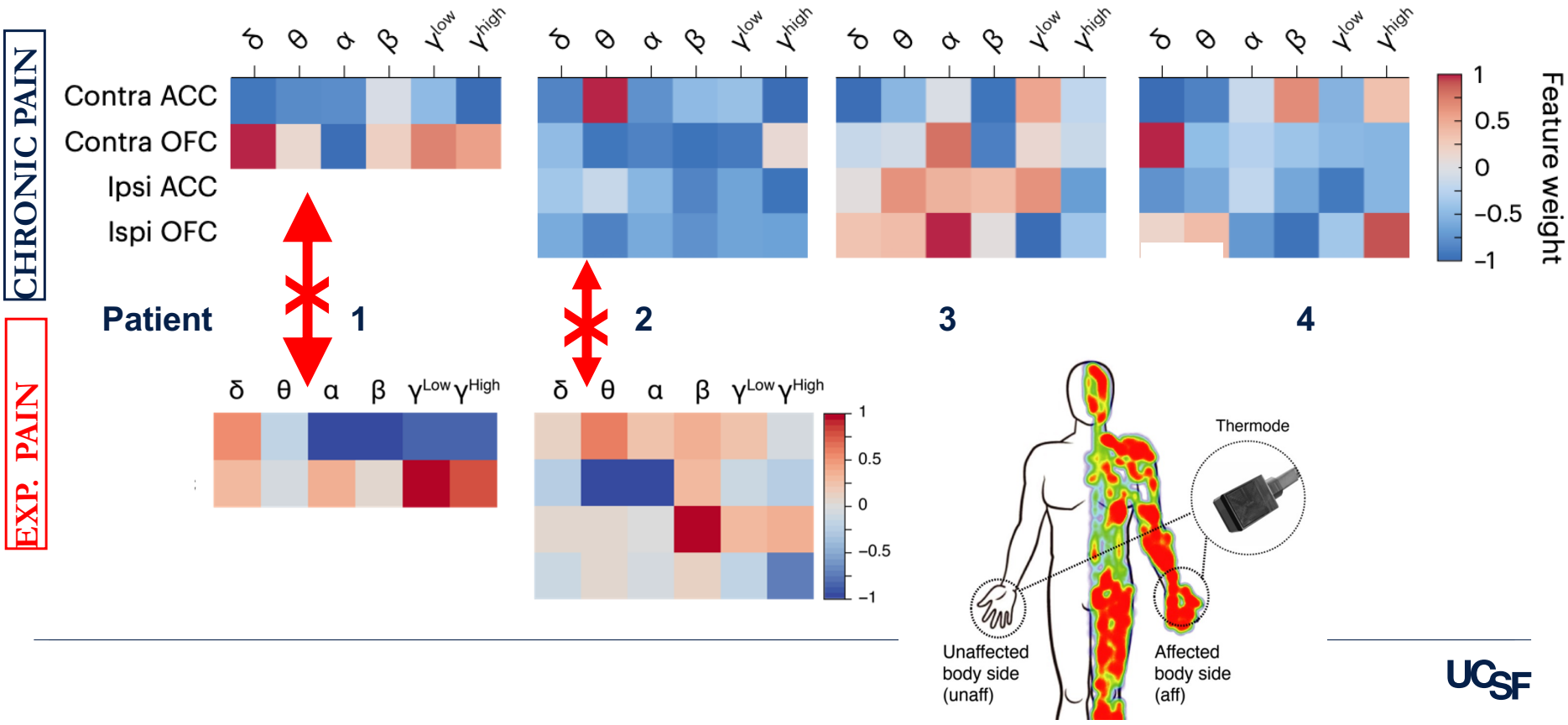
What about experimental pain?



Brain signatures of pain showed intra-individual variability. Chronic Pain ≠ Experimental Pain.



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Thank you!

Edward Chang, MD
Co-investigator

Philip Starr, MD, PhD
Co-investigator

Julian Motzkin,
MD, PhD

Chad Sitgraves, MS

Joanna Lin

- **Patients Living with Chronic Pain**

- Heather Dawes, PhD
- Howard Fields, MD, PhD
- Andrew Krystal, MD, PhD

- Niko Schiff, MD
- Vikram Rao, MD PhD
- Daniel Lu MD, PhD
- Cynthia Kubu, PhD
- Joshua Kuluva, MD

UF-Gainesville

- **Cora DeHemptinne, PhD**
- **Jackson Cagle, PhD**

USC

- Omid G. Sani, PhD
- Parima Ahmadipour
- Maryam M. Shanechi, PhD

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BRAIN INITIATIVE

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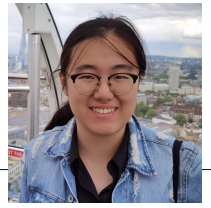
MD candidate

Jeremy Saal
PhD candidate

Ryan Leriche

Andreea Seritan, MD
Psychiatrist



Yiyuan Han, PhD

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