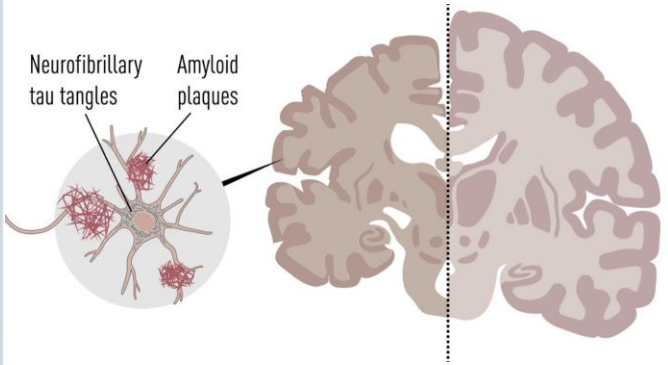
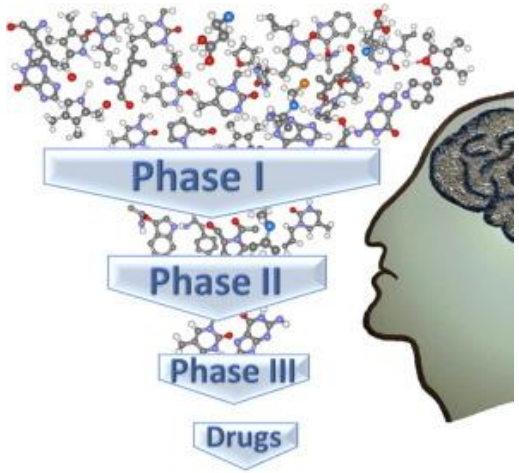
# Wearable Transcranial Magnetic Stimulation for Alzheimer's Disease

# Unmet Clinical Needs

**> 131.5** million people will suffer with dementia by 2050

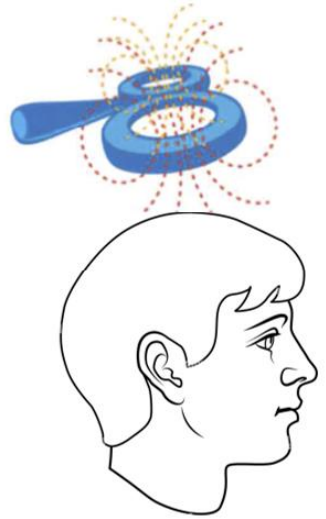
**~70%** of dementia cases are caused by AD, which results in brain atrophy and death



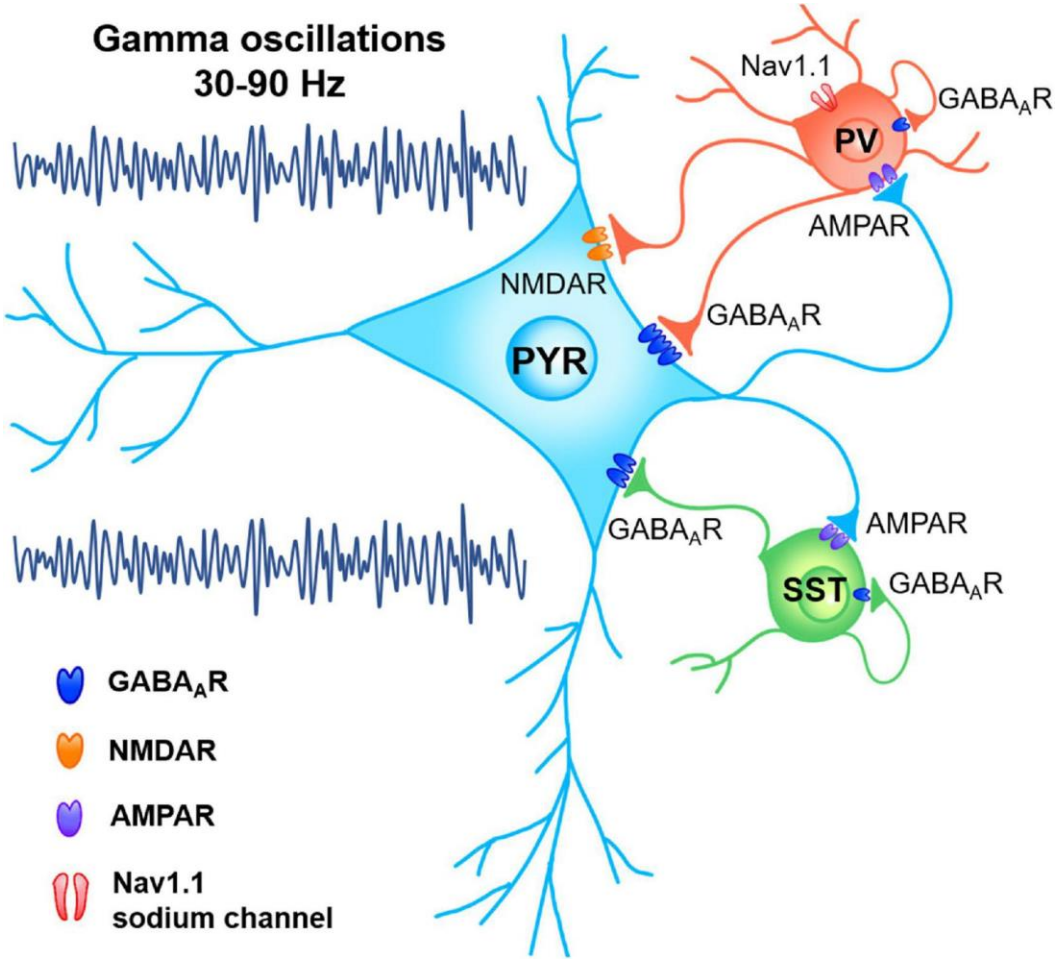



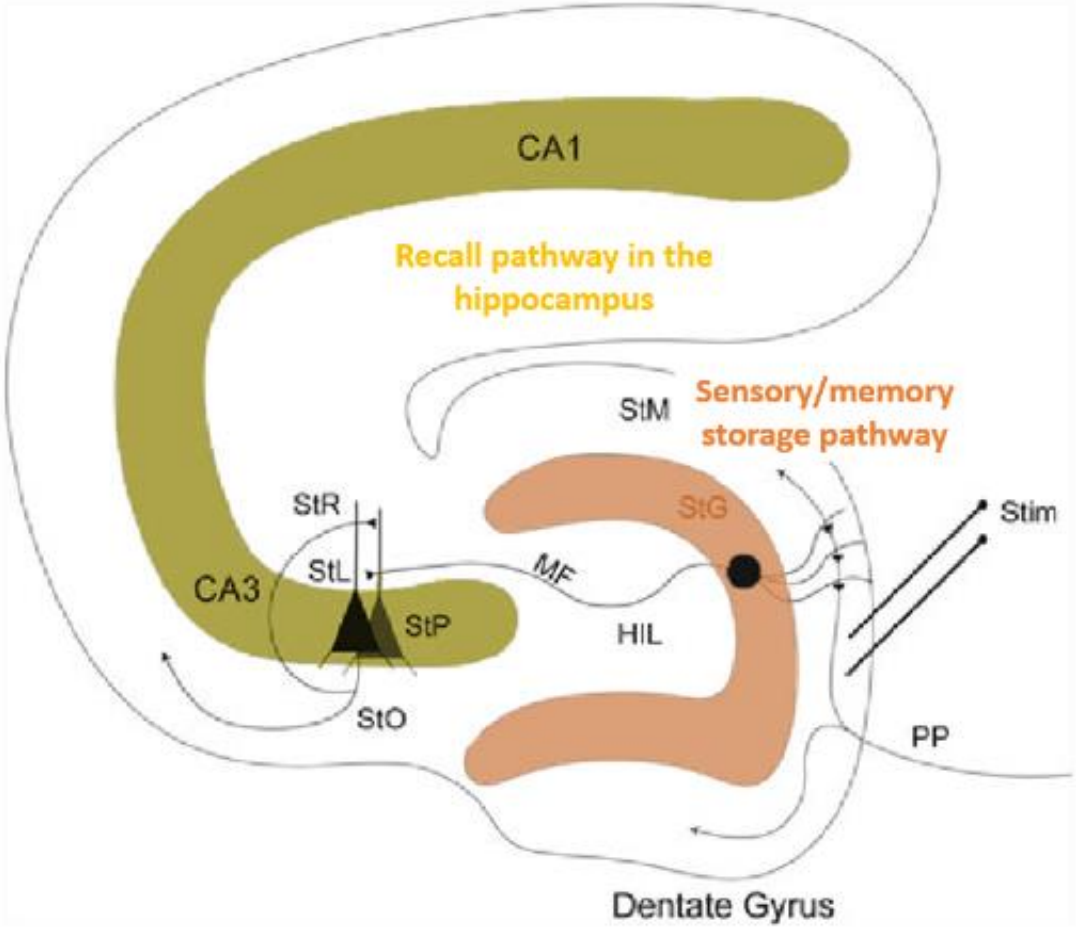

**> 99%** of AD drugs have been discontinued despite tremendous research and investments

**TMS** has proven to have beneficial therapeutic effects on AD patients but requires improvement



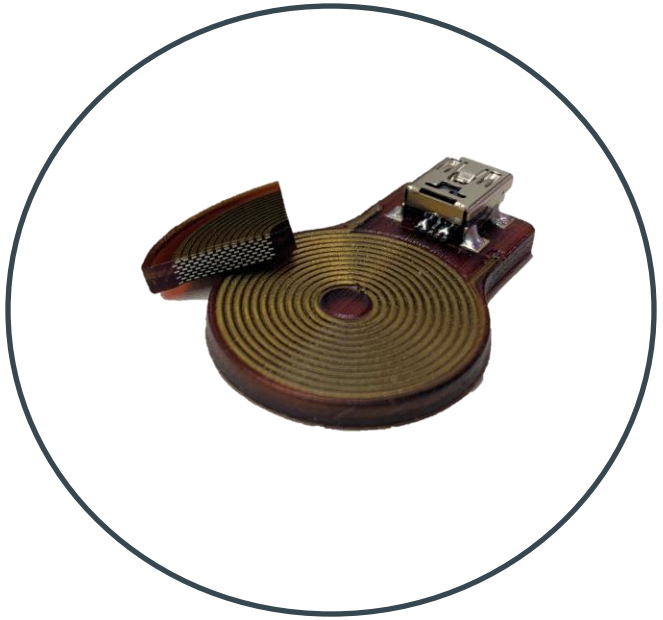
# Gamma Oscillations

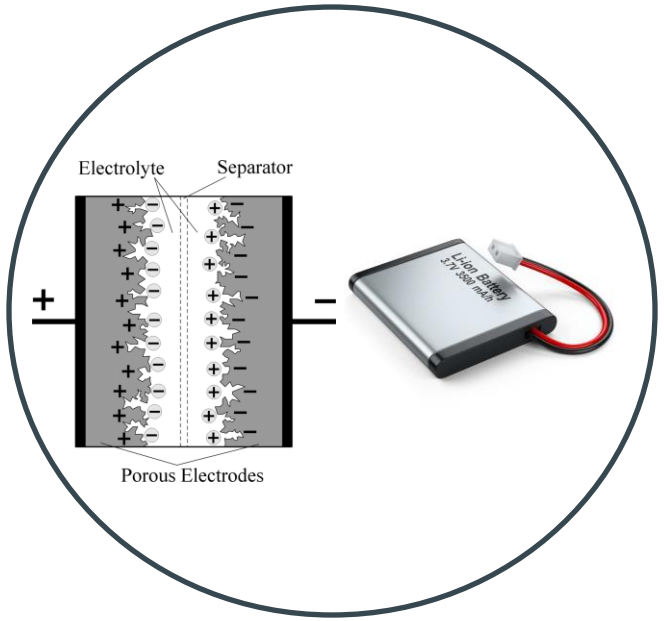


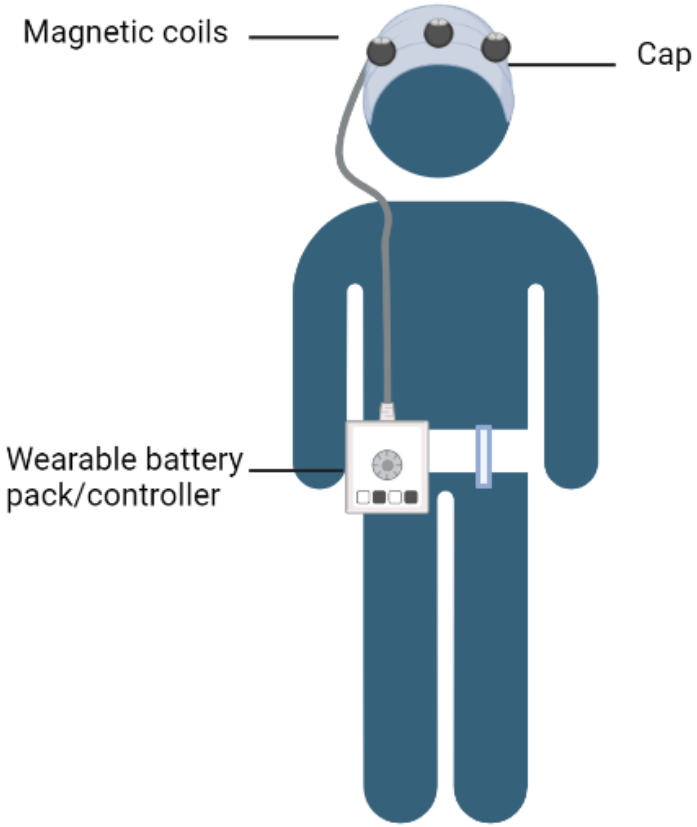



Current Speaker: Srusti

# Our Solution



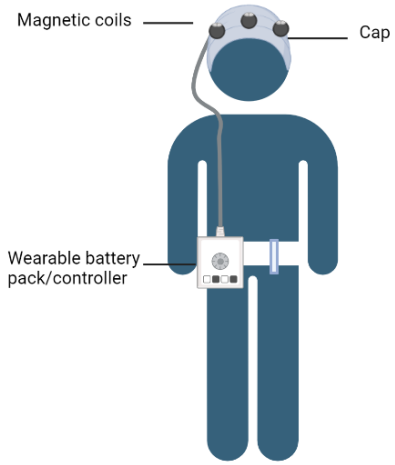



# Comparison to Current Technologies

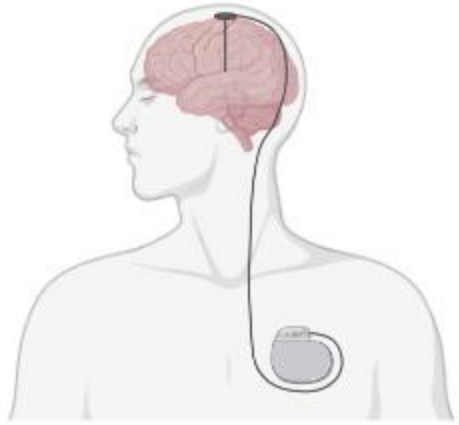
## Gamma Oscillation Magnetic Stimulation Cap

- ☑ At-Home
- ☑ Cost Effective
- ☑ Non-invasive
- ☑ Direct Stimulation
- ☑ Customizable




## DBS Electrodes

- ☑ At-Home
- ☒ Cost Effective
- ☒ Non-invasive
- ☑ Direct Stimulation
- ☑ Customizable



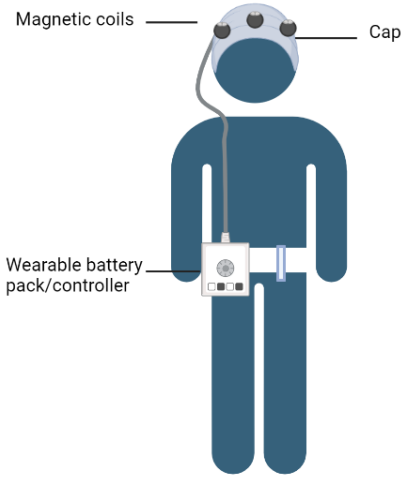
## Alzheimer's Drugs

- ☑ At-Home
- ☑ Cost Effective
- ☑ Non-invasive
- ☒ Direct Stimulation
- ☒ Customizable

# Comparison of Solution to State of the Art

## Gamma Oscillation Magnetic Stimulation Cap

- ☑ At-Home
- ☑ Cost Effective
- ☑ Non-invasive
- ☑ Direct Stimulation
- ☑ Customizable

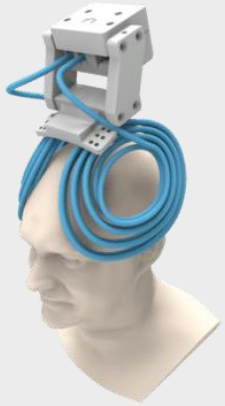



## Cognito Therapeutics

- ☑ At-Home
- ☑ Cost Effective
- ☑ Non-invasive
- ☒ Direct Stimulation
- ☑ Customizable

# Achilles Heels

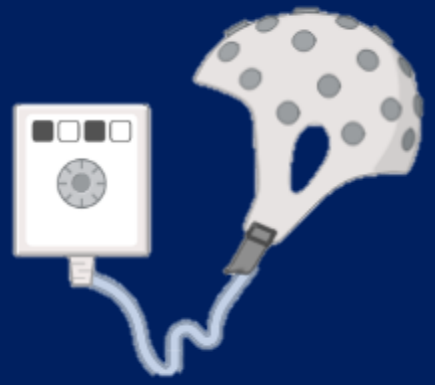
**H1-Coil**
for Major Depressive Disorder (MDD)



**H7-Coil**
for Obsessive-Compulsive Disorder (OCD)

**H4-Coil**
for Smoking Cessation

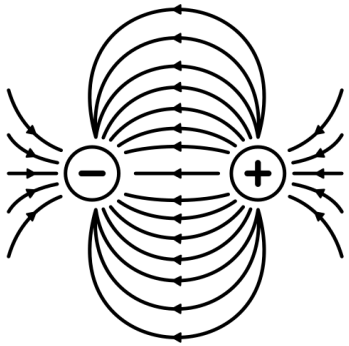
**Traditional TMS Coil**
for Major Depressive Disorder (MDD)



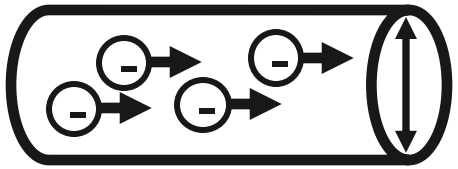
Current Speaker: Kyla

# Future Work

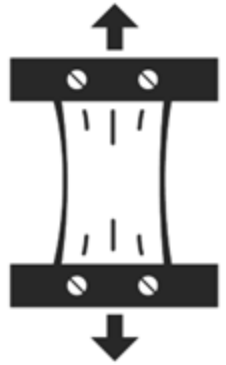
**Critical Temperature**



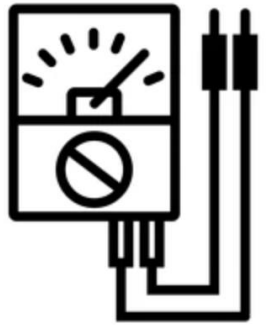
**Critical Magnetic Field**



**Critical Current Density**



**Mechanical Testing**



**Electrical Testing**

# Wearable Transcranial Magnetic Stimulation for Alzheimer's Disease

Gaia Di Bernardini, Niharika Mahesh Dhande, Kyla Frenia, Abby Kuelker, Ilisha Prasad, and Srusti Sain

# What standards/regulations will you follow?

## Applicable Standards

IEC 60601-1:2005
+A1:2012+A2:2020

ISO 10993-1:2018

IEC 62304:2006

IEC 62366-1:2015

ASTM F-3127-22
ASTM F3357-19
ISO 17664-1:2021

ISO 17.220.01

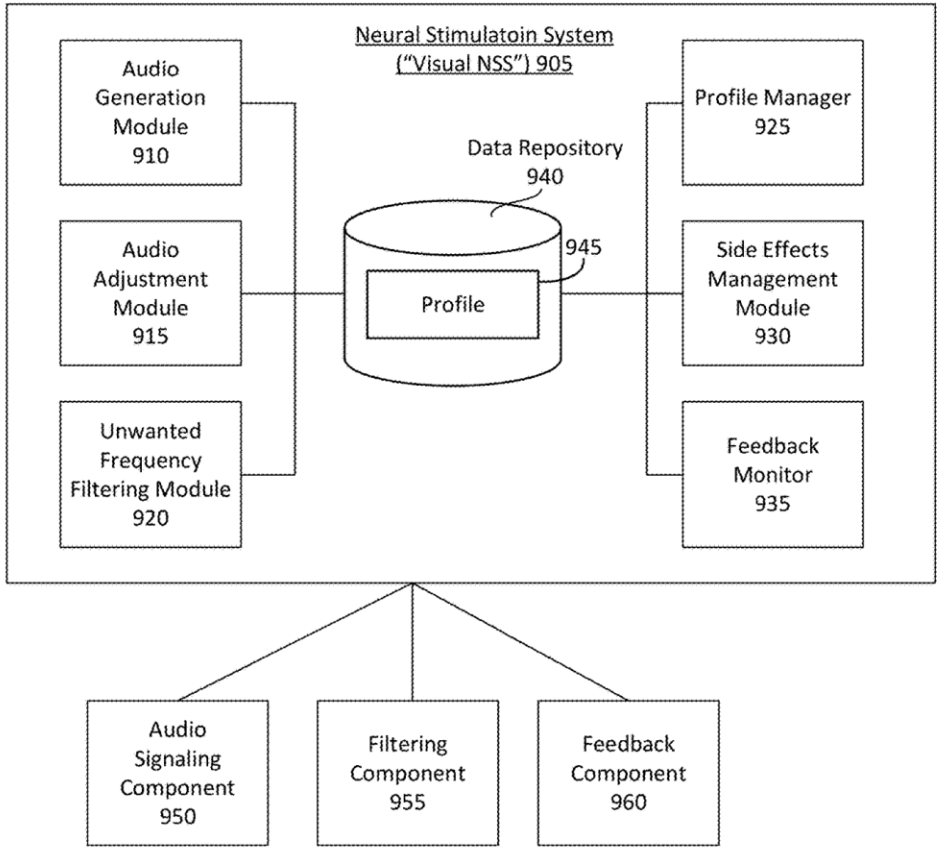
ASTM F1980

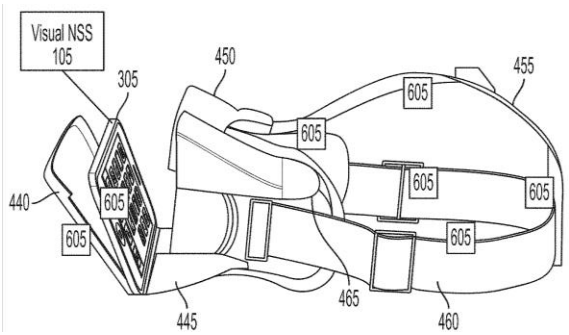
ISO 13485:2016
ISO 14971:2019
ISO 20417:2021

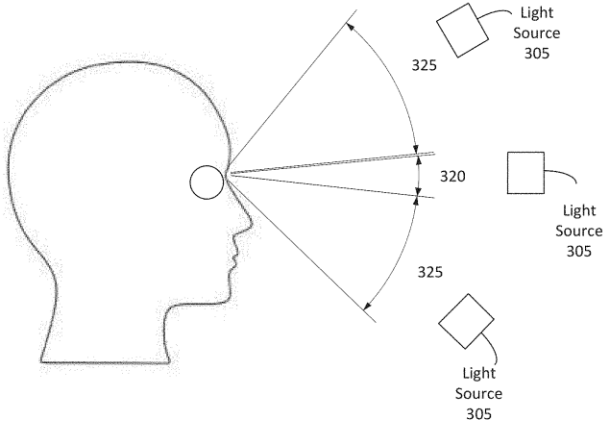
## Regulations

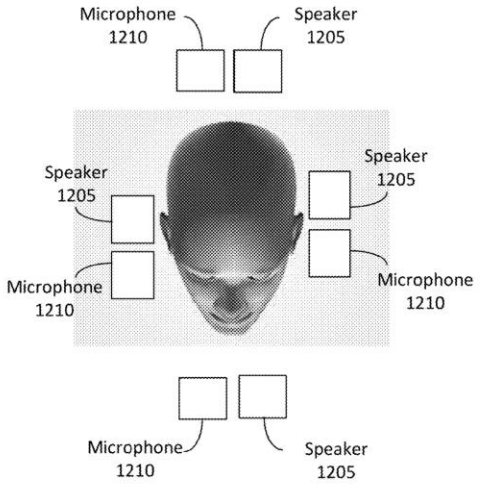
21CFR862.1345
21 CFR 898
21 CFR
807.87(e)
21 CFR 809.10
21 CFR 820

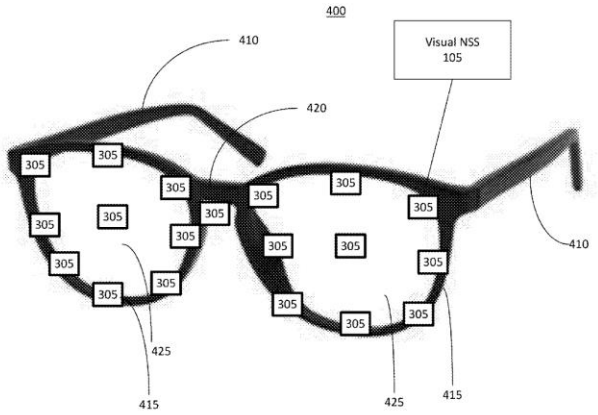
# Intellectual Property – Cognito Therapeutics



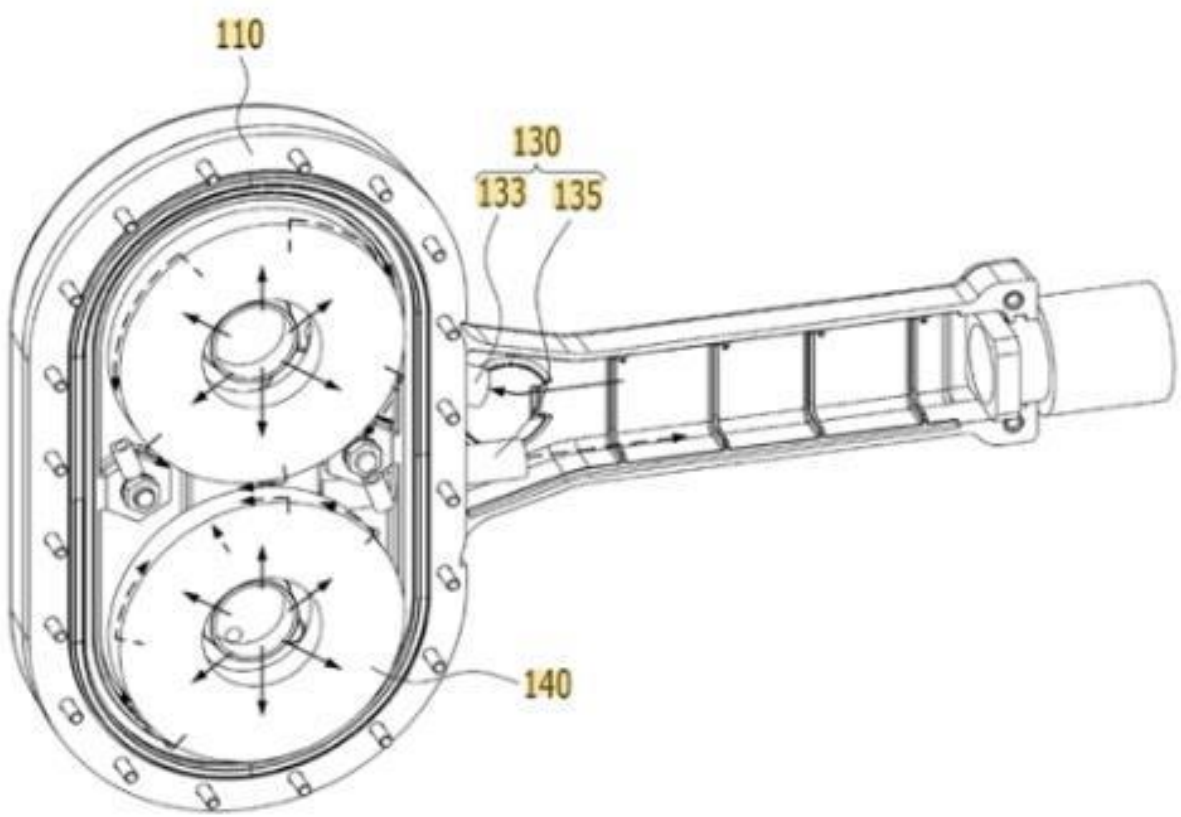



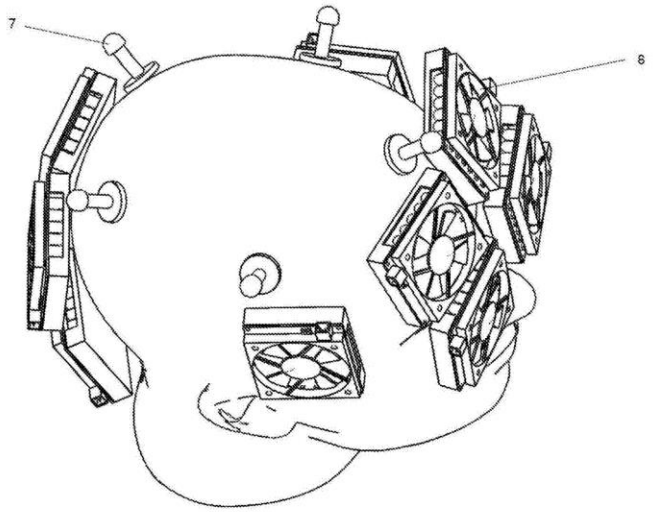



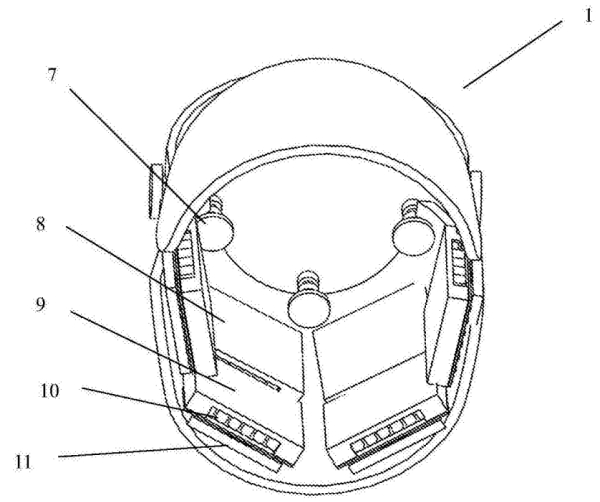



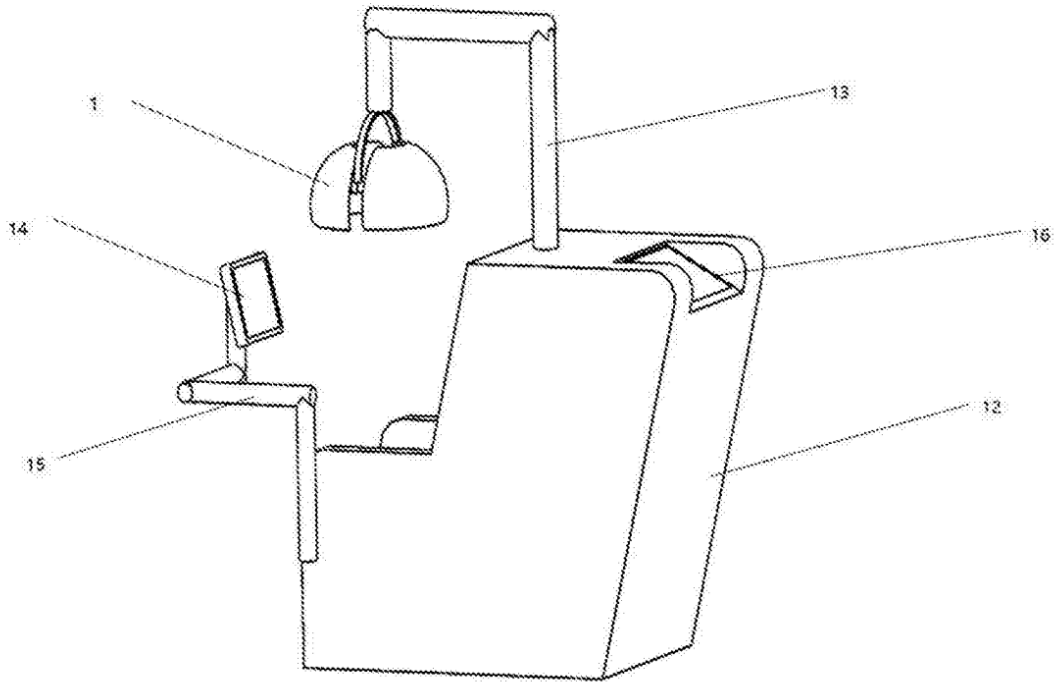
# Other Intellectual Property - REMED



# Other Intellectual Property



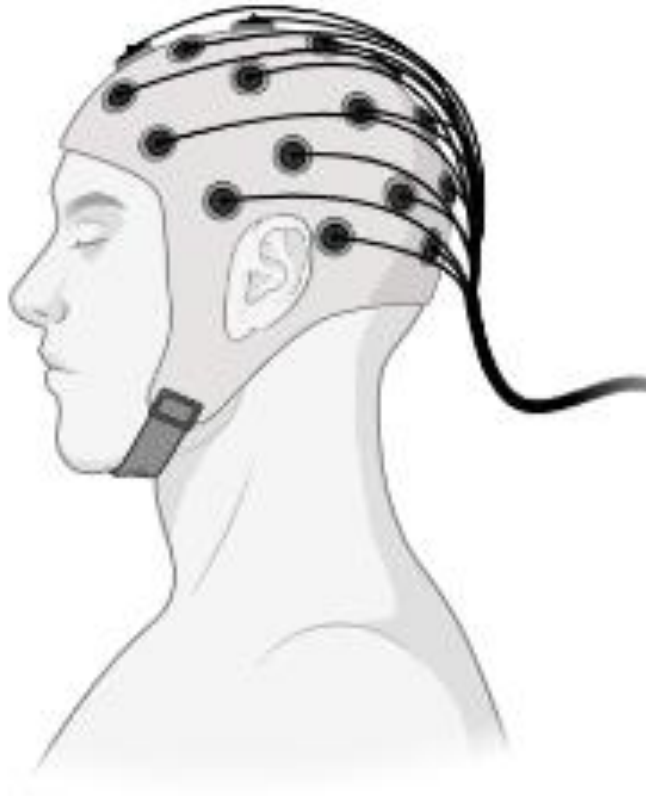



# Why choose TMS vs DBS?

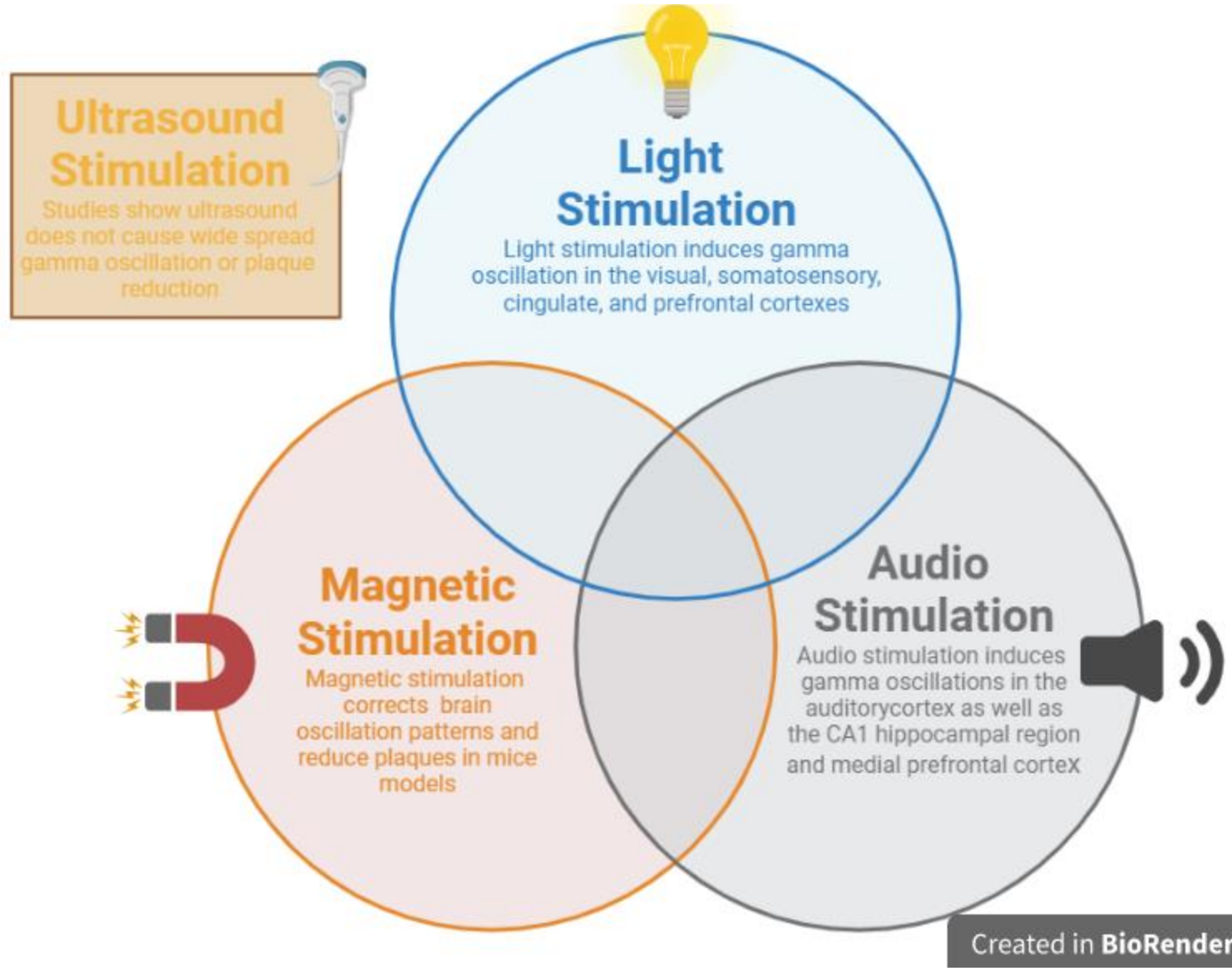
**Remove Surgical Risk**

**Reduce Cost**

**Evidence Backed**



# Why did you choose magnetic stimulation?



# What were our key design considerations?

1

The treatment shall promote gamma oscillations in the brain

2

The treatment shall be customizable for individual patients

3

The treatment shall minimize the disruption to patients life and routines

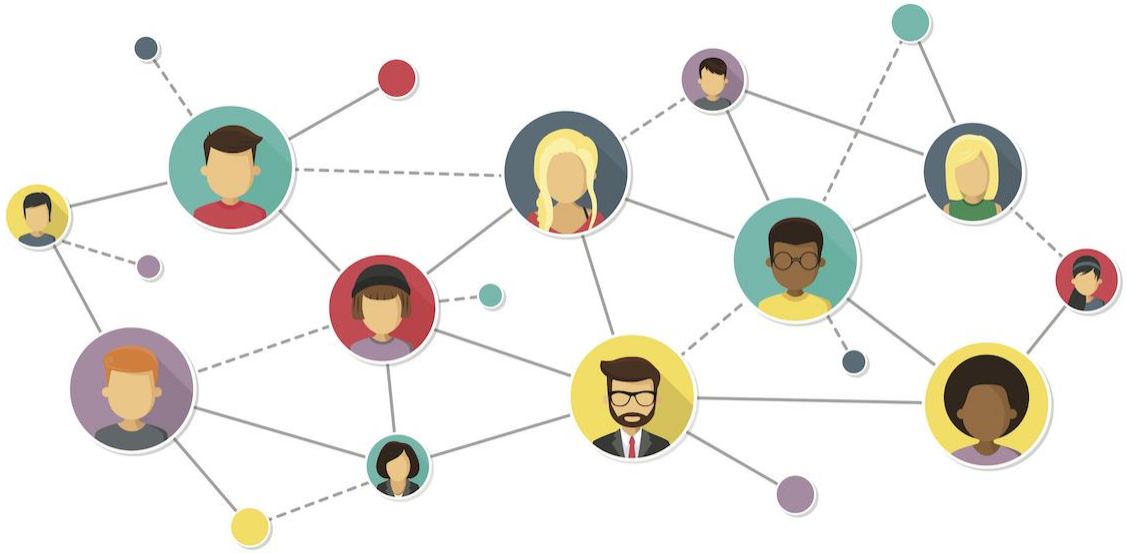
4

The treatment shall be self administered by the patient

# Who did we contact?

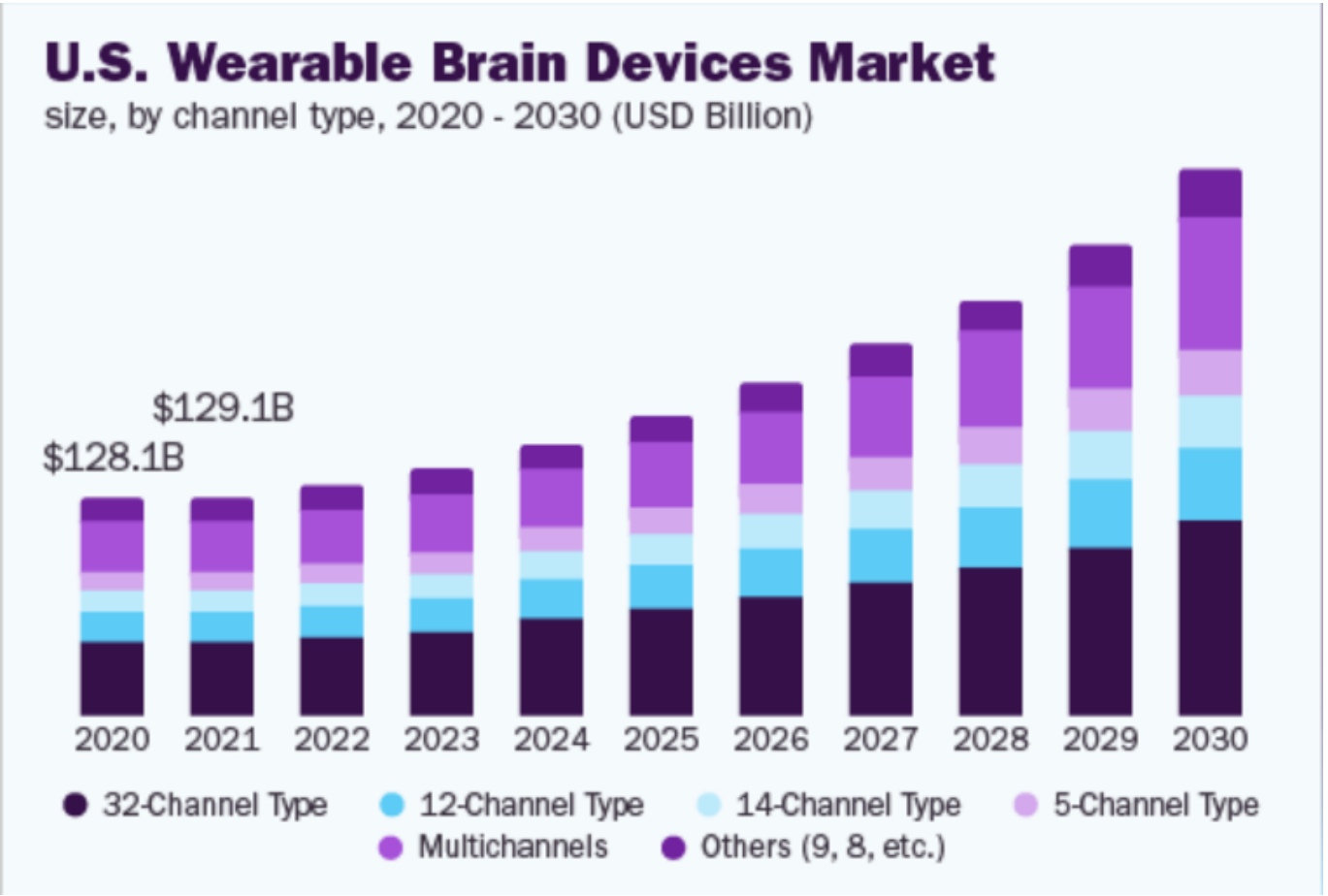
**Within Northeastern**
- Professor Yaseen (Optical Microscopy and Neural-Imaging)
- Professor Sozer (Biophysics, Electrostimulation)
- Professor Makowski (Biophysical data analysis and AD)
- Professor Barenberg (instructor)

**External Sources**
- Rick Kuntz (Medtronic, Cognito Board)

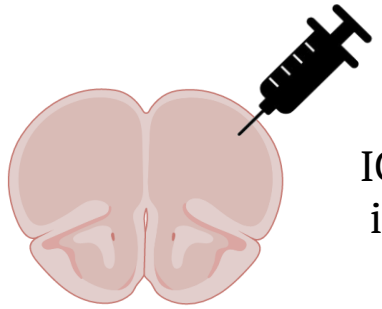


# Cost And Market

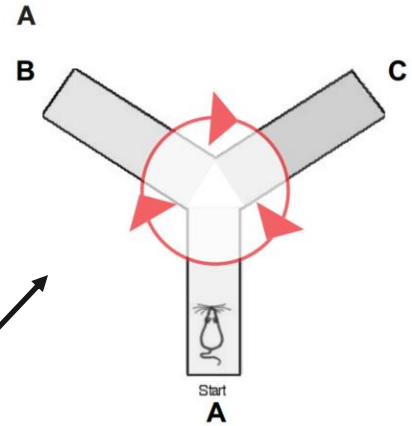
- In the United States, the cost of DBS surgery (including the implanted device, hospital fees and anesthesia) can range from **$35,000 to $100,000**.
- Cognito Therapeutics has raised **$53.3 million** in funding.
- Typical TMS caps cost $20 with every treatment costing ~$300

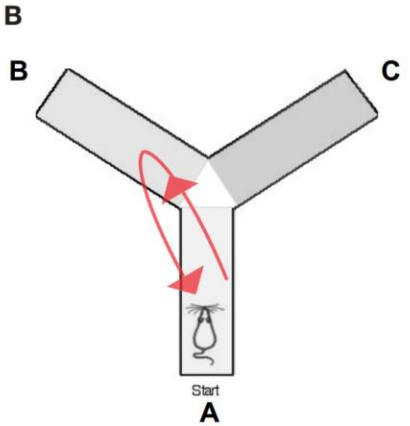


# How would you design your animal experiments?

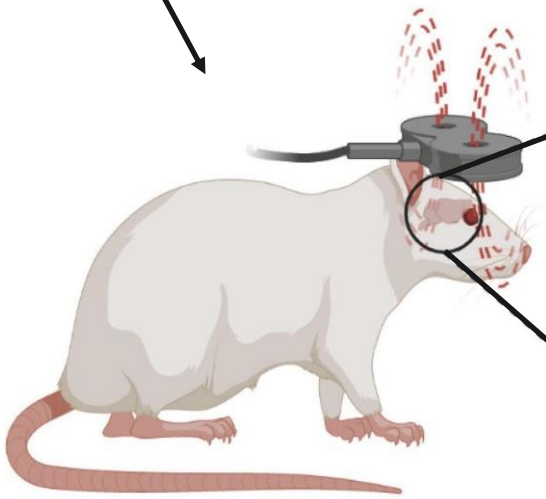


ICV Aβ42 injection




TMS



**Upregulates** Anti-apoptotic proteins: TrkB, BDNF, CREB, GABA, ERK, AKT, NMDA, Ca+

**Downregulates** Apoptotic proteins: Cleaved caspase-1, cleaved caspase-3, TNF-α, COX2