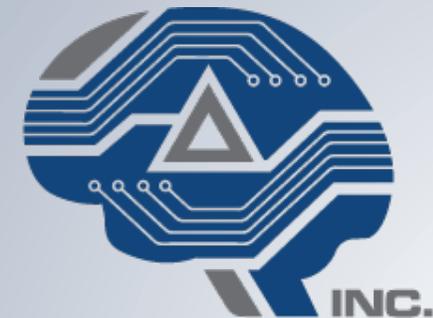


Neural Engineering

Healing the Brain Through Electromagnetic Stimulation

Adam C. Lichtl, Founder
Delta Brain Inc.

RIKEN Lunch Seminar
November 5, 2015



DELTA BRAIN

The Seat of Reason

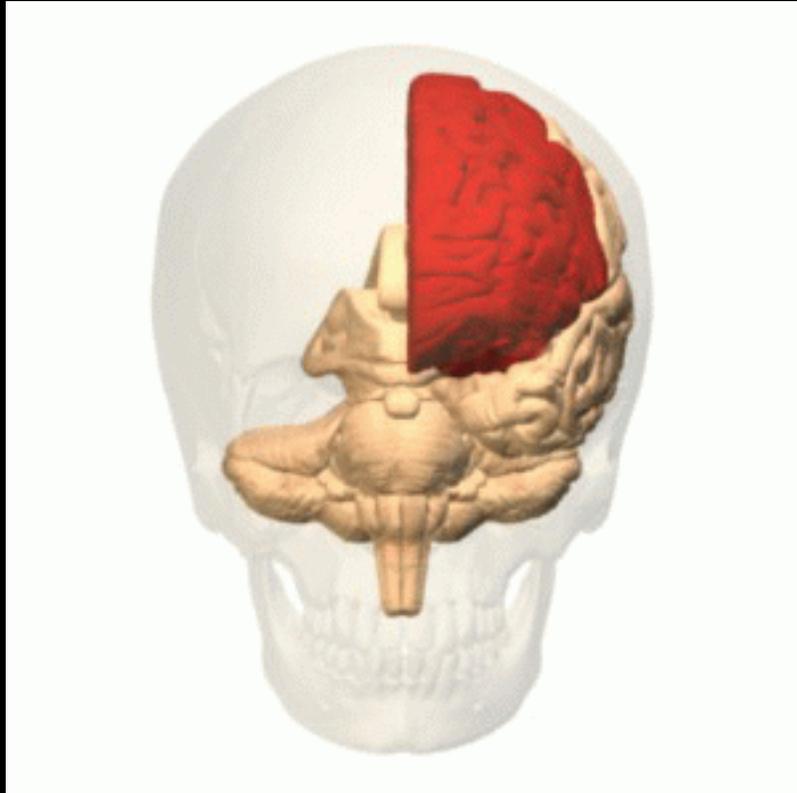


Image credit: Life Science Databases.



Phineas Gage, c. 1849

Image credit: Jack and Beverly Wilgus



Image credit:
John M. Harlow, MD

130 Years of Neuroscience on One Slide

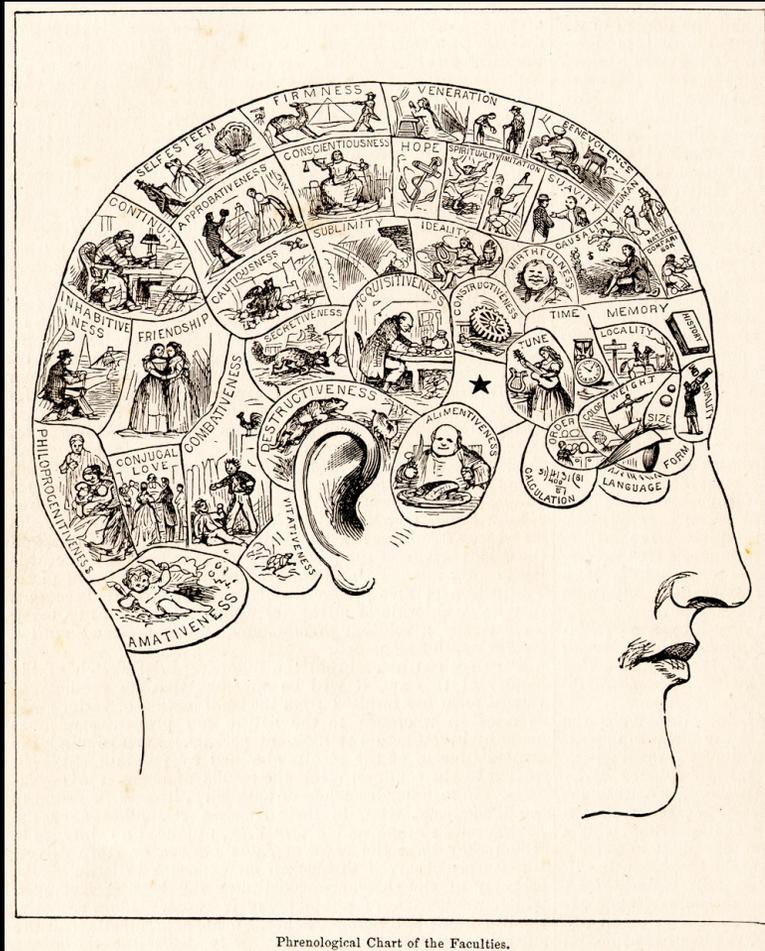


Image credit:

People's Cyclopedia of Universal Knowledge
(1883)

Functional Areas of the Brain¹

Motor Area
• control of voluntary muscles

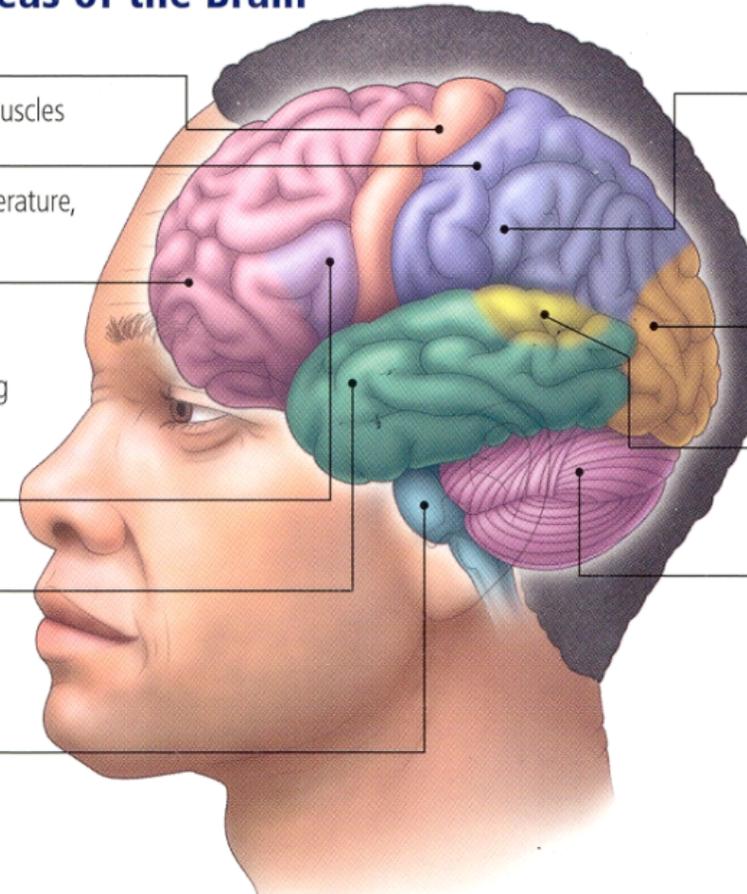
Sensory Area
• skin sensations (temperature, pressure, pain)

Frontal Lobe
• movement
• problem solving
• concentrating, thinking
• behaviour, personality, mood

Broca's Area
• speech control

Temporal Lobe
• hearing
• language
• memory

Brain Stem
• consciousness
• breathing
• heart rate



Parietal Lobe
• sensations
• language
• perception
• body awareness
• attention

Occipital Lobe
• vision
• perception

Wernicke's Area
• language comprehension

Cerebellum
• posture
• balance
• coordination of movement

Image credit: Dr. Avinash K.M.
(2013)

Illness as a Structural and Functional Issue

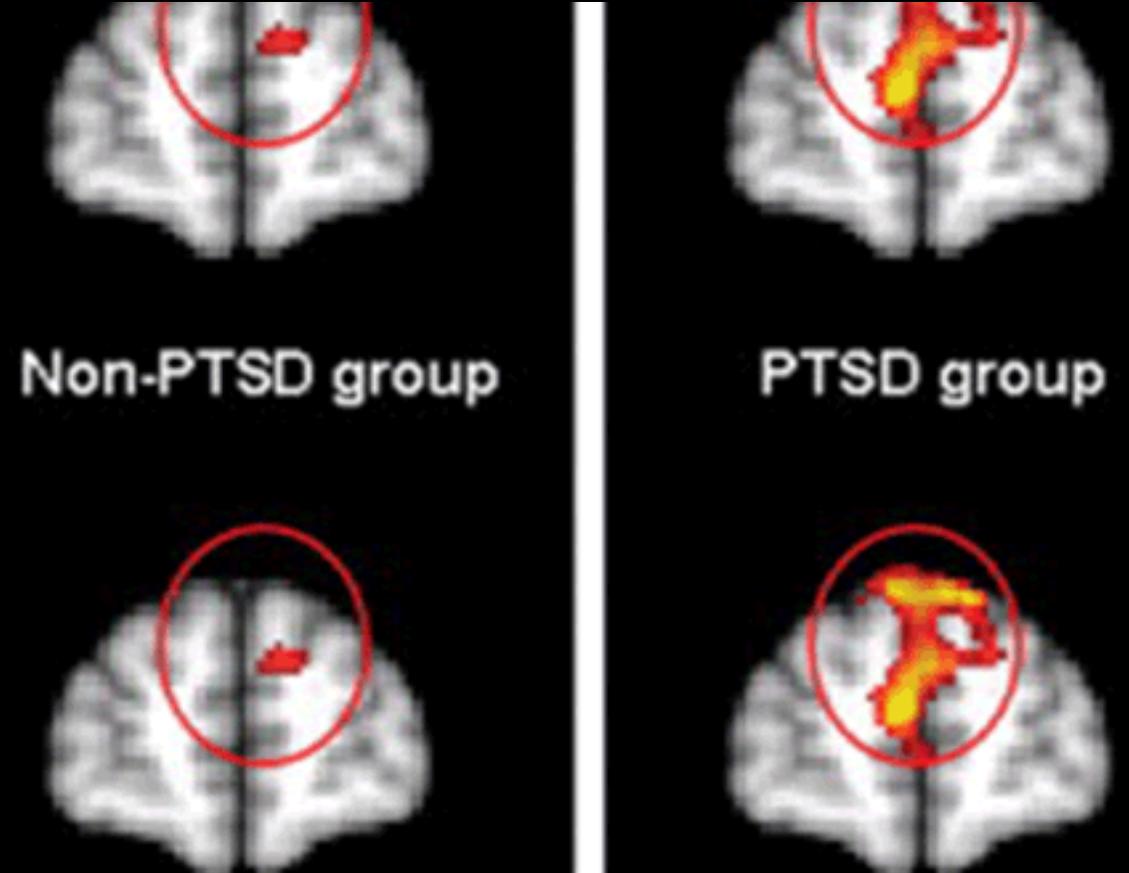
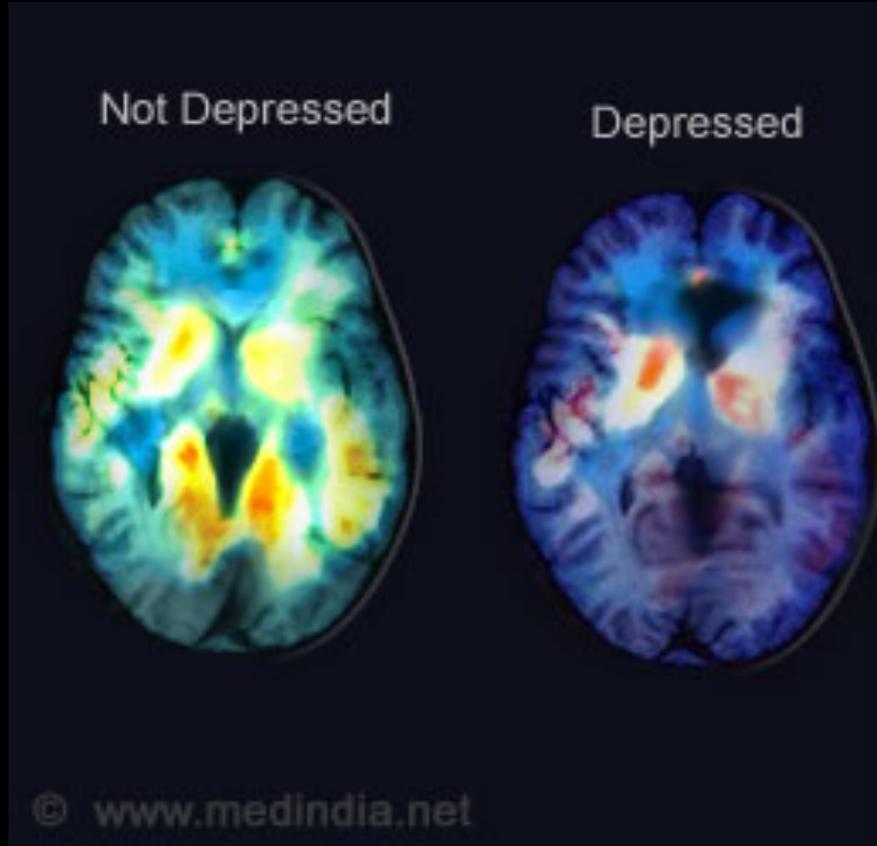
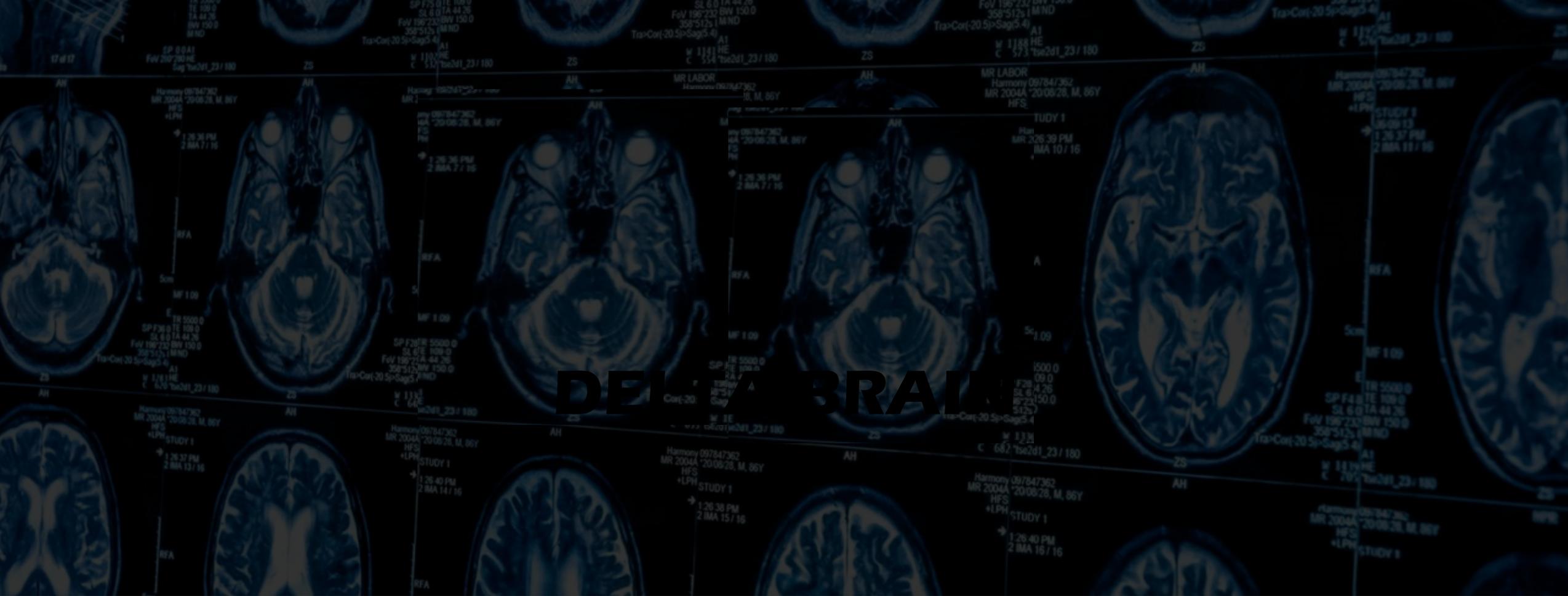
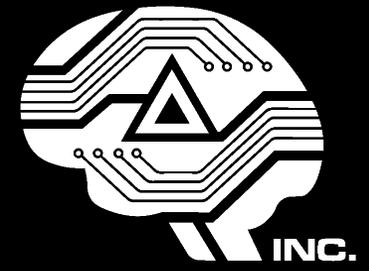


Image credit: Tony Dell



DEEP BRAIN

Clinical Depression



Clinical Depression: A Major Problem

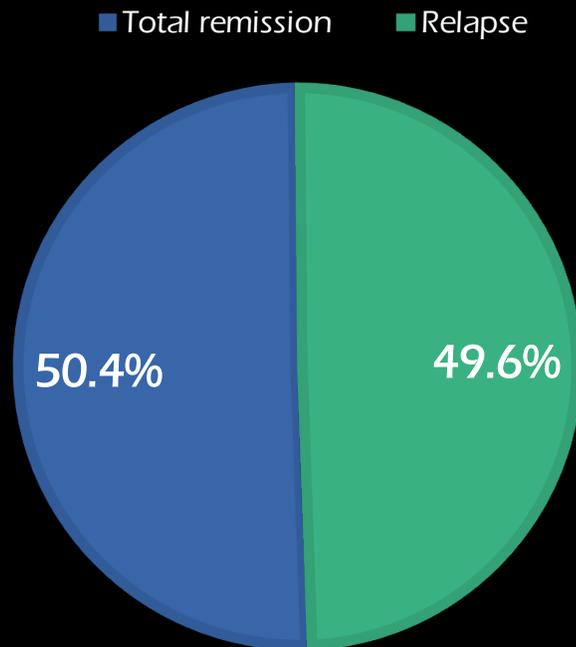


- Affects ~ 14.8 million American adults
 - This is about 6.7% of the 18+ US population (Archives of General Psychiatry 2005)
- People with depression are four times as likely to have a heart attack (NIMH 1998)
- Major depressive disorder is the leading cause of disability in the US for ages 15-44 (WHO 2004), and is the leading cause of disability worldwide for people over five years old (WHO 1996)
- For every two homicides in the US, there are three suicides, two of which are caused by depression. (CDC 1998 and White House Conference on Mental Health 1999)

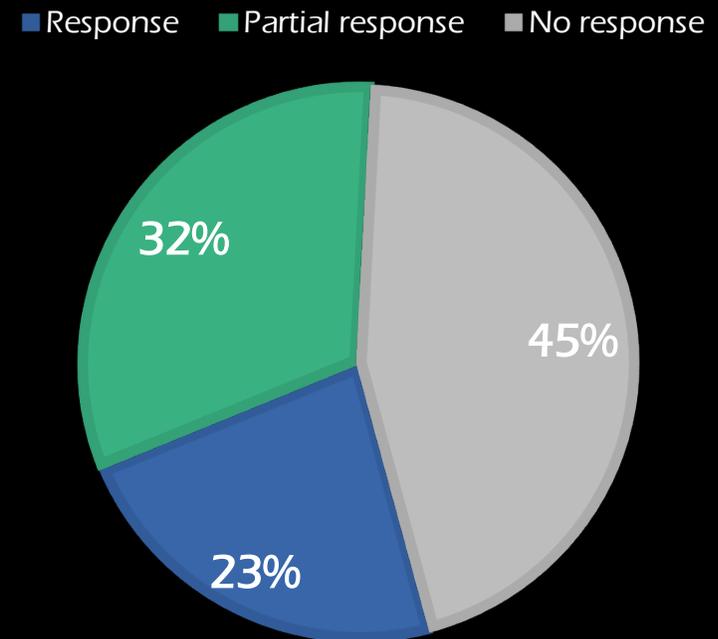
Pills Are Not Sufficient



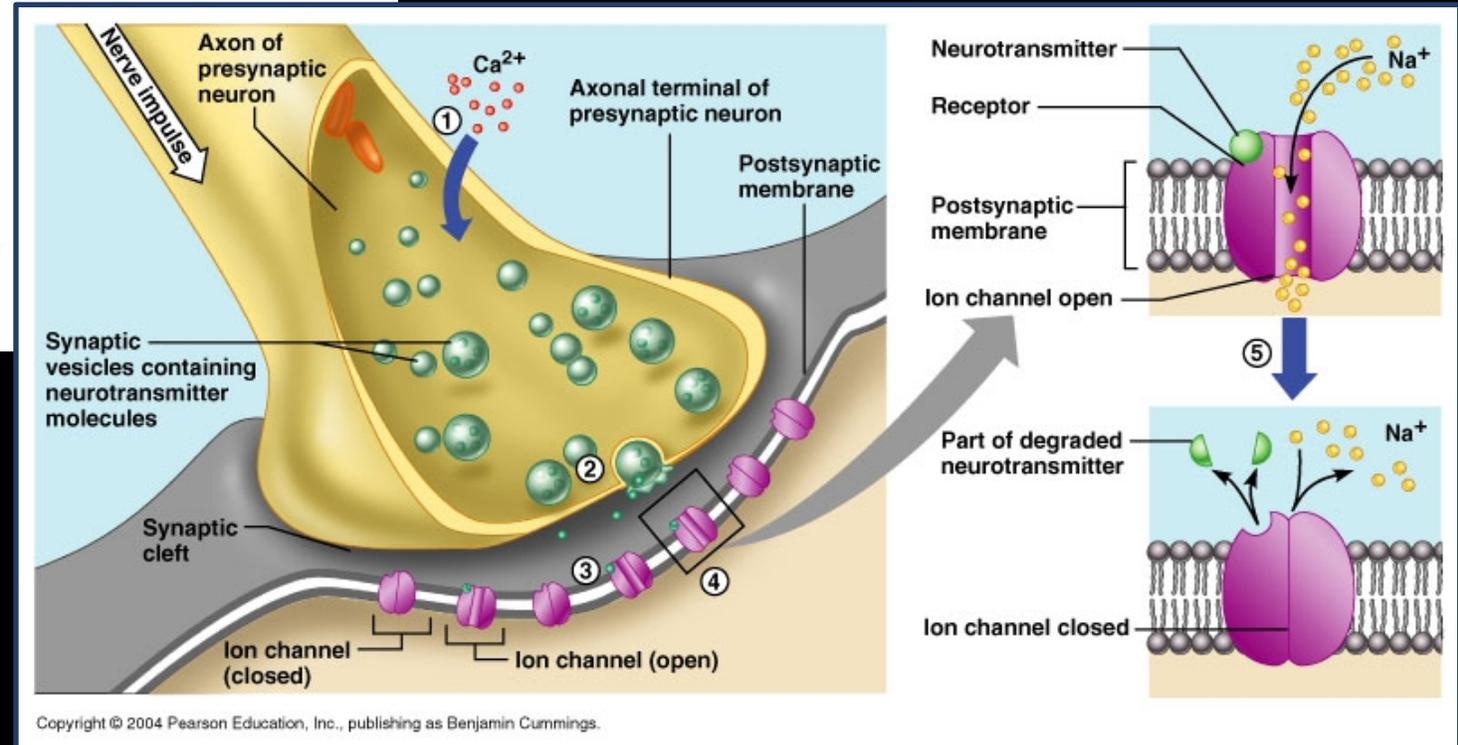
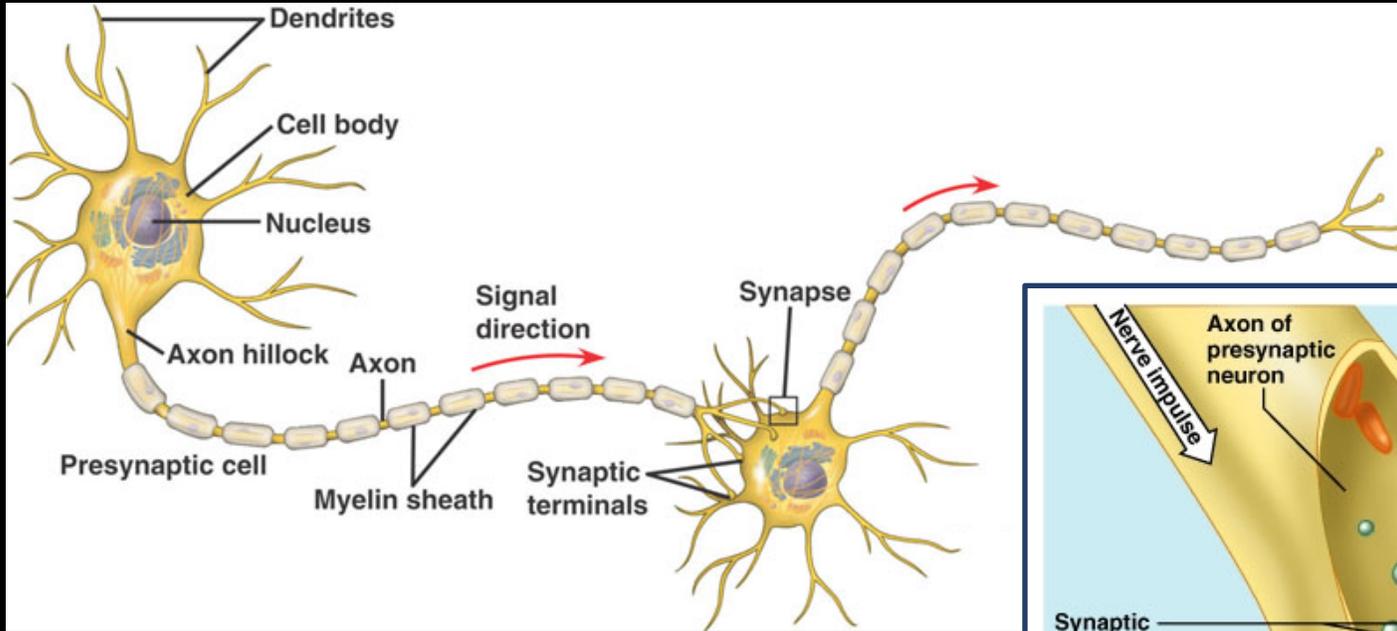
EFFICACY OF ANTIDEPRESSANT TREATMENT



RESPONSE TO ANTIDEPRESSANT TREATMENT BY PRIMARY-CARE PHYSICIAN



Neural Nuts and Bolts



Neurogenesis



- New neurons are created in the subventricular zone (SVZ)
- These neurons migrate via the rostral migratory stream (RMS) to their final location
 - In this example, the olfactory bulb
- One possible correlation with depression is a reduction in neurogenesis (Neural Plasticity Theory of Depression)

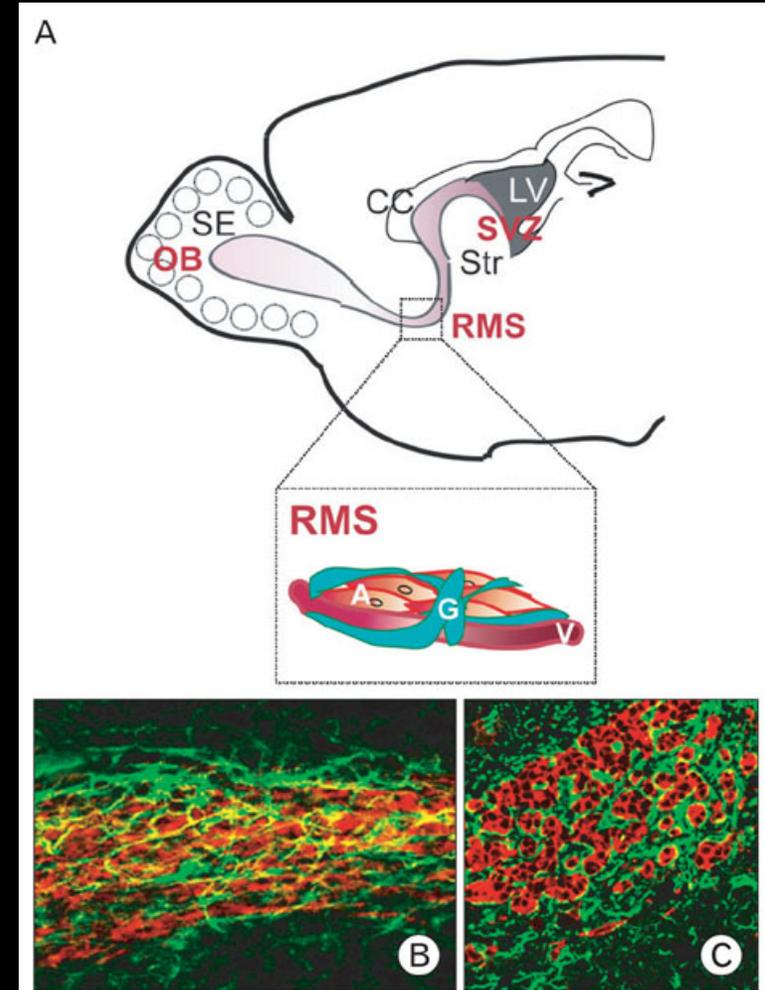
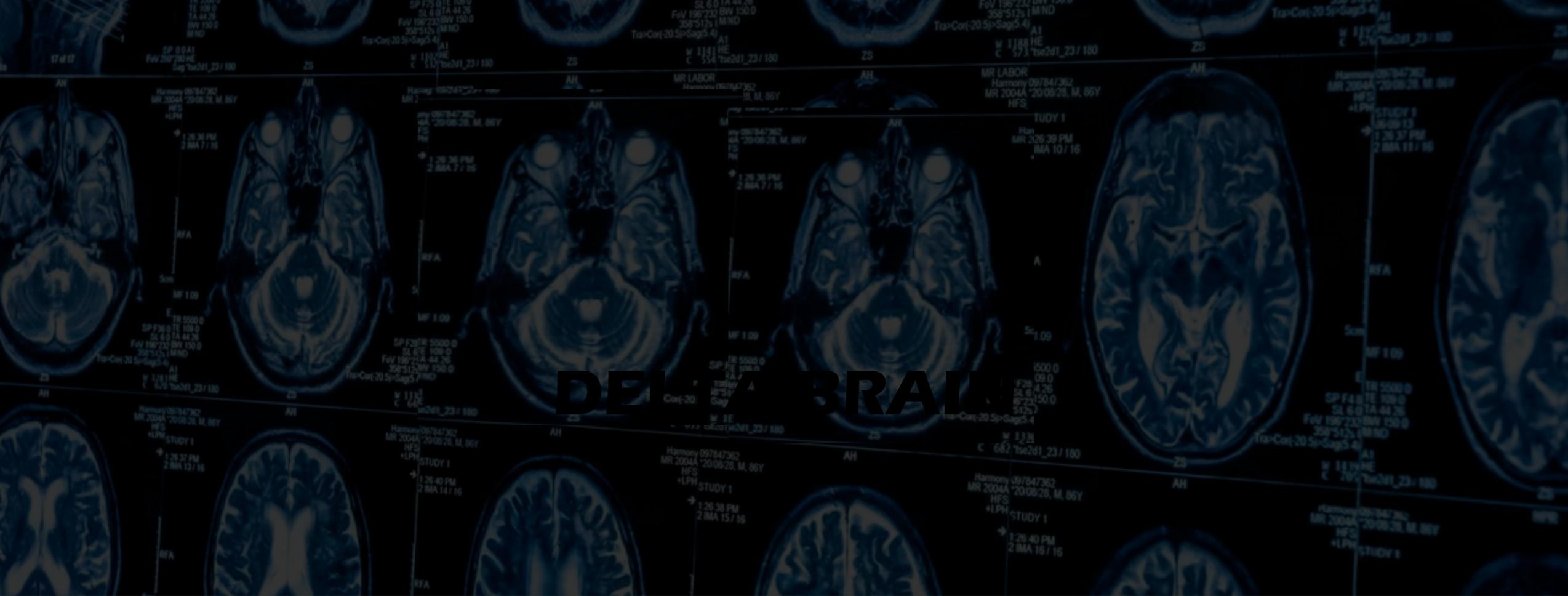
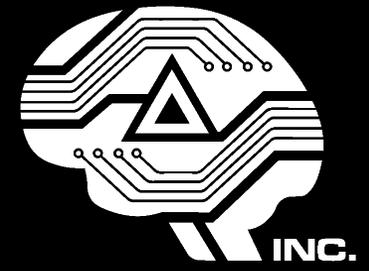


Image credit: Woong Sun et al



DELTA BRAIN

Electroconvulsive Therapy (ECT)



Electroconvulsive Therapy (ECT)

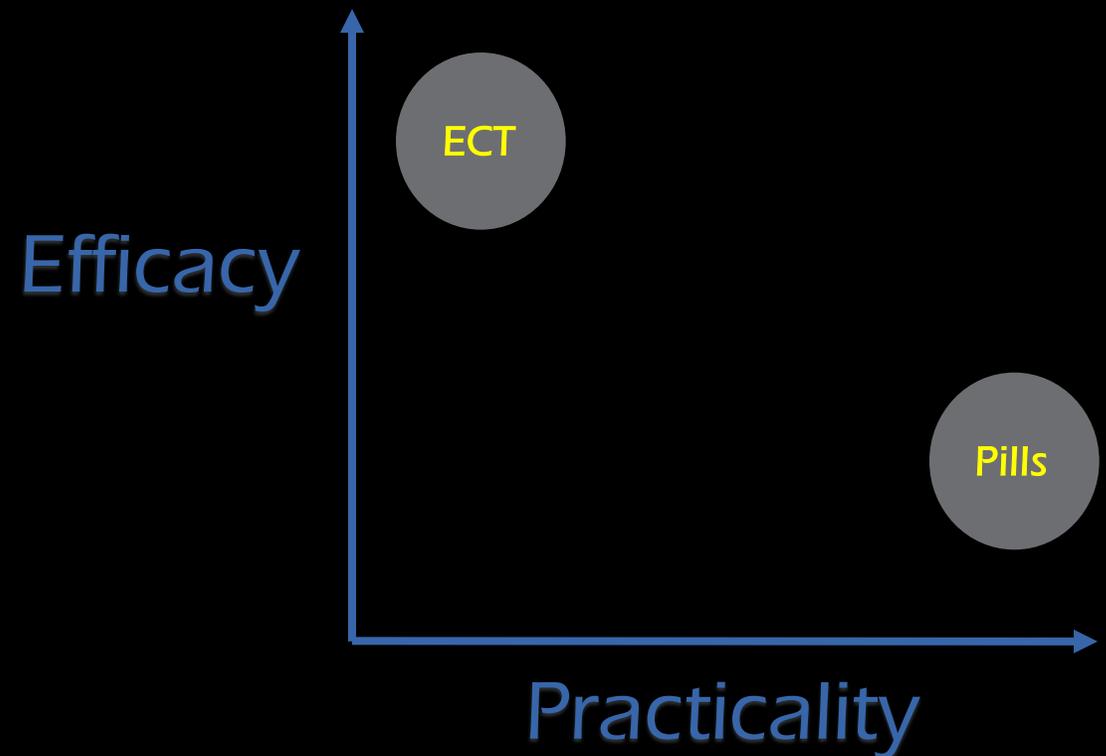


- The application of electric current to the brain to induce a seizure
- Used primarily for the treatment of severe depression (delusional or at risk for suicide)
 - Also used to treat mania in people with bipolar disorder, and sometimes in the treatment of catatonic schizophrenia
- About 100,000 people receive this treatment each year in the US
 - Treatment course is 6-12 sessions over 2-4 weeks
- Patients are given anesthesia before the treatment, and are are monitored by medical professionals
- The treatment may cause memory loss and learning impairments
- 85% of patients have a full recovery
- With the use of follow-up monthly maintenance treatments

Barriers to Widespread Use of ECT



- Expensive
- Negative perception
- Time-consuming
- Requires medical staffing at each session
 - Anesthesiologist
 - Physician
 - Recovery room

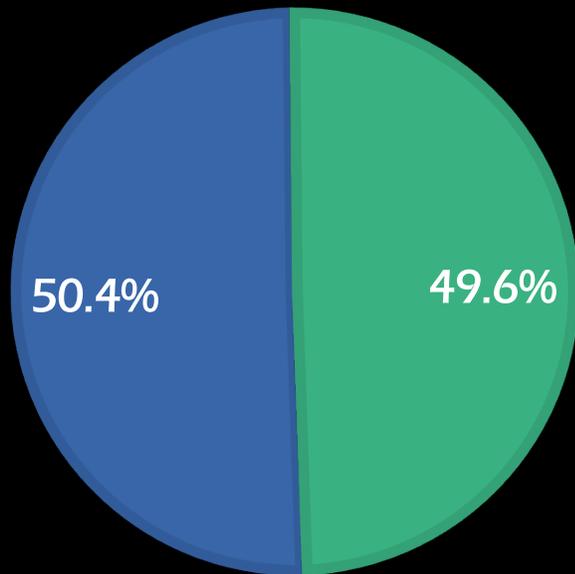


ECT Helps Treatment-Resistant Depression



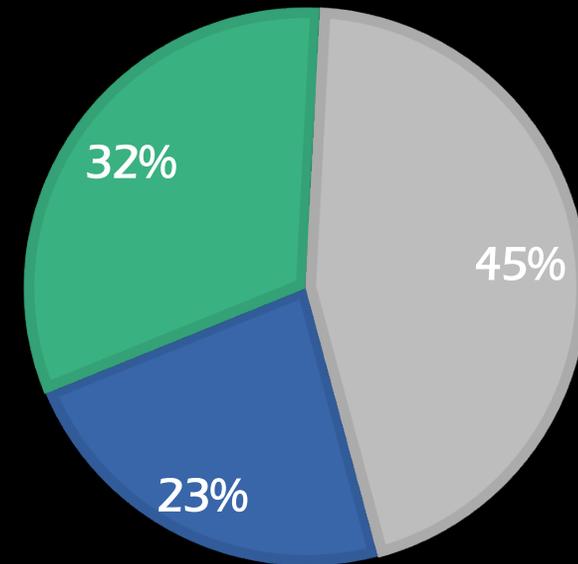
EFFICACY OF ANTIDEPRESSANT TREATMENT

■ Total remission ■ Relapse



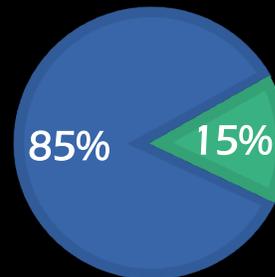
RESPONSE TO ANTIDEPRESSANT TREATMENT BY PRIMARY-CARE PHYSICIAN

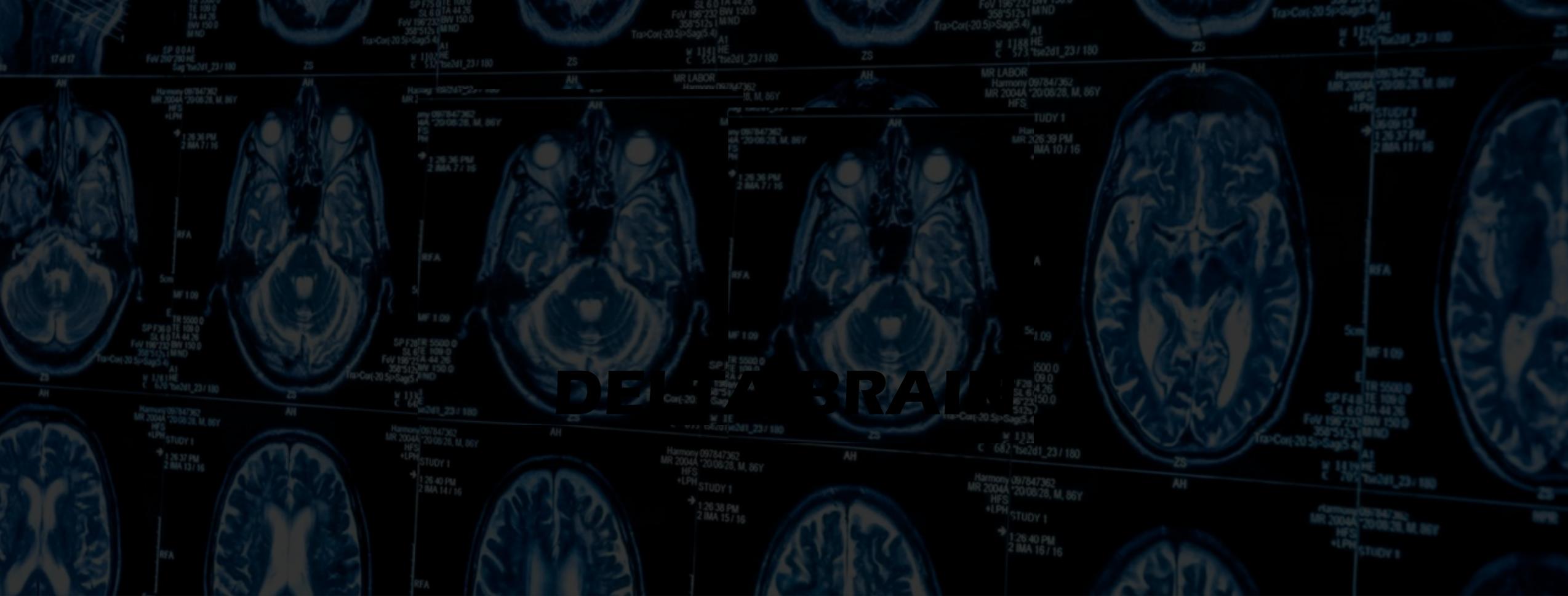
■ Response ■ Partial response ■ No response



ECT EFFICACY

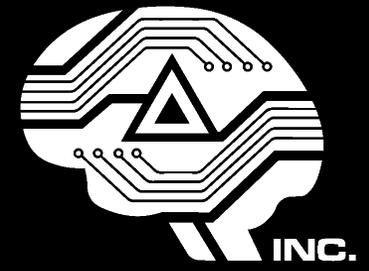
■ Total remission ■ Remission





DEEP BRAIN

Deep Brain Stimulation (DBS)



Deep Brain Stimulation (DBS)



Deep Brain Stimulation (DBS)



DBS EFFICACY

■ Significant improvement ■ Other

