2015 Science Writers Symposium

Investigating the Early Detection of Traumatic Brain Injury

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Facts about Traumatic Brain Injury (TBI)

- Traumatic brain injury (TBI), a form of acquired brain injury, occurs when a sudden trauma causes damage to the brain.

  http://www.ninds.nih.gov/disorders/tbi/tbi.htm

- Each year in the United States, there are more than 1.5 million TBIs, resulting in 50,000 deaths.

  Corrigan, J.D. et al. 2010 J. Head Trauma Rehabil.

Diagnosis of TBI

How is TBI diagnosed?

Clinical Exam and CT Scan

Why is early diagnosis important?

To prevent repetitive injury

To develop new therapeutics

Advance the development of neurodiagnostic medical devices for head injury

What diagnostic methods are under investigation?

Imaging

Biofluid

EEG (Electroencephalography)

Advantages of EEG as a Biomarker

Noninvasive

Inexpensive

Fast

Portable

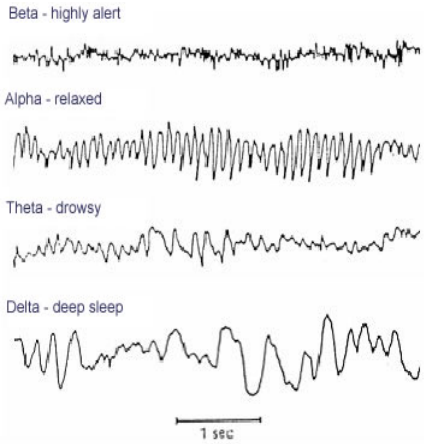
Field-deployable

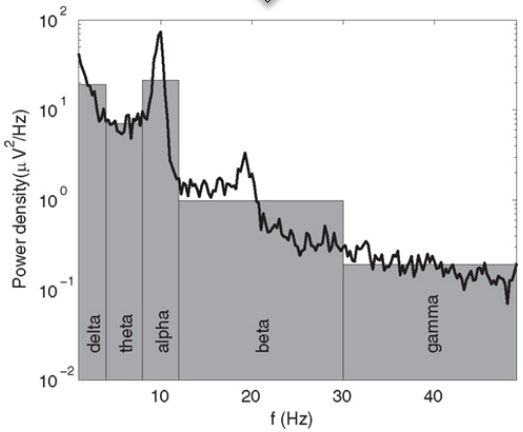
Research goal: To investigate the use of EEG to detect brain injury in a small animal model.

EEG

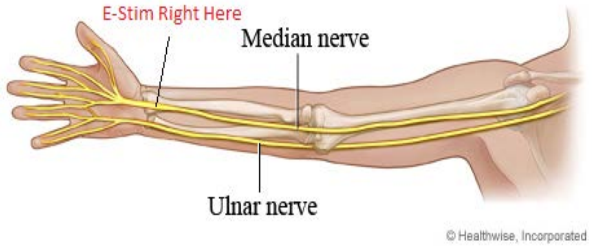
Recording of neural electrical activity along the scalp

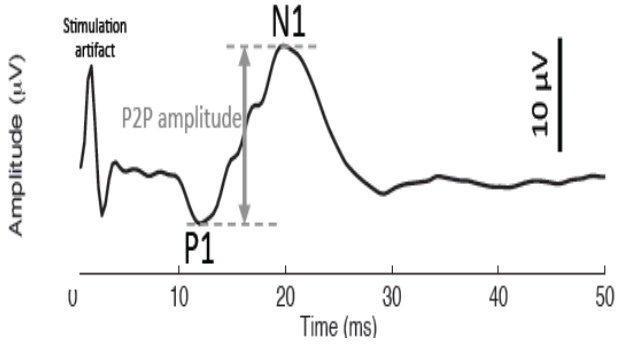
Resting State



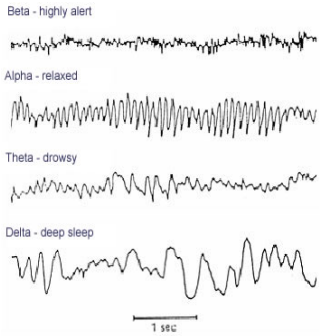


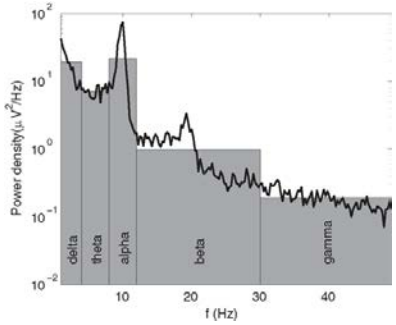
Sensory Evoked Potential (SEP)

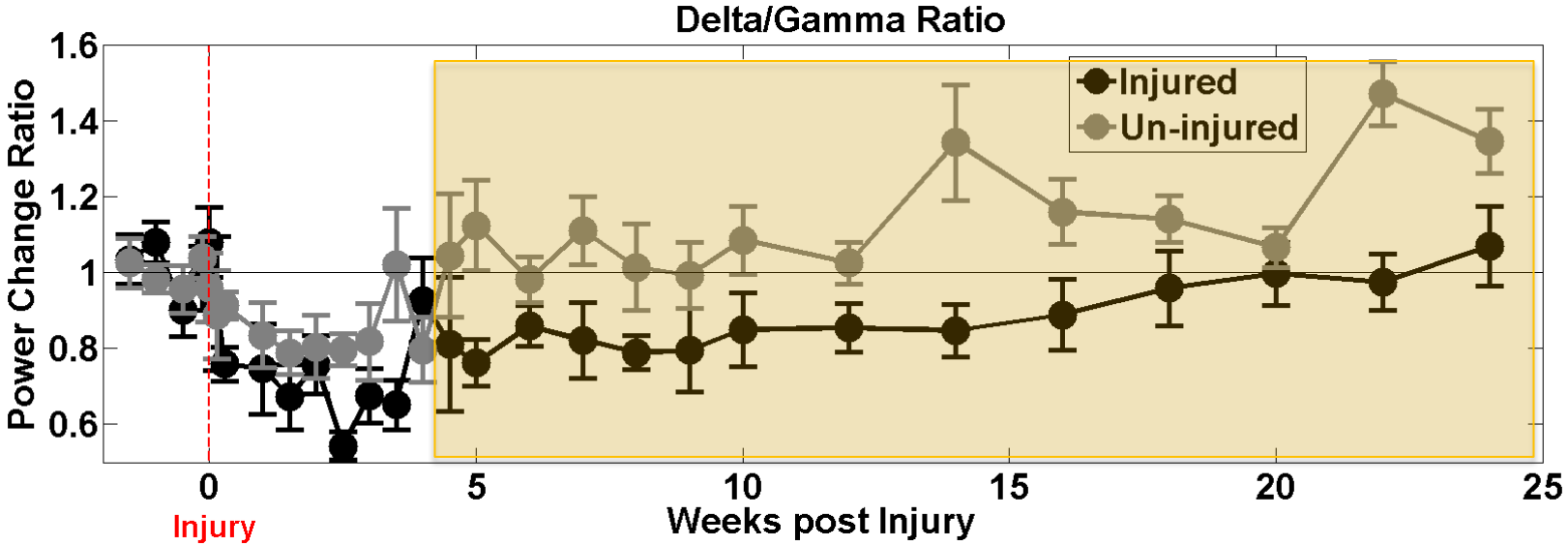




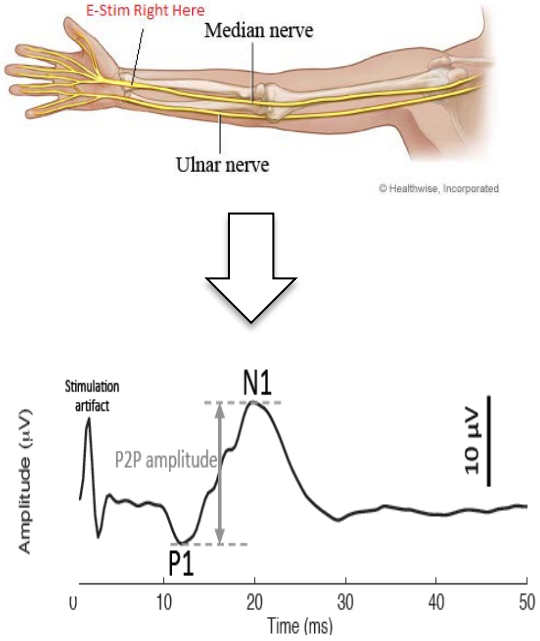
EEG: Resting State

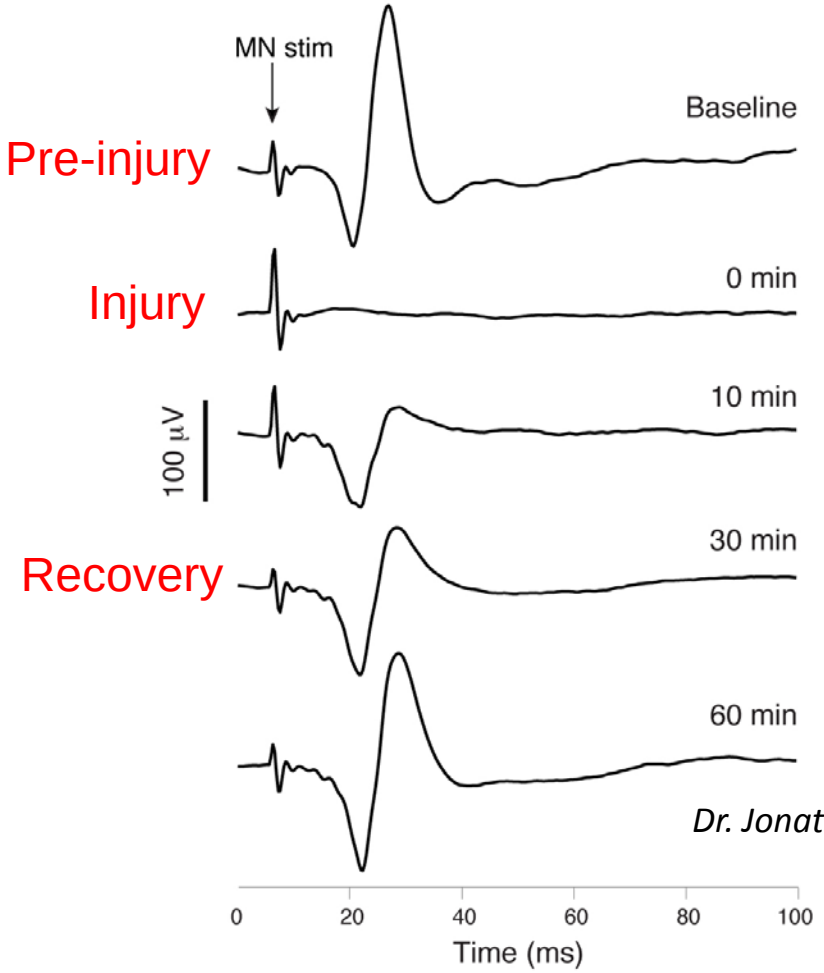






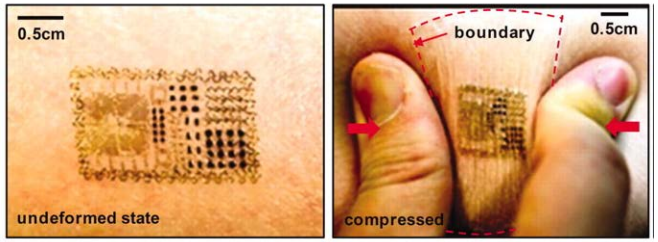
EEG: Sensory Evoked Potential (SEP) Through Median Nerve Stimulation



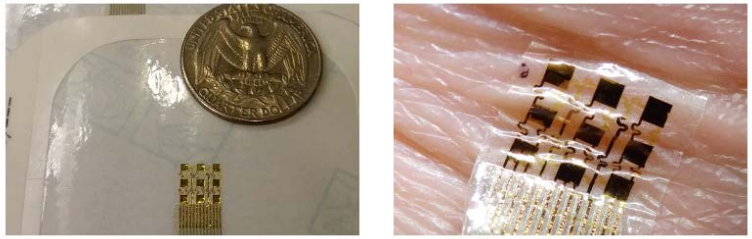


Dr. Jonathan Fisher

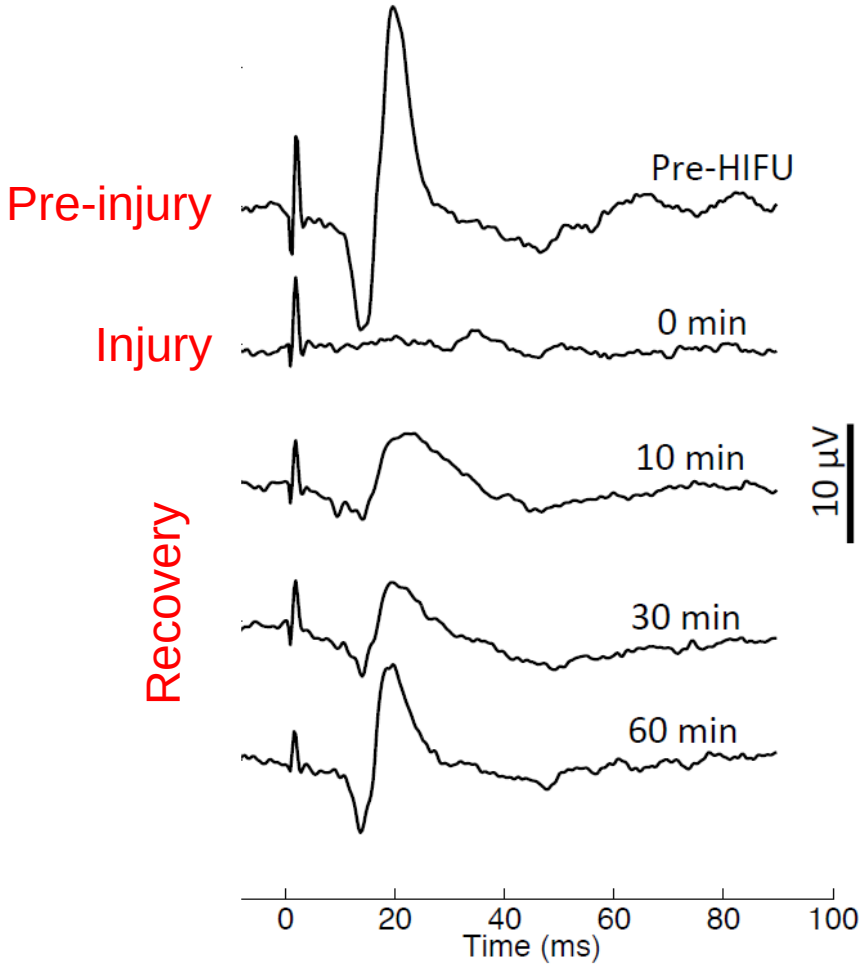
Novel Flexible Epidermal EEG Electrodes



Dae-Hyeong Kim et al. Science 2011



Dr. Stanley Huang, in collaboration with Dr. Todd Coleman in UCSD



Take-Home Messages

- EEG can detect brain injury: short-term SEP reduction and long-term delta/gamma ratio reduction.
- Novel flexible epidermal electrodes have the sensitivity to detect SEP changes after brain injury.
- Regulatory science at CDRH can contribute to the TBI scientific community and efforts to develop diagnostic devices for TBI.

Next Steps

- Use SEP and resting state EEG to detect *impact* brain injury in a small animal model.

- Start clinical investigations in military service members with brain injury in 2016; in collaboration with Walter Reed National Military Medical Center and Uniformed Services University of the Health Sciences.

- Refine epidermal electrode design, in collaboration with University of California, San Diego.

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