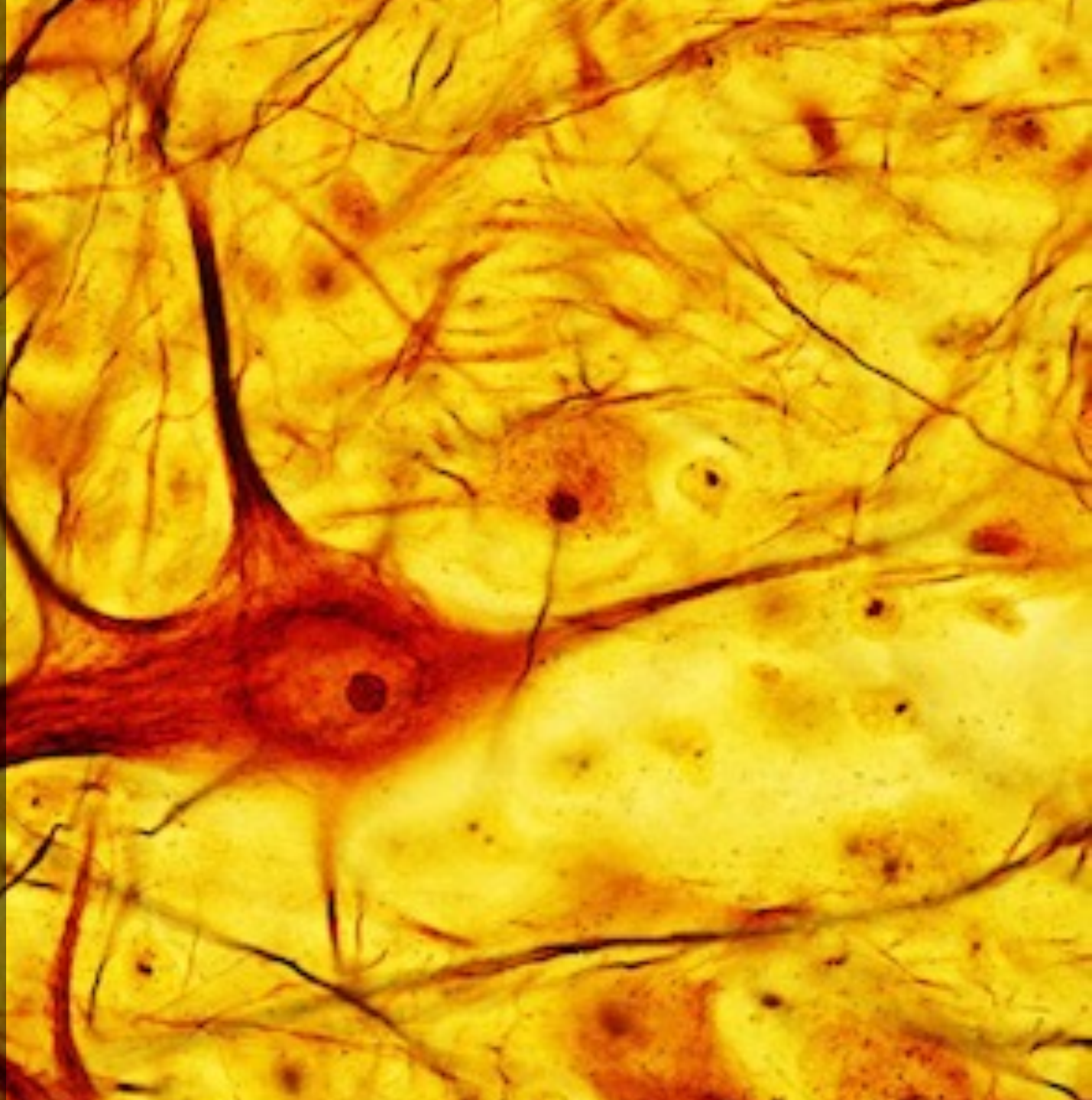




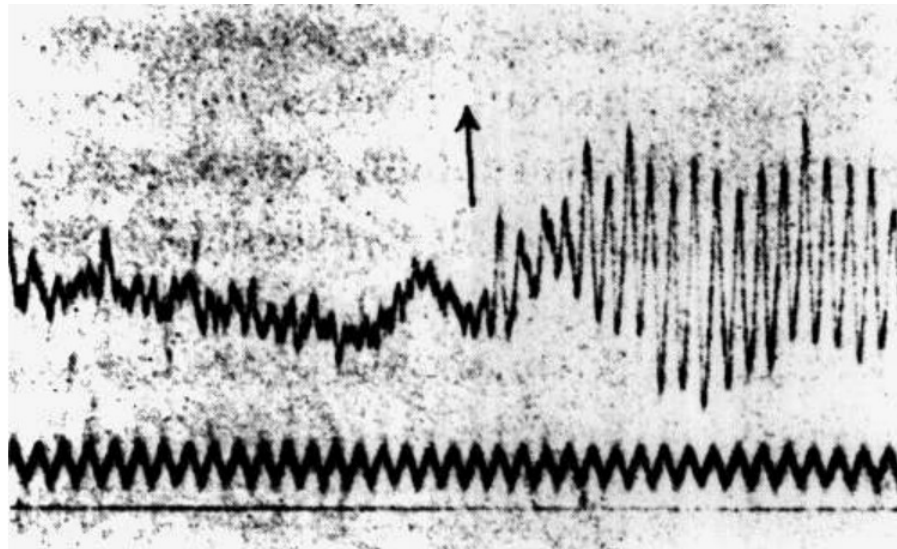
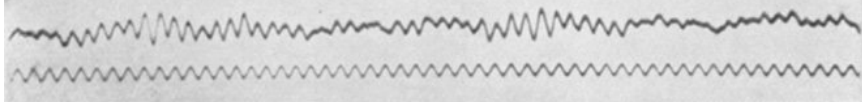
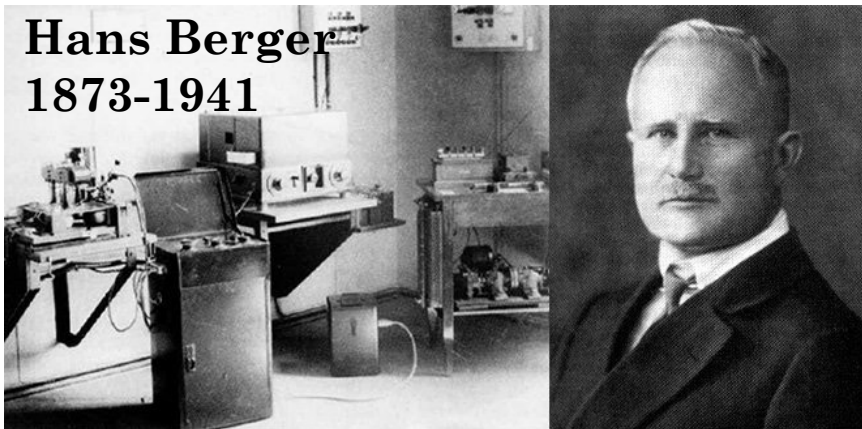
Lecture 8

EEG: Basic Principles

Oleksii Shandra



Hans Berger
1873-1941



16
channels



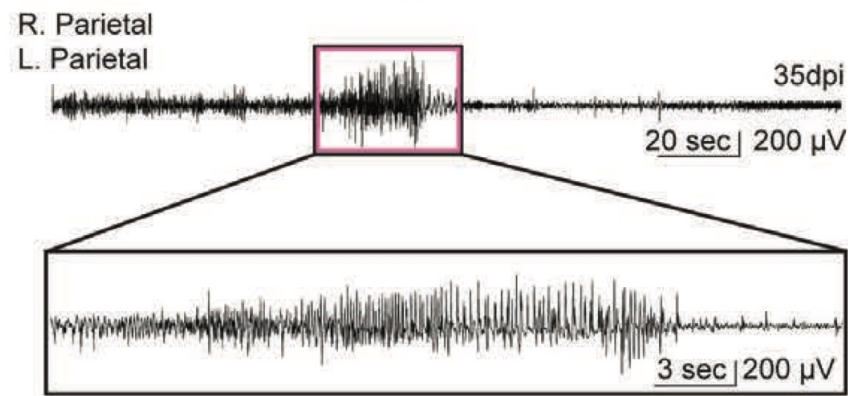
512
channels



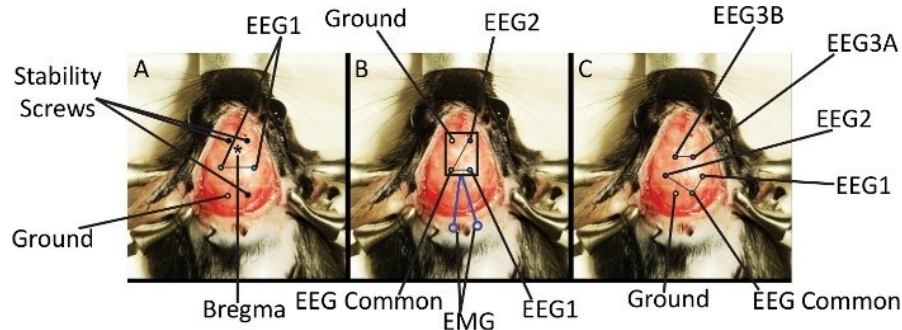
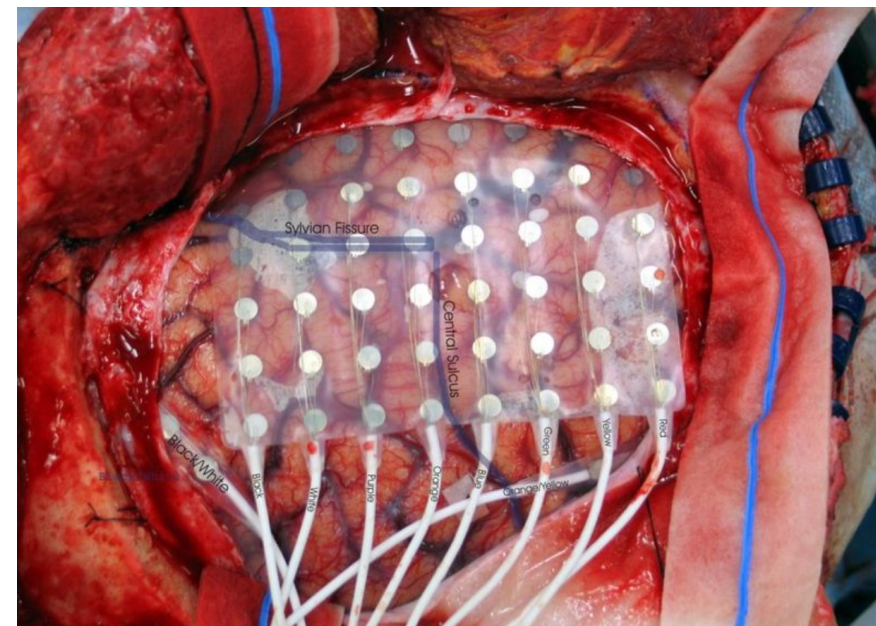
b 3xSham



c rdTBI Convulsive seizure



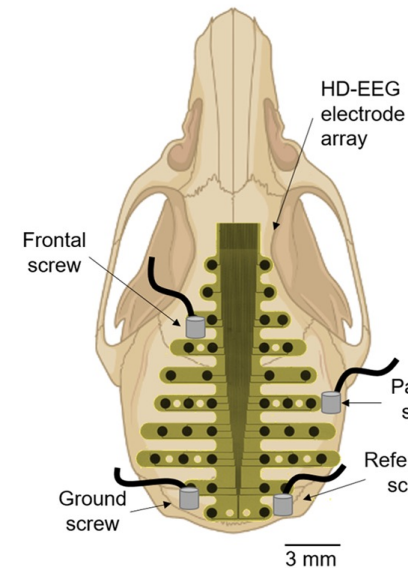
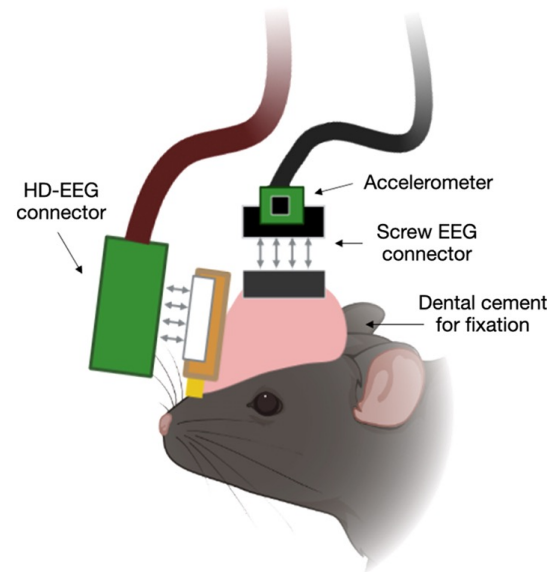
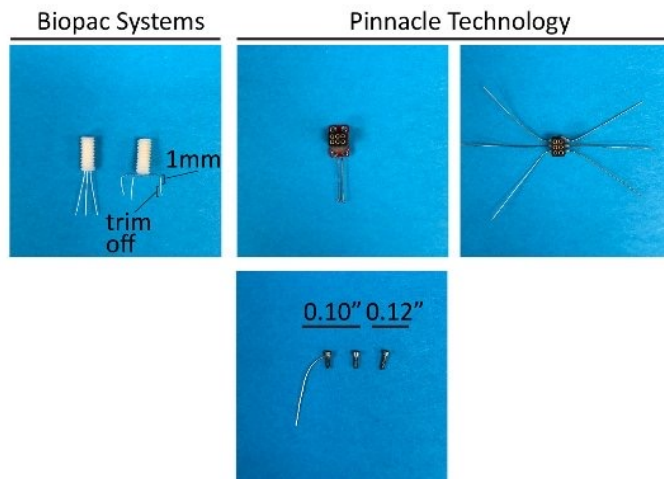
Shandra et al., 2019



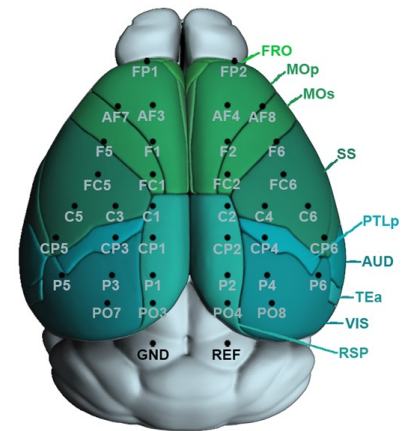
a. EEG recording on freely-moving mice

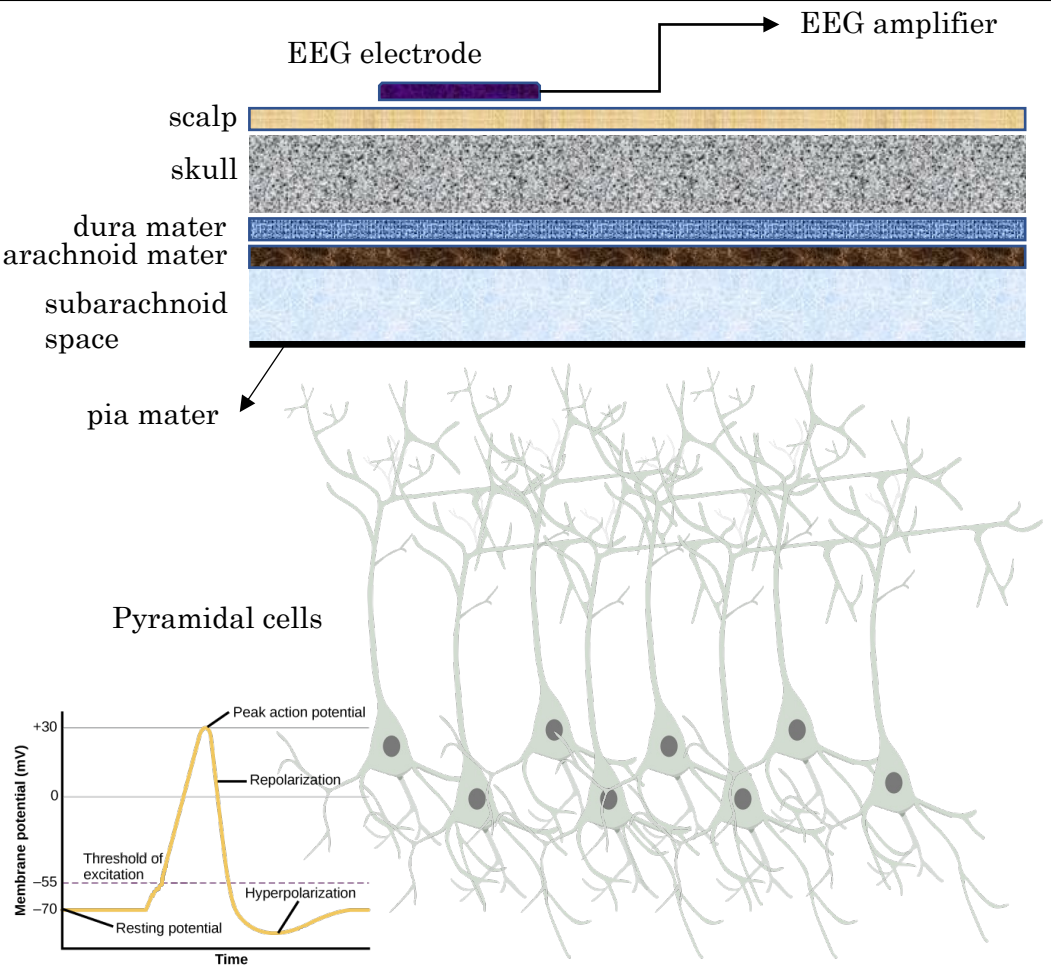
b. Electrode position on skull

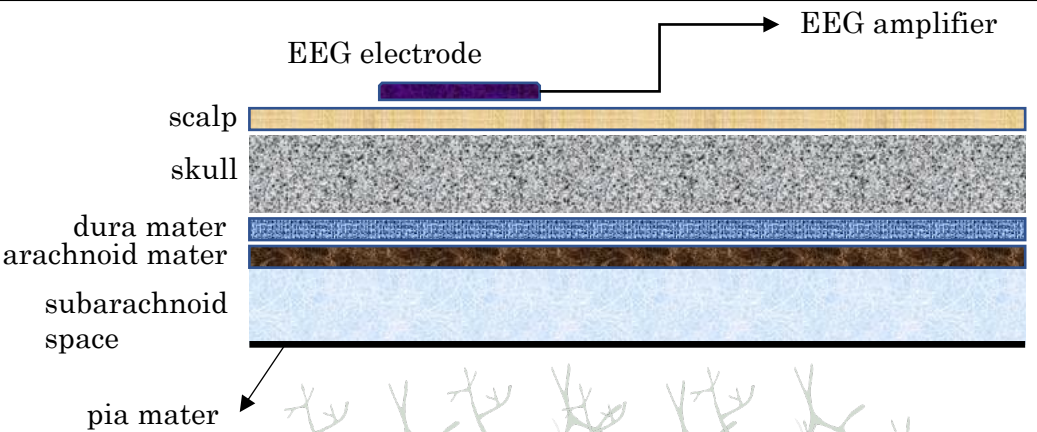
c. HD-EEG electrode



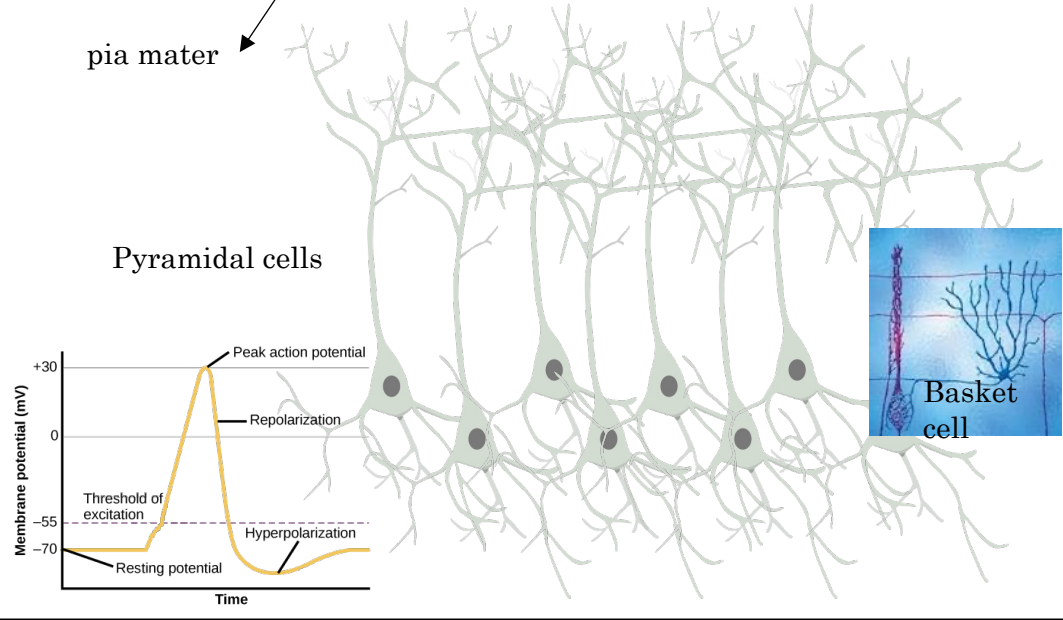
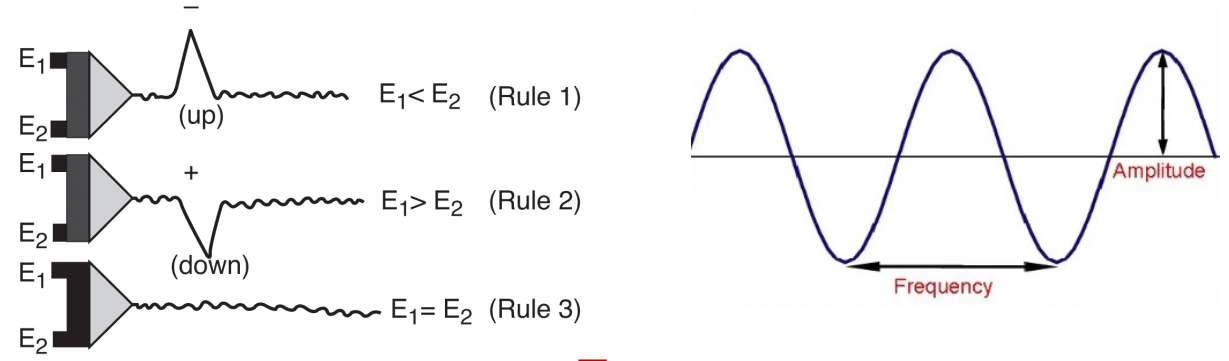
d. Montage of HD-EEG array



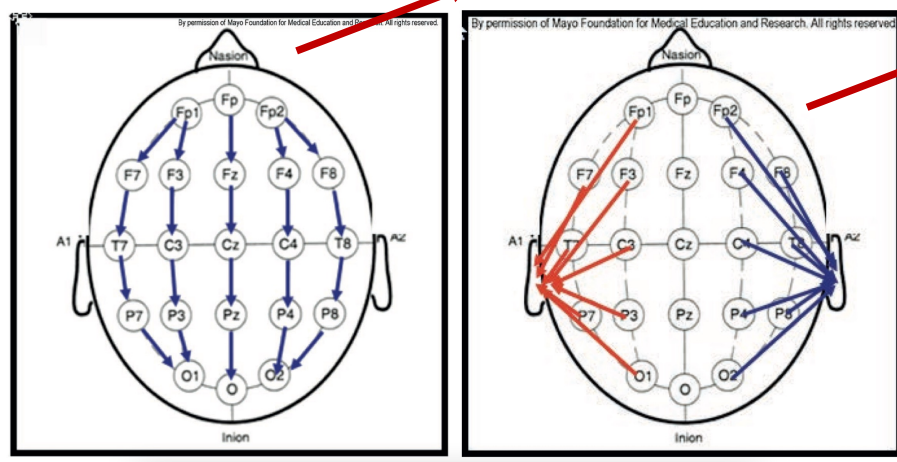




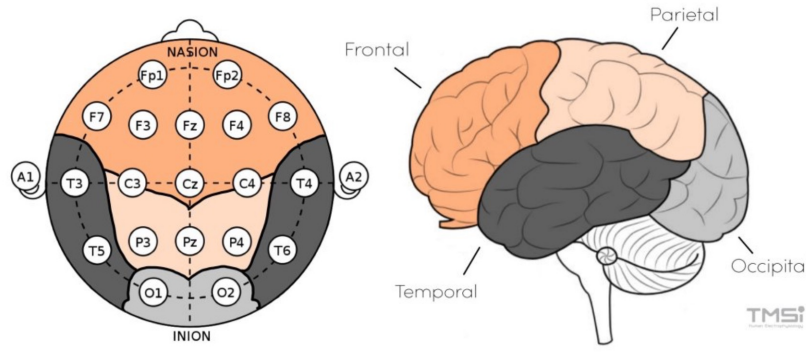
Differential amplifier polarity convention



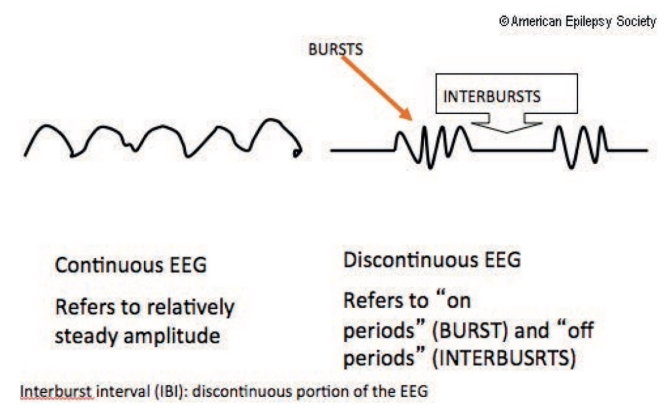
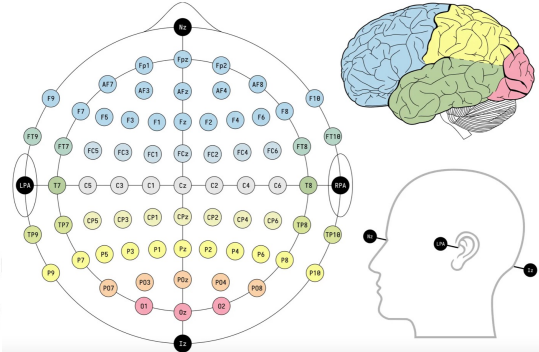
Montage



10-20 system



10-10 system



How neurons turn epileptic?

Excitation (too much):

- Ionic – inward Na^+ , Ca^{++} currents
- Neurotransmitter – glutamate, aspartate

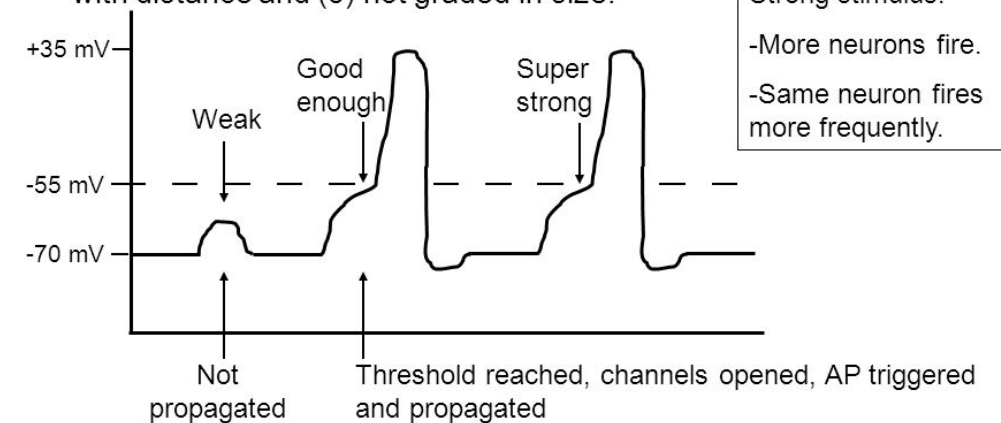
Inhibition (too little):

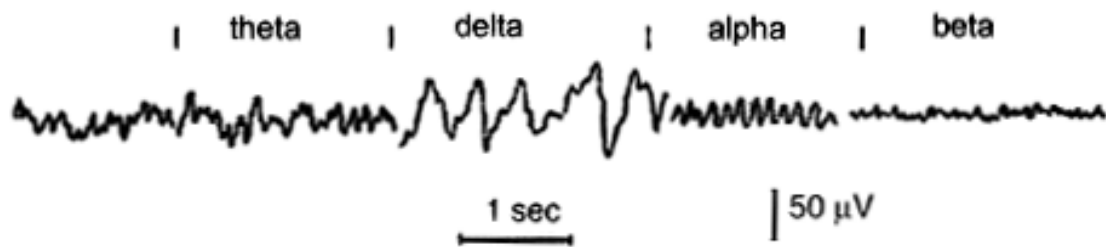
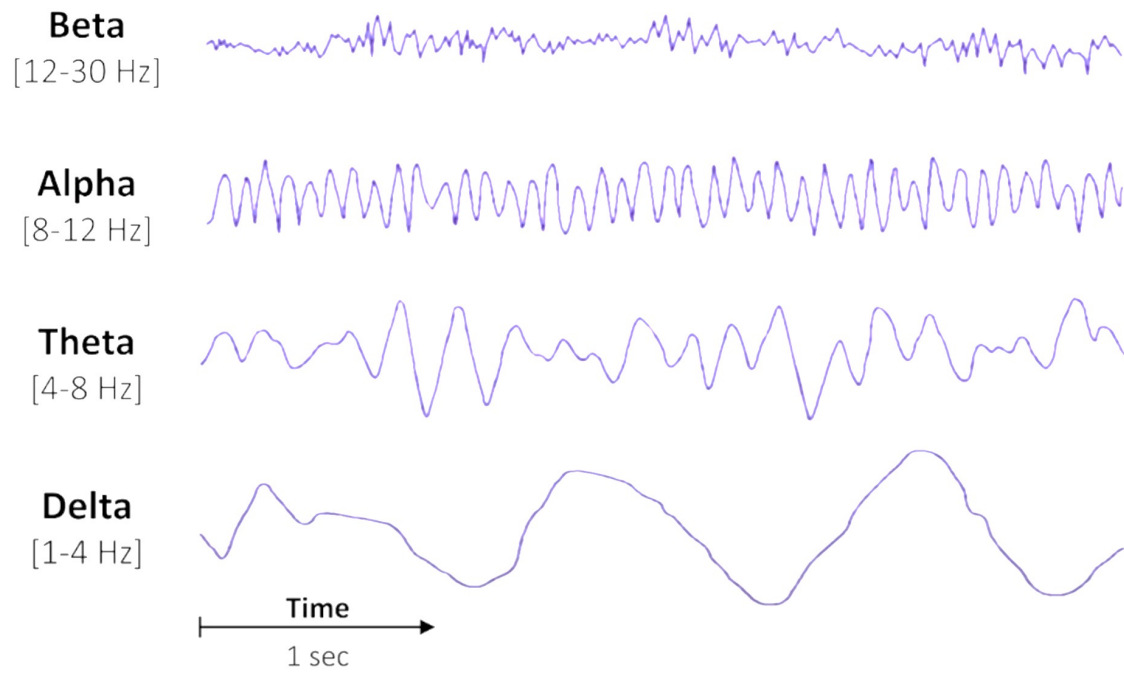
- Ionic – inward Cl^- , outward K^+ currents
- Neurotransmitter – GABA

Action Potential

▪ All-or-none principle

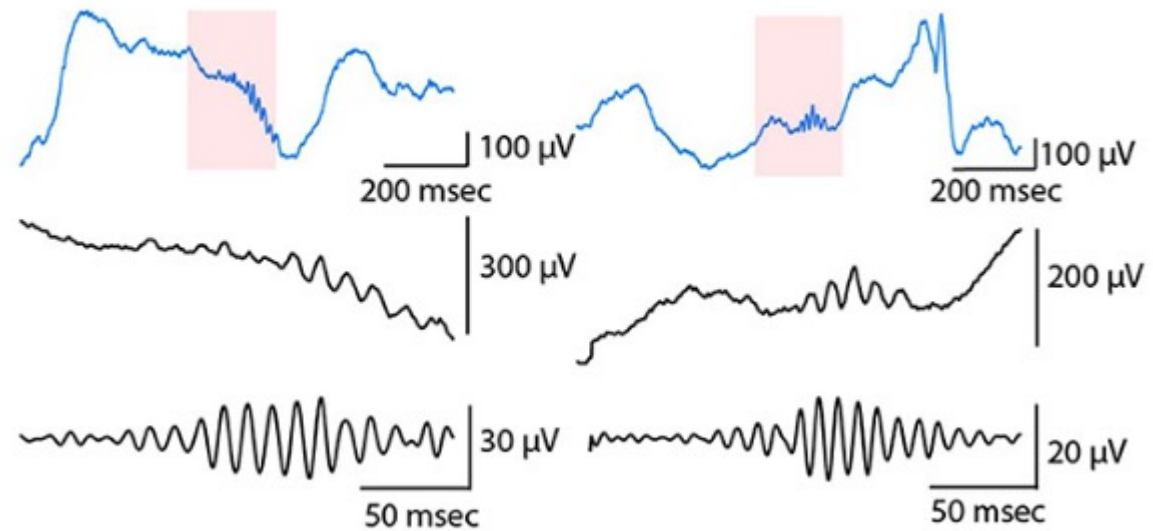
- Threshold: Voltage that will trigger an action potential. Based on the density and number of channels opening.
- Action potentials are (1) actively propagated, (2) do not decrement with distance and (3) not graded in size.





Ripples on Slow Waves

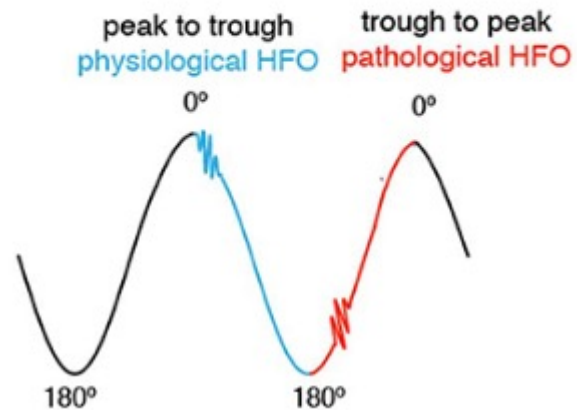
Peak-Trough Trough-Peak

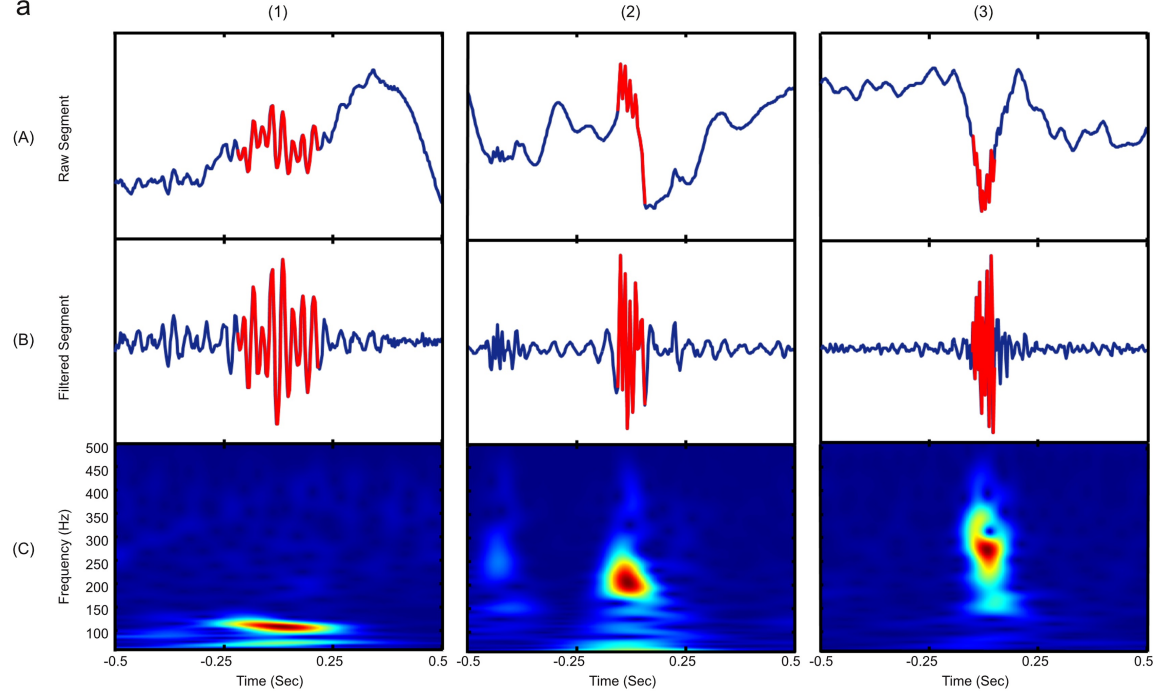


Hippocampus

Hypothesis

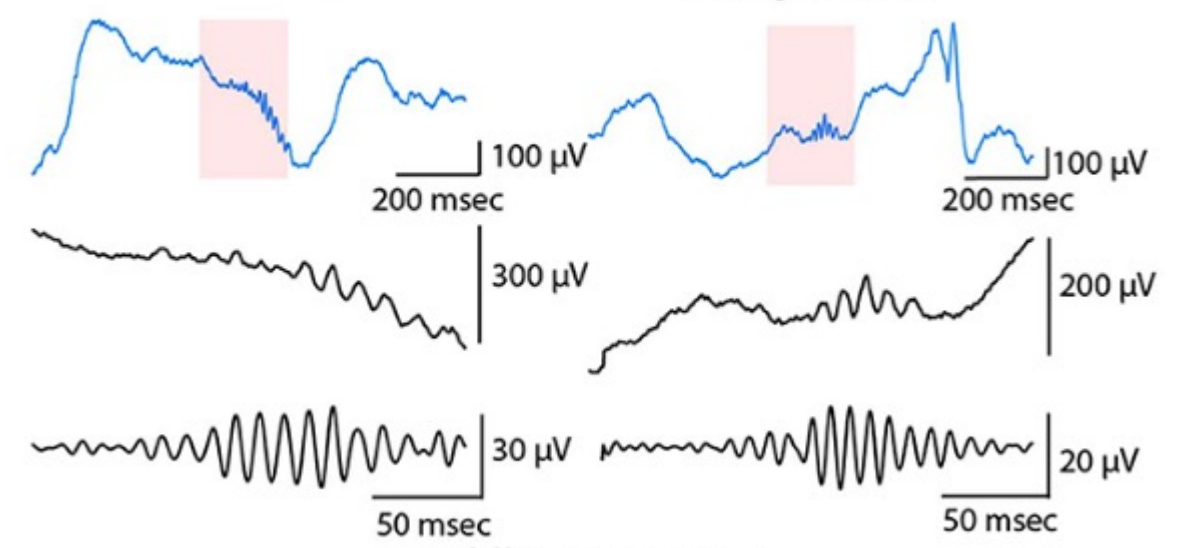
pathological ripples and fast ripples occur predominantly during trough to peak.



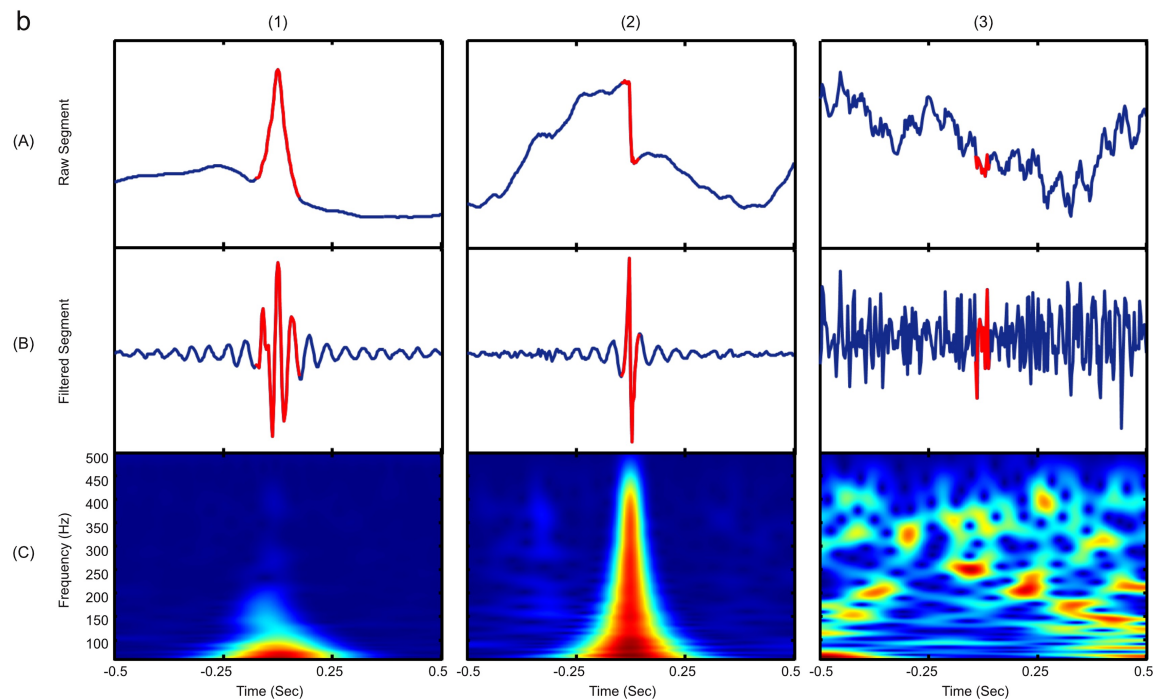


Ripples on Slow Waves

Peak-Trough Trough-Peak

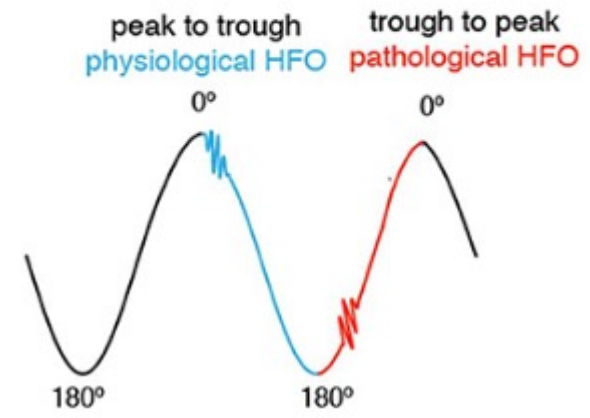


Hippocampus



Hypothesis

pathological ripples and fast ripples occur predominantly during trough to peak.

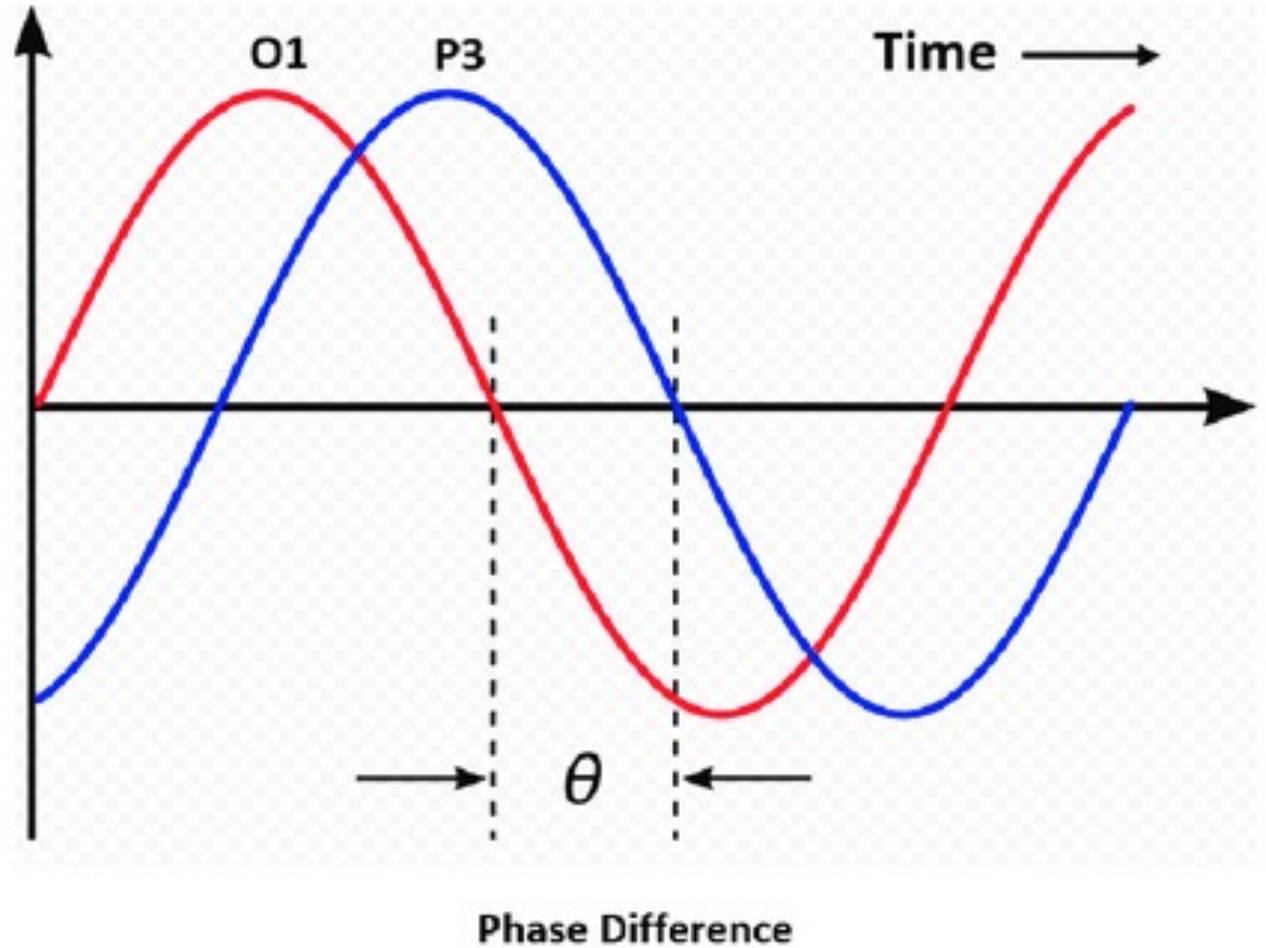
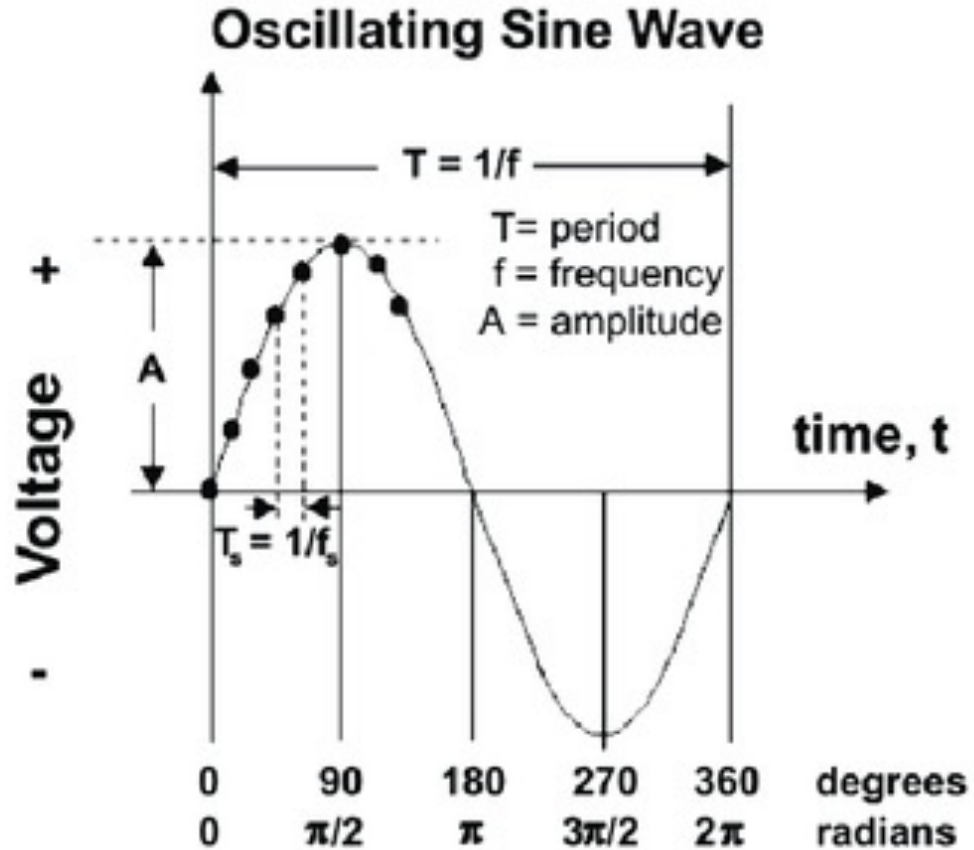


Navarrete et al., 2016

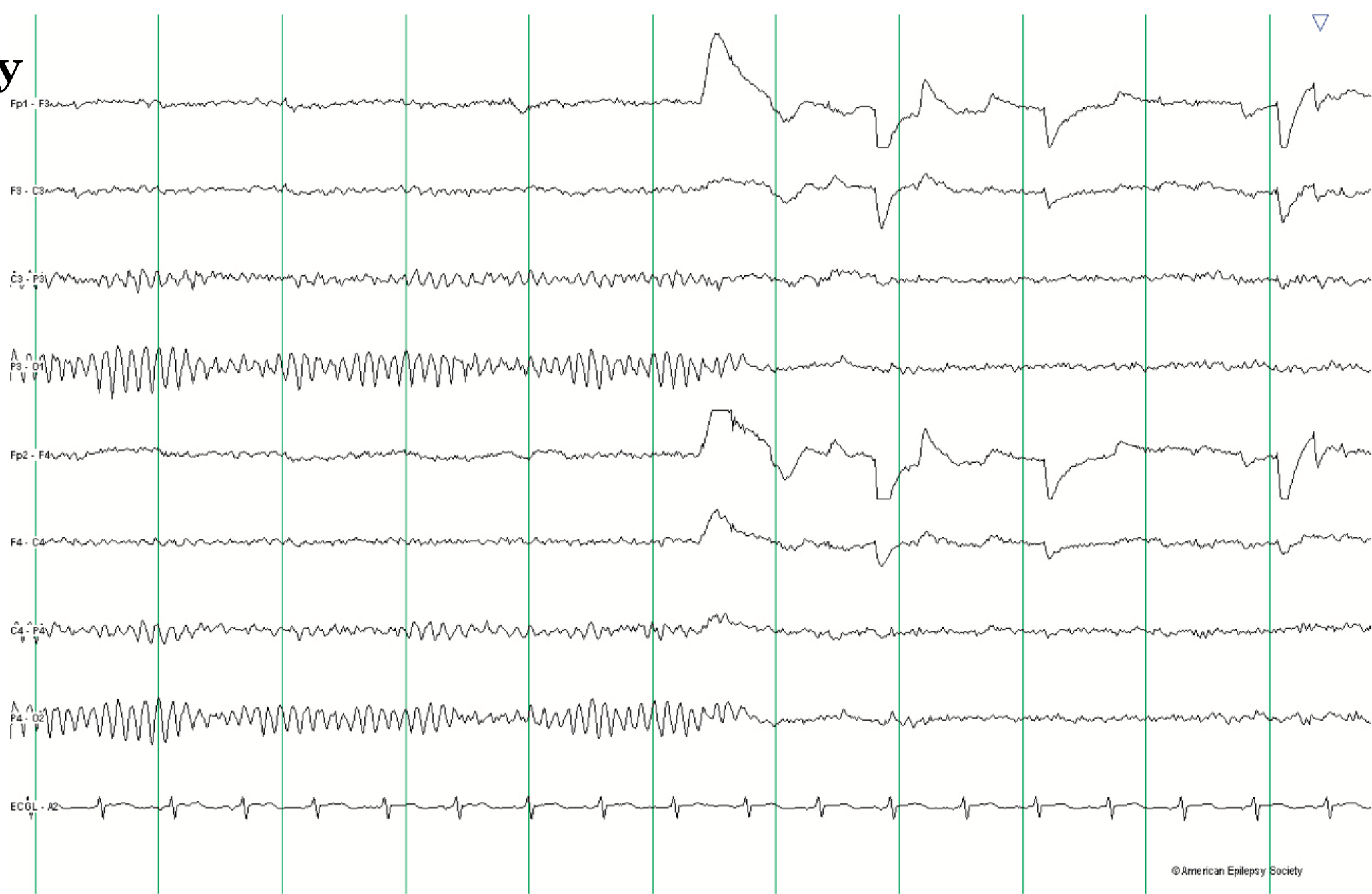
Weiss et al., 2020

Illustration of Phase Difference and Phase Shift.

The horizontal axis represents an angle (phase) that is increasing with time.

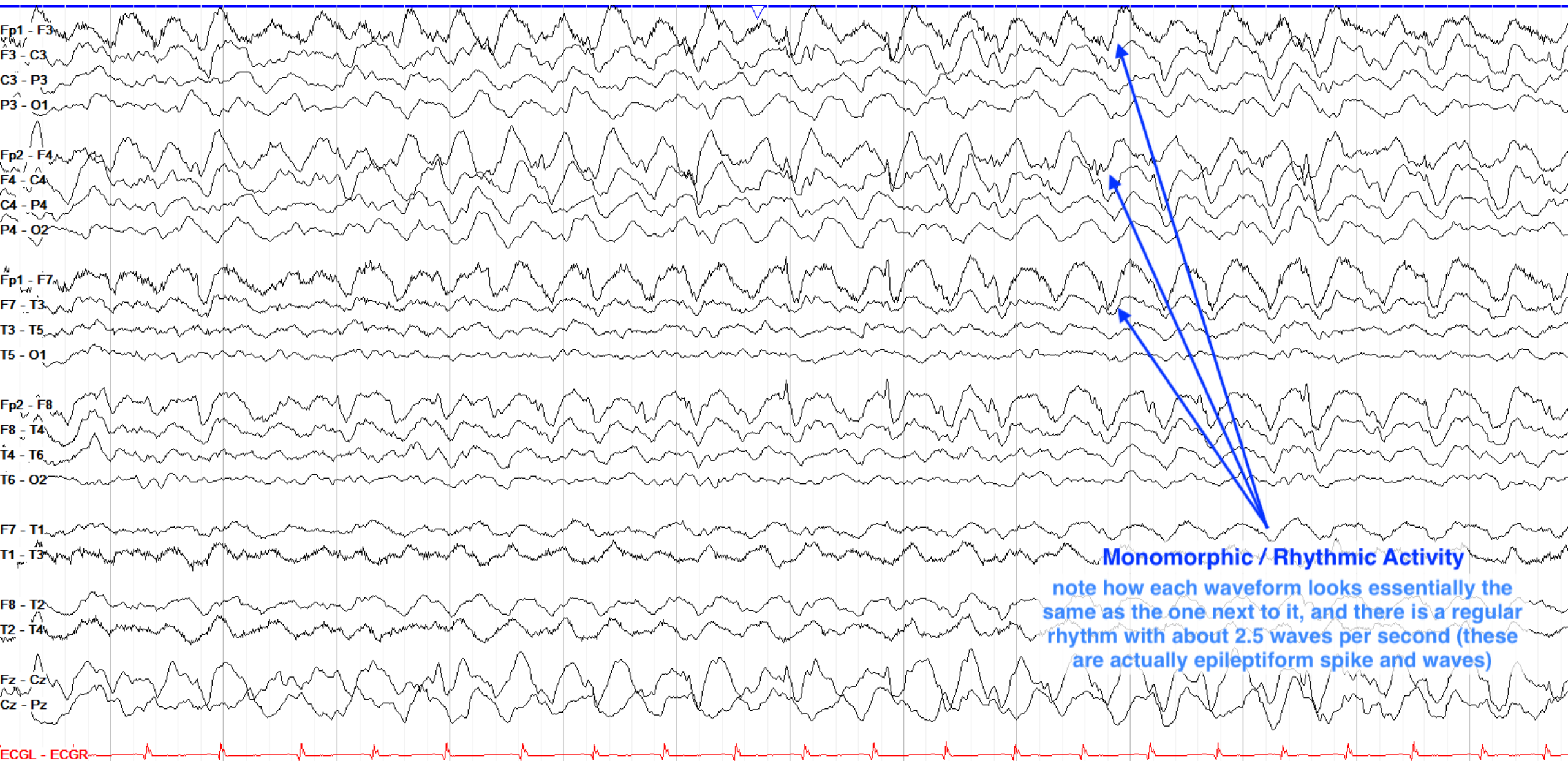


Rhythmicity

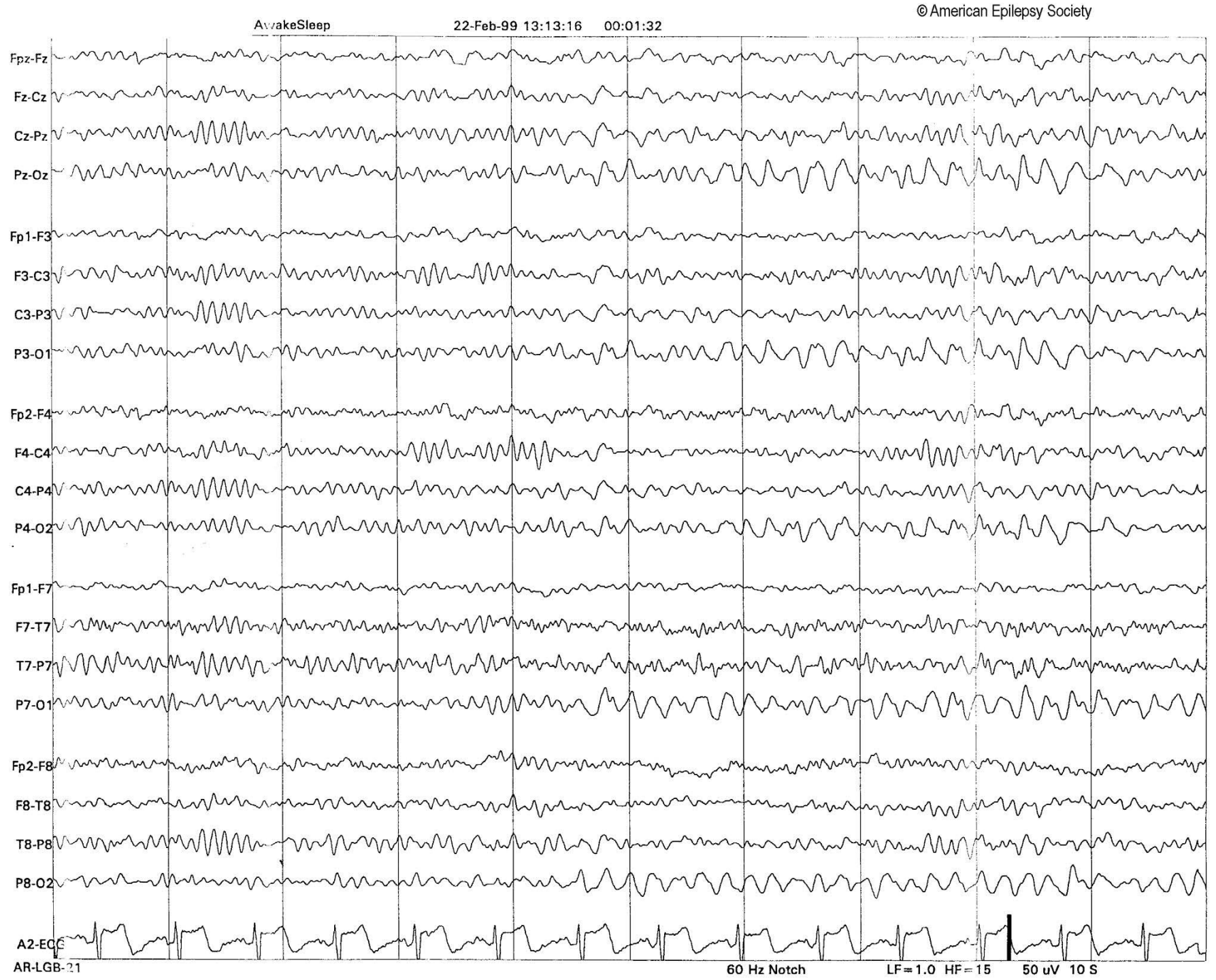


The posterior
dominant alpha
rhythm

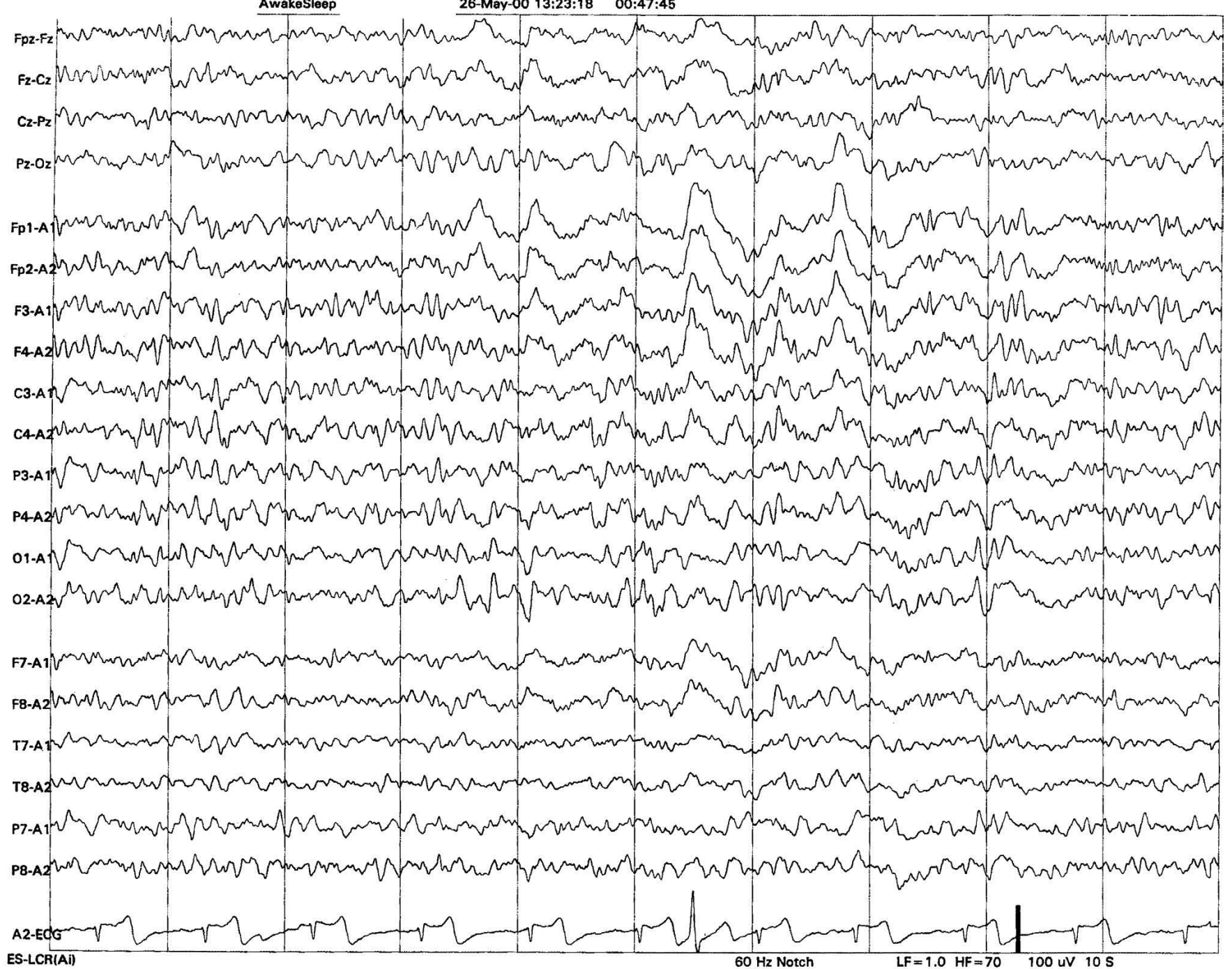
Rhythmicity



Awake
(drowsiness)



Stage 1 (N1) sleep



Stage 2 (N2) sleep



Stage 3 (N3)
Slow wave sleep

