

How Does TMS Work?



OHSU

A pulsing magnetic coil induces electrical current in the conductive tissue of the brain.

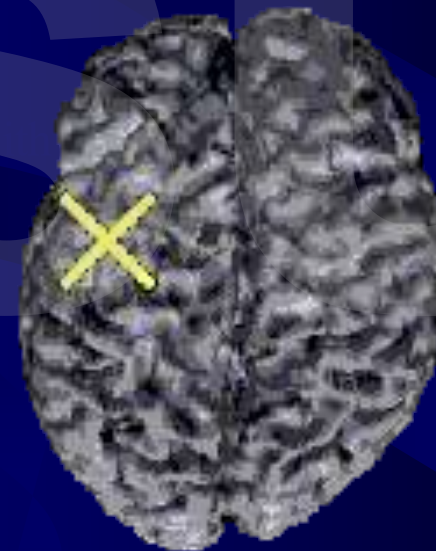
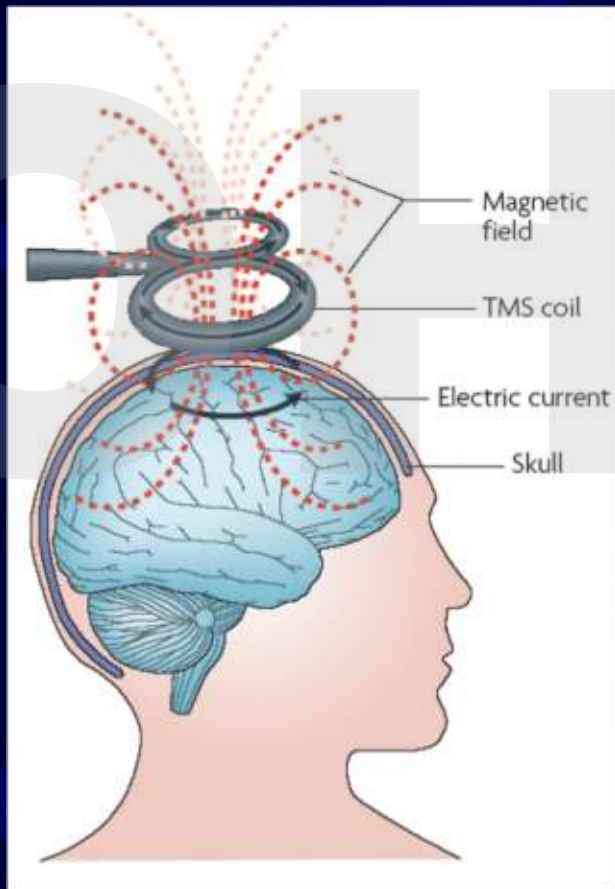
The magnetic field is similar to an MRI, but the induced magnetic field is much stronger.

Changing magnetic field induces electrical field in the brain.

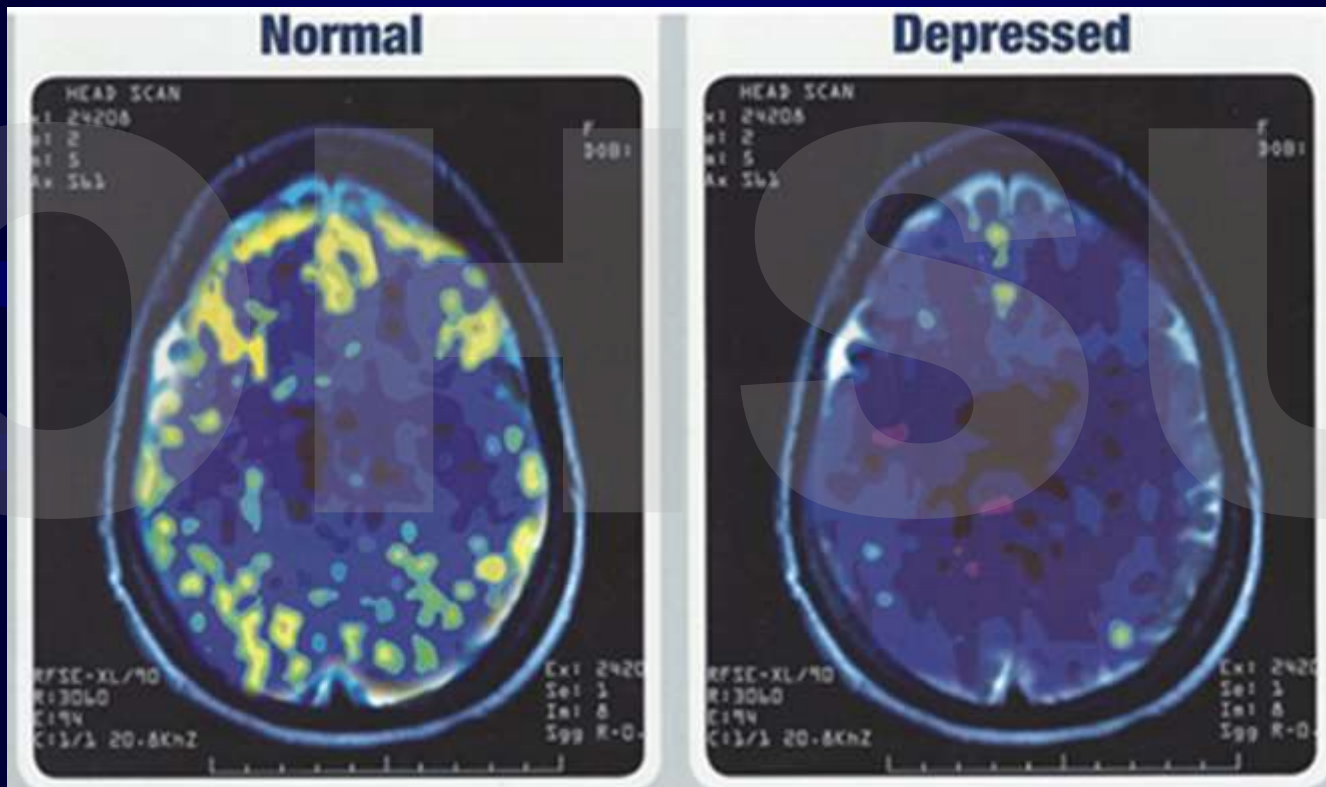
Electric field stimulates localized neurons in the brain.

Neuronal stimulation modulates neuronal²⁰ “firing”, resulting in behavioral effects.

The Physics of TMS



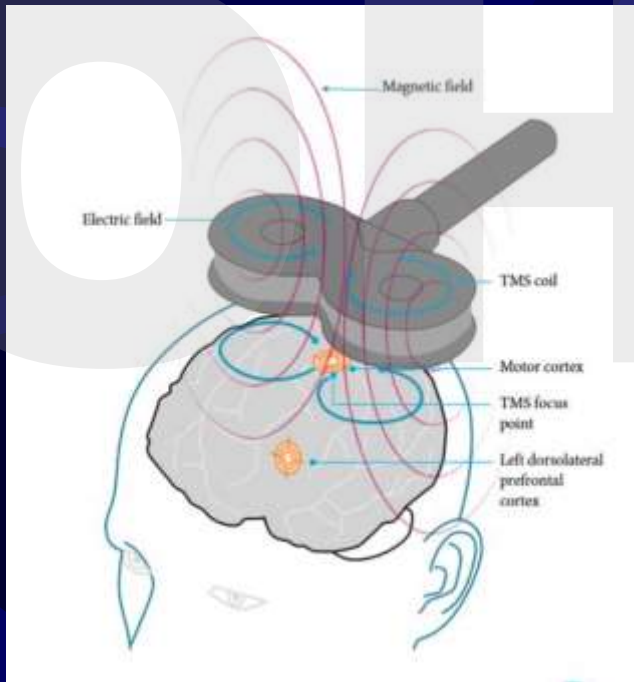
Depressed Brains Look Different



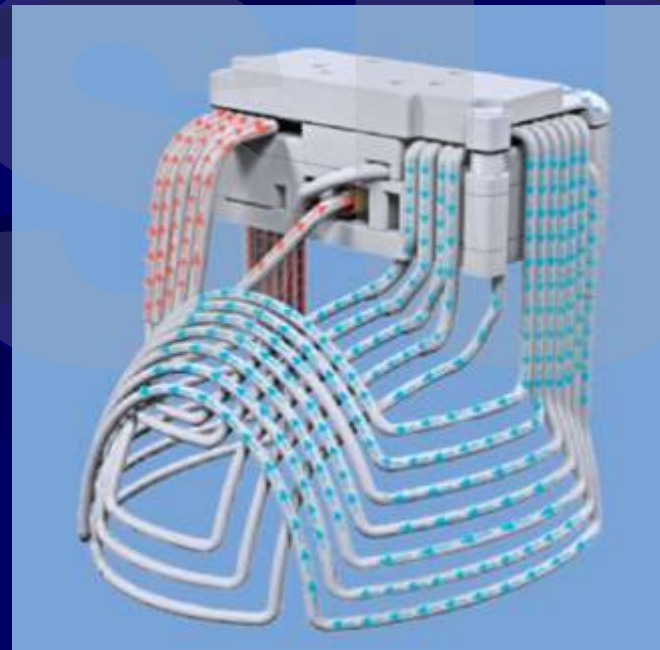
Mark S. George, MD. Fluorodeoxyglucose positron emission tomography (PET) images acquired at the National Institute of Mental Health (NIMH, Bethesda, MD), 1994.

Two Types of TMS Coils

**rTMS Figure 8 Coil
(Neurostar 2008)**



**dTMS H-1 Coil
(BrainsWay 2013)**



What is the Evidence for TMS in Depression?

O'Reardon et al Biological Psychiatry 2007

- 301 patients, unipolar depression, s/p med washout
- Randomized, double blind, sham controlled
- Significant differences in HAM-D for responders and remitters at 4 and 6 weeks.

2007

2015

Levkowitz, et al World Psychiatry 2015

- 212 patients, unipolar depression, s/p med washout
- Randomized, double blind, sham controlled
- Response rates 37% vs. 27.8% ($p < .03$)
- Remission rates 30.4% vs. 15.8% ($p < .016$)

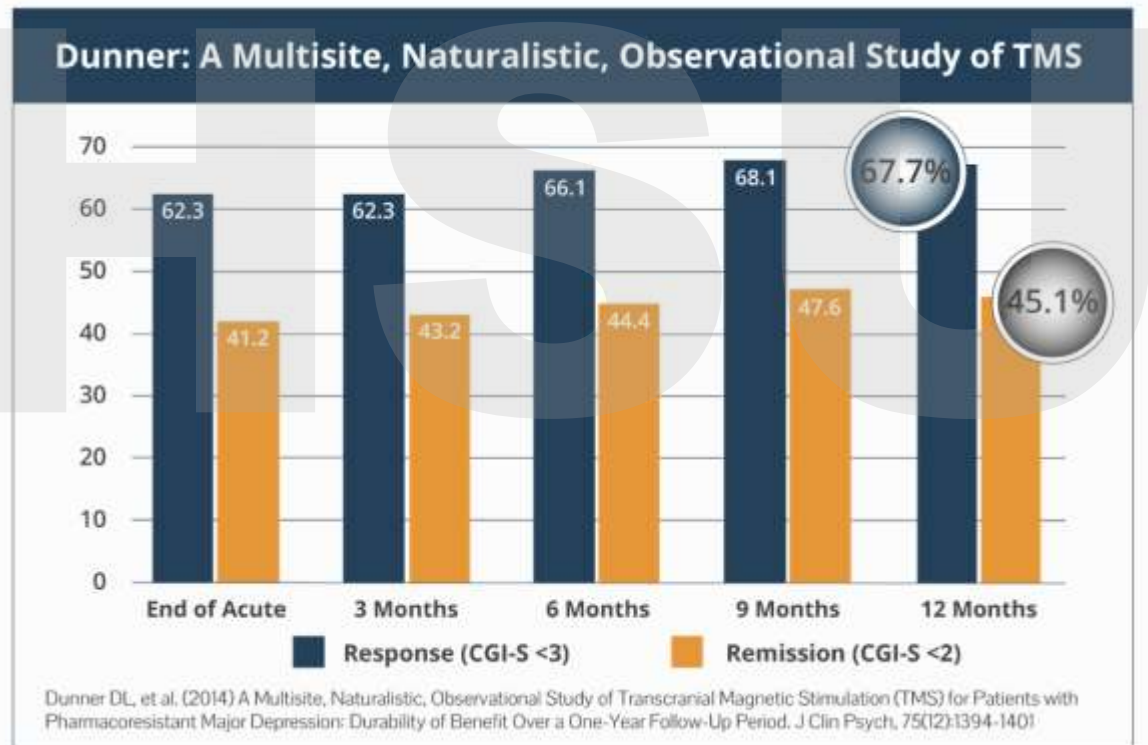
What is the Evidence for TMS in Depression?

Dunner, et al 2014:

67.7% of acute remitters sustained response at one year.

- Responders tended to maintain their gains over the year.

2014



Side Effects of TMS



RARE

- Seizure: less than 1 in 30,000 treatment sessions (<.003%), less than 6 in 5,000 patient exposures (<0.12%).
- Risk of hearing damage (earplugs are used which minimizes risk)
- Syncope (initial session)
- Less than 5% of patients in TMS trials discontinue b/c of side effects.

LESS RARE

- Scalp discomfort → usually responds to reassurance and a slower titration.
- Headache—Usually limited to a few minutes after session. Can pre-treat with NSAIDS.
- Lightheadedness, esp. in initial sessions.
- No effect on memory.

Contraindications to TMS

- Only absolute contraindication is non-removable metallic objects in and around the head.
- Relative Contraindications:
 - Seizure Disorders
 - Significant TBIs/stroke (depends on location)
 - Active substance use disorder (MJ usually ok)
 - Certain Medications (usually dose can be adjusted)
 - Other Psychiatric Disorders (can be used off-label for some of these)

What is an Acute Course of TMS?



First treatment is “mapping session” and takes about an hour.



Subsequent treatments are 20 minutes.



Treatment is 5 days/week (M-F) for six weeks, then six “tapering” sessions over the last three weeks for a total of 36 sessions.



Most patients see improvement between 3-5 weeks of treatment.



Treatment may be extended based on clinical situation.



Does Insurance Cover TMS?

- For Major Depressive Disorder: **YES**
 - Medicare, Medicaid (in many states, including Oregon, Washington).
 - Almost all commercial insurance plans.
- For Obsessive Compulsive Disorder: Not Yet . . .
- Other potential indications: Migraine, Anxiety Disorders, Addiction, Pain Disorders, etc.

Thank You

Fortune Favors the Prepared Mind

- Louis Pasteur