

me 421

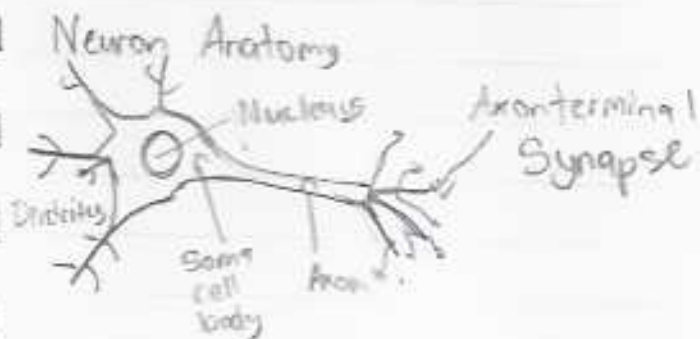
Science Fair Ideas:

- The science of memory loss & enhancement
 - Show HOW memory works, ~~show~~ what regions work when doing ~~stuff~~ using LEDs or visual images. ↳ activities
 - Build an interactive

Brain is more like a computer network, with each individual cell being a computer.

General themes in neuropathology:

1. Genes
2. Neuronal properties (myelination, synapses)
3. Neurotransmitters (Dopamine, acetylcholine) and their receptors
4. Neural circuits (substantia nigra, basal ganglia)



~ -60 mV resting potential

Study the brain. Figure out how Muse headsets work. Email UFC guy for help. Make something which is controlled by your brain

Title

Mapping Memory: The

Science of memory formation,
consolidation, decline &
renewal.

Muse S Athena uses EEG AND fNIRS technology. to measure brain activity, track brain blood flow. EEG measures electrical signals, while fNIRS measures oxygenation levels of the brain.

Muse 2 uses just EEG.

Preferably Muse S Athena, but other could also work

Dec 22nd 2025

- The formation of long term memories is necessary for survival.

- In the last 20 years great progress has been made in understanding memory formation, consolidation, and reconsolidation and can now treat psychopathologies.

- memories can be classified into short/long term.

- there is a major distinction

- explicit (declarative)
implicit (procedural)

- d. memories are those that can be consciously recalled (such as facts)

Procedural memories are those that store information about skills such as driving a car.

- Temporal lobe-dependant memories
- Molecular Modifications at any level of translation is critical in memory storage.
- When a memory is formed, it is fragile and can be easily disturbed. With time, it becomes stable. However when retracing memory it can become fragile again. When it becomes stable again, that is known as reconsolidation.

CREB, C/EBP β & δ (CREB β & δ)
necessary in memory
consolidation.

- Stress shows \cap relationship
with memory retention.
Stress helps form memories,
but too much can impair
memory.

Dec 23.

- Glucocorticoid receptors (GRs) play an essential role in memory formation and consolidation.
- GRs increase the CREB protein, and increase all things necessary in making memory.
- BDNF can rescue neurological impairments from GR inhibition. It is selective for GRs.

Muse Headset

Muse headset helps increase attention which is vital in helping form and consolidate memories. It uses biofeedback to help one keep focused and stay attentive. It can be used to assess cognitive decline. "Alpha Peak" is a state of relaxed attentiveness.

Potential Theory: People remember things when in Alpha Peak better, faster, and for a longer time.

Use Muse to proven this.

Muse can measure a heightened response from a specific trigger.

Can identify which stimuli the brain finds important.

Higher importance to self is better remembered.

Alternative network activation can show that memory areas are damaged.

The hippocampus forms and encodes memories like in Inside Out. The crystal balls are like each memory after taking in all the sensory input.

Idea

- Make an activity which tests all aspects of memory.
- While participants are doing the activity, the Muse is measuring all their activity.
- Once done, the Muse will compile all the data and a code will form a kind of final thing which gives the person an overview of their learning.

How Muse Works

Activity



Person wears
headband



Muse collects
data



Gives a
final report



Make Game in Unity

2D game with minimal
graphics. ✓

ans
)

Stroop test.

Final Games

1. Stroop Game - 40 trials
2. N-back Game - 30 trials
3. Pattern Game - 30 trials
4. Spatial Game - 8 trials

Connect Muse 2 to Unity
and stream data.

Possible need of phone?

No

Maybe doesn't have to be in
real-time.

Ways to Connect Muse:

- Use MuseLab (very hard & unlikely)
- Use Mind Monitor or Petal (costs money) but easy
- Use LSL python code (best one?)
- Use Muse Unity SDK?

Another option:

- Use phone to record data, and analyze from there.
- Export data from specific time frame, analyze that, instead of making it seamless

1. Make everything into one whole experience.

Play Games



Analyze Data



Give Report

2. Play the games, and record brainwaves. Use timestamps to take all data.

Export data as a CSV



Analyze separately



Generate Report

3. Use phone???????????

Direct stream and processing is difficult. Hard to use LSL and other apps as well.

Different options:

- Use streaming from phone and analyze using Muse app
- Stream separately on laptop and only use Unity for event markers.
- Make python script which analyzes files and generates report.
- Maybe make game generate report.

Trifold design:

Include background research on in depth memory formation, consolidation, and retrieval and loss. Different types of memory

Include game background and research on Muse, including

EEG Time stamps

St = Start E = End

S = Stroop, N = N-back, P = Paterny C = Corsi

256 hz sampling rate.

Latency (Sample Point) =
Timestamp (in sec) \cdot Sampling Rate.

$$S, St = L = 6 \cdot 256$$

$$L = 1536$$

$$S, E = L = 78 \cdot 256$$

$$L = 19968$$

α/β .

Clinical Significance: Abnormal patterns can help diagnose conditions such as epilepsy, Alzheimer's, and depression.

Neurofeedback Loop: α/β , It can provide α/β biofeedback instantly. This helps users see or hear their internal state, making it easier to learn the physical feelings of a focused vs distracted mind.

Ask judges the last name
of last project or if first
person, or the color of the
door at the front. (Short-
term memory)

Then ask the name of
your grandfather. (long-term)
Color of car.

Full game workflow

1. Import Raw CSV into MATLAB by dragging into side panel.

2. EEGLAB \rightarrow Import data \rightarrow Using EEGLAB functions and plugins \rightarrow ASCII.

┌ # of channels = 4
└ Sampling Rate = 256
 Everything else empty.

Find what columns are EEG and note them.

Then use this script.

```
eeg_only = data(:, 2:5);
```

└
Replace with numbers.

Timestamps.

Stroop Start : 10.36 sec

Stroop End : 1:18.36

N-Back Start : 7:24 sec

N-Back End : 2:16.36 sec

Pattern Start : 10.78 sec

Pattern End : 5:16.61 sec

Spatial Start : 6.93 sec

Spatial End : 1:47.99 sec

Prep

Prep's

Stroop Start : 2560

Stroop End : 19968

N-Back Start : 1792

N-Back End : 34816

Pattern Start : 2560

Pattern End : 80896

Spatial Start : 1792

Spatial End : 27648

Trifold:

Make a table for different areas of the brain and what impact they have on memory.

Different areas can relate with each other to form different pathways, showing neuroplasticity.

Intro

High cost
Memory

Memory
loss

Consolidating
fragments

Recall
drum



Tracked?

Title

sub-title



ETG

col

Gen

ESG

col

Gen

Esri Pipeline

Analysis

coll

Anal

input

final

Anal

input

Stroop Test : Start

NT Back : 4:45

Pattern : 8:35

Spatial : 12:55

Analyze : 22:20

Program : 42:50