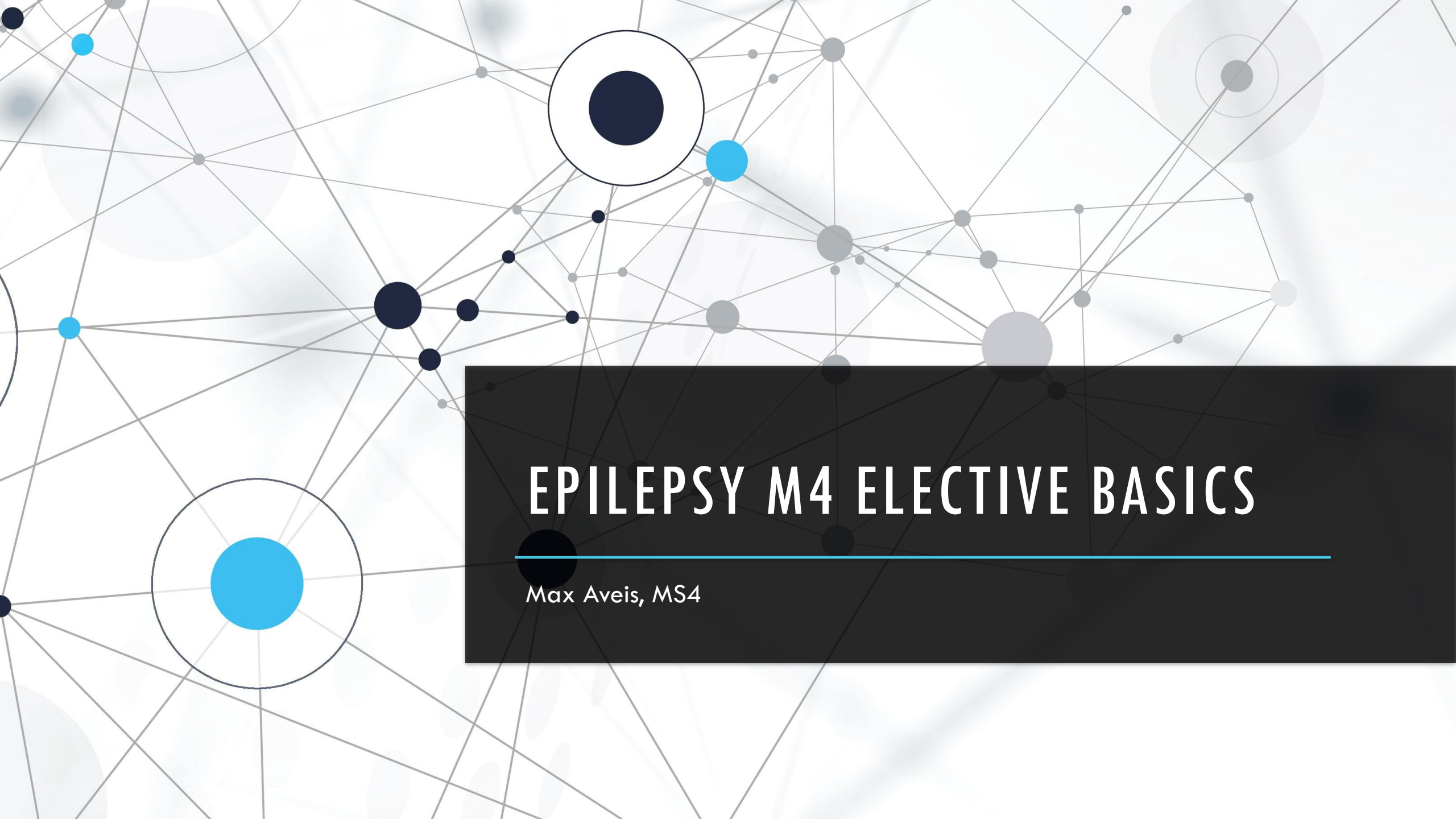


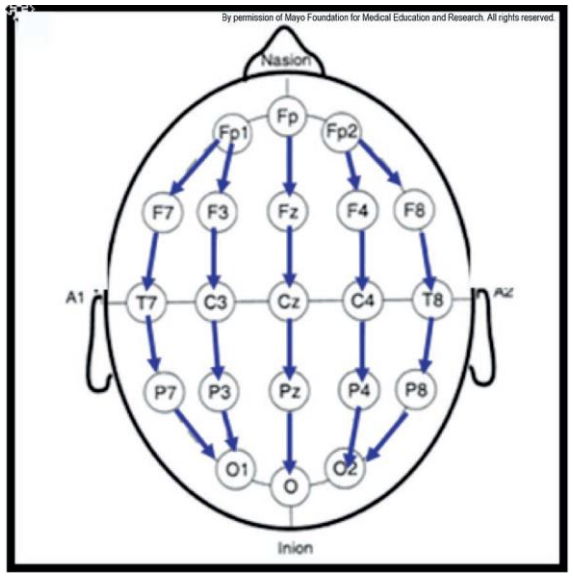
EPILEPSY M4 ELECTIVE BASICS

Max Aveis, MS4

WHERE DO I GO? WHO DO I TALK TO?

- On your first day, you will go to UCMC and find the main hospital elevators just outside the cafeteria.
- Take the elevator to 4th floor and walk out to the right, 4East, and go down the hallway that says Epilepsy Monitoring Unit. Once at the end of that hallway, go through the door on your right, 4163.
- You will meet the team: typically one fellow, one resident, and several EEG techs. The attending will arrive any time after 08:00.
- Become acquainted with the EMU and find your workstation, the resident/fellow will guide you.
- Shadow your first day and read basic guides to EEG. Jeremy Moeller guides on YouTube are very helpful.
- The morning consists of the fellow/resident reviewing continuous EEGs with the attending for billing. Try to observe and see what terminology you can pick up.
- You will mostly work alongside the resident since they do the EMU admissions on Sunday, Monday, and Tuesday.
- You will be in the EMU all day (unless you have clinic), and will round once per day on the EMU floor to check in on patients with the team.

WHAT IS AN EEG AND WHERE DO I START?



- EEG = electroencephalogram. It is a series of electrodes oriented on the scalp in an array detailed on the left image that attempts to record brain activity. Specifically it is used in the EMU to monitor for epileptiform activity in an attempt to create a differential diagnosis.

- You will deal with 2 kinds of EEG recordings: routine EEGs and continuous EEGs. Routines last 20min and are part of some patient workups throughout the hospital. Continuous EEGs are the ones monitored in the EMU and are typically for patients who require a differential diagnosis/need to capture their seizure episodes over a course of 5 days. Some inpatients will be on continuous for possible status/concern for seizures.

- Even number = Right side

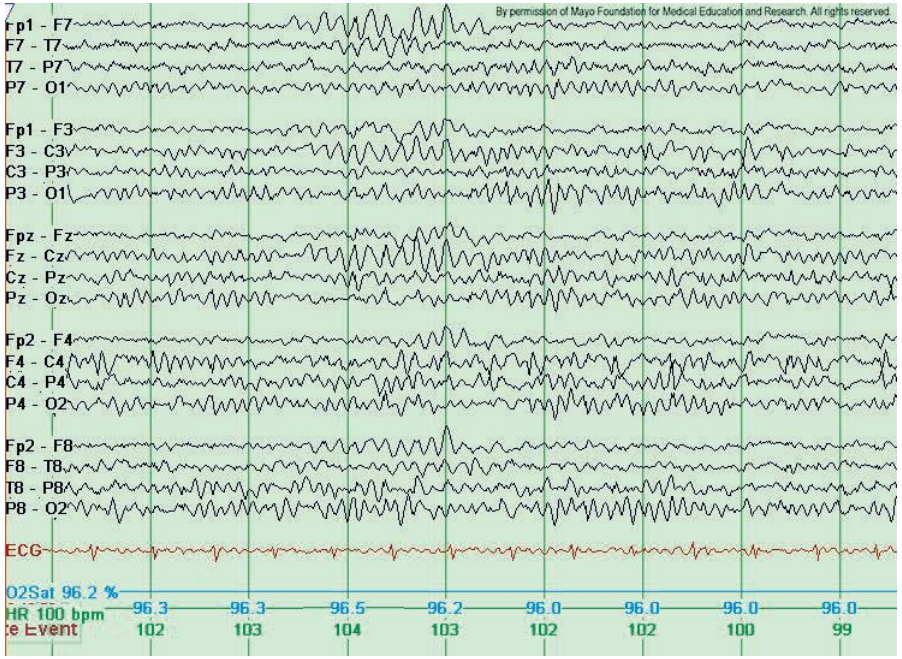
- Odd number = Left side

- F = frontal, P = parietal, T = temporal, O = occipital, C = central, A = auricular, z = midline

- The picture to the left displays a "montage" or specific layout of the EEG leads you will see on the screen. This montage is called the longitudinal bipolar or "double banana" since after looking at it for awhile it looks like 2 bananas facing each other.

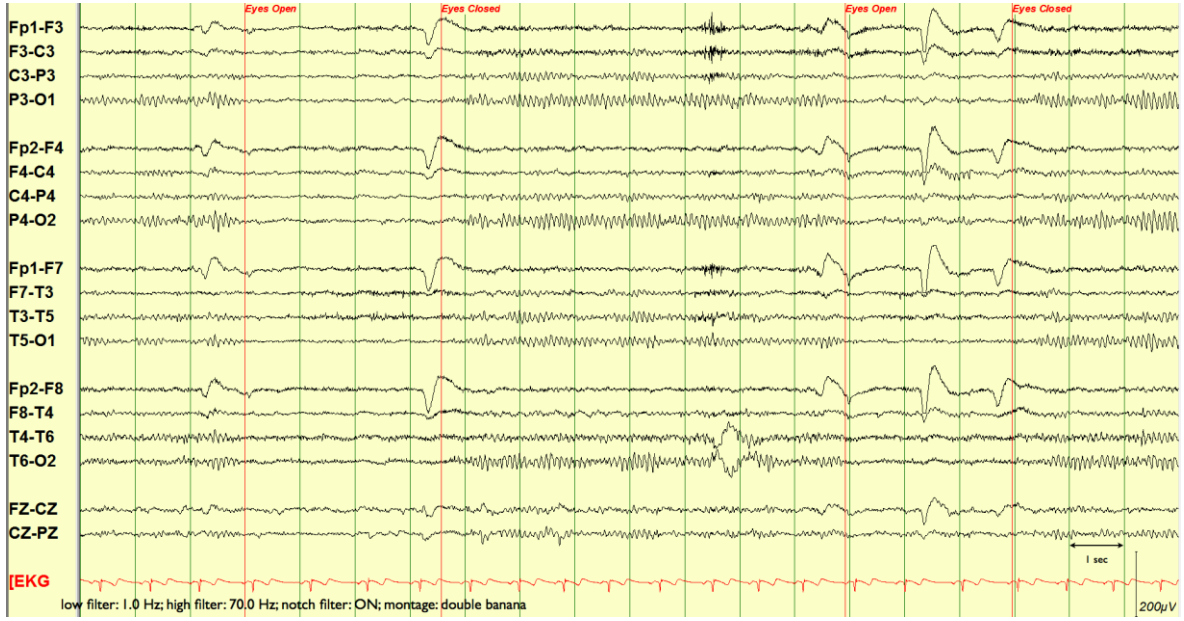
- There are several other montages but this one is the main one you will work with to get a general feel for reading EEGs.

WHERE DO I START? (CONT.)



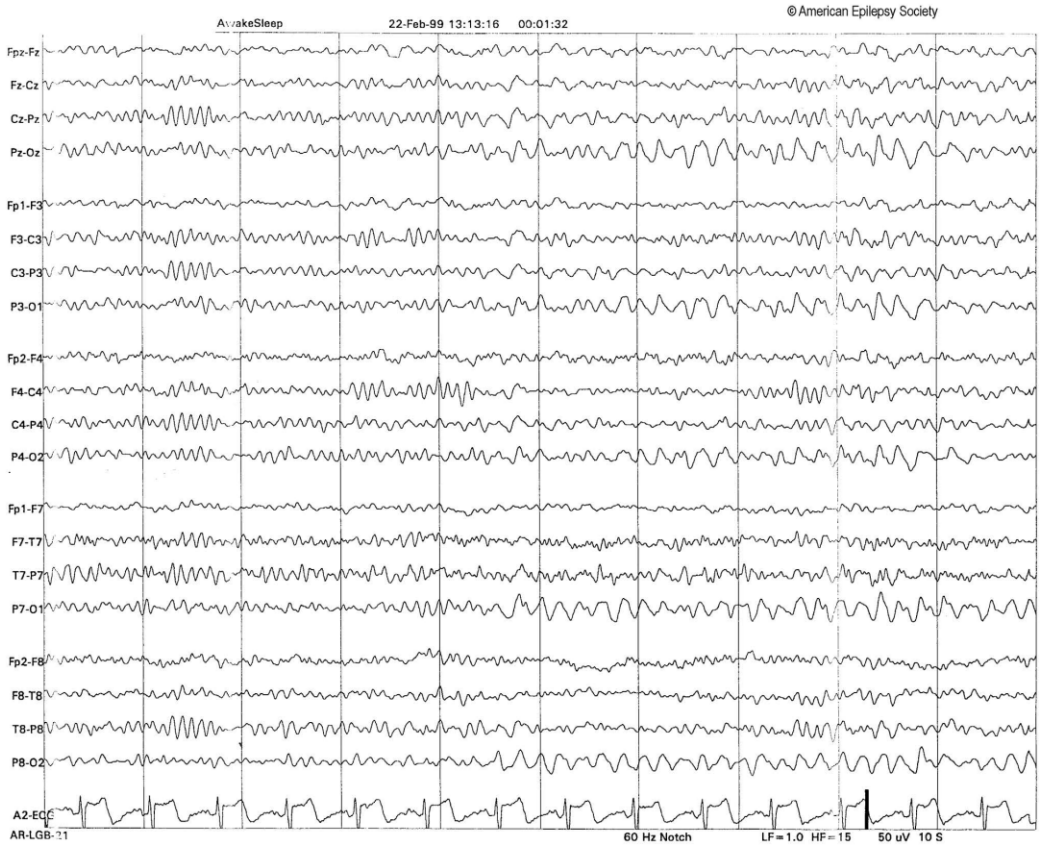
- This image is the screen you will typically see with the leads arranged in the "double banana" montage. They are arranged longitudinally from front to back, on the sides and top of the head as indicated on the previous slide.
- There is always a single EKG lead at the bottom of the montage.
- Between each vertical line represents 1 second in time.
- The entire page represents an "epoch" of time.
- Waveforms are measured in Frequency (Hz) and Amplitude (mV). You will mostly be dealing with analysis of frequency.
- Frequency is analyzed as number of waves per 1 second block of time and is separated into different types:
  - Delta: 1-3Hz
  - Theta: 4-7Hz
  - Alpha: 8-12Hz
  - Beta: >13Hz

NORMAL AWAKE EEG



- First step when reading an EEG is to determine when the patient is awake, what is their "background." Background is assessed by measuring the Posterior Dominant Rhythm (PDR).
- PDR is assessed by looking at the Occipital leads and counting the frequency. Normal awake PDR for adults is typically in the alpha frequency range (8-12Hz).
- PDR is seen when patients are awake and their eyes are CLOSED.
  - Note to the left where it labels eye opening and closing at the top. These large, isolated waveforms are normal and indicate eye opening/closure.
- In the center of the image, note the increased oscillatory waveforms in the posterior/occipital leads following eye closure. If you count the peaks within a second, you will have your PDR.
- Typically, count out a couple seconds after eye closure before counting your PDR.

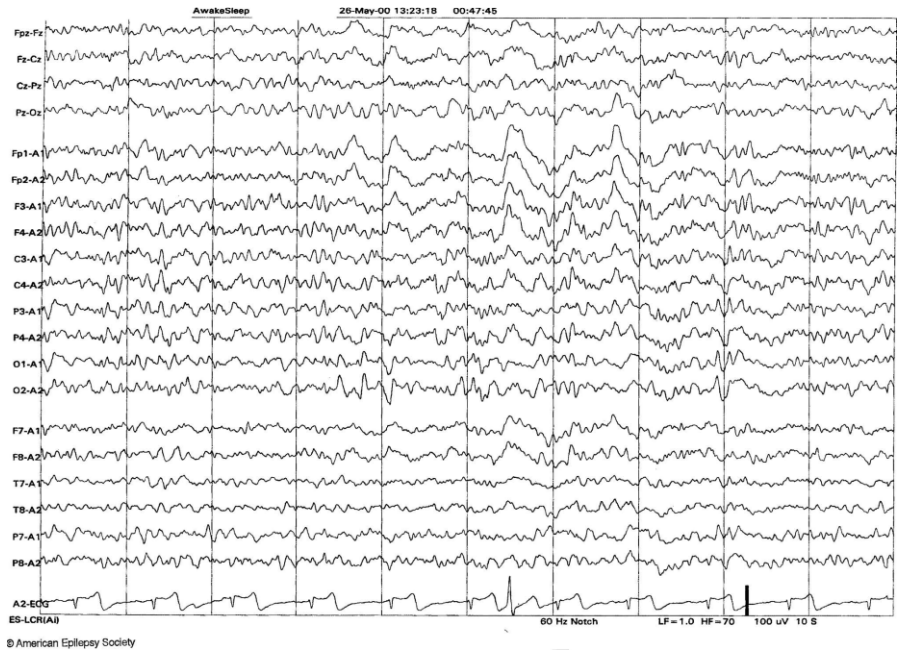
NORMAL DROWSINESS ON EEG



- Generally slower frequencies in the PDR background (occipital leads) while awake
- Seen transiently, considered to be “bursts” of generalized/diffuse theta or delta frequency
- There is loss of muscle and movement artifacts (this is more complex and sometimes difficult to discern, so do not hesitate to ask your resident/fellow/attending to double check for artifact)
- Reduced blinking and lateral eye movement

NORMAL SLEEP ON EEG

- Sleep on EEG is broken down into 3 types:
  - NREM (non-REM) light sleep, stages I-II
  - Deeper SWS (slow wave sleep), stages III-IV
  - REM
- The EEG on the top right depicts NREM (stage I) sleep
  - Stage I sleep is very similar to drowsiness and features some slower delta/theta frequencies and vertex waves (V-waves in the fronto-central leads)
- The EEG on the bottom right depicts NREM (stage II) sleep
  - Stage II sleep is more slower delta/theta frequency in the background
  - 2 major morphologies to look for are “K complexes” and “sleep spindles” (these can be seen faintly in the penultimate second of the epoch shown in the bottom right EEG)
- These will be the predominant sleep waveforms you will see in the EMU.
- SWS and REM are more distinct and thus can be discerned more clearly and with a bit of guidance from your resident/fellow/attending



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- Britton JW, Frey LC, Hopp JLet al., authors; St. Louis EK, Frey LC, editors. *Electroencephalography (EEG): An Introductory Text and Atlas of Normal and Abnormal Findings in Adults, Children, and Infants* [Internet]. Chicago: American Epilepsy Society; 2016. Available from: https://www.ncbi.nlm.nih.gov/books/NBK390354/
- https://eegatlas-online.com/index.php/en/alphabetical-index/posterior-dominant-rhythm-guest