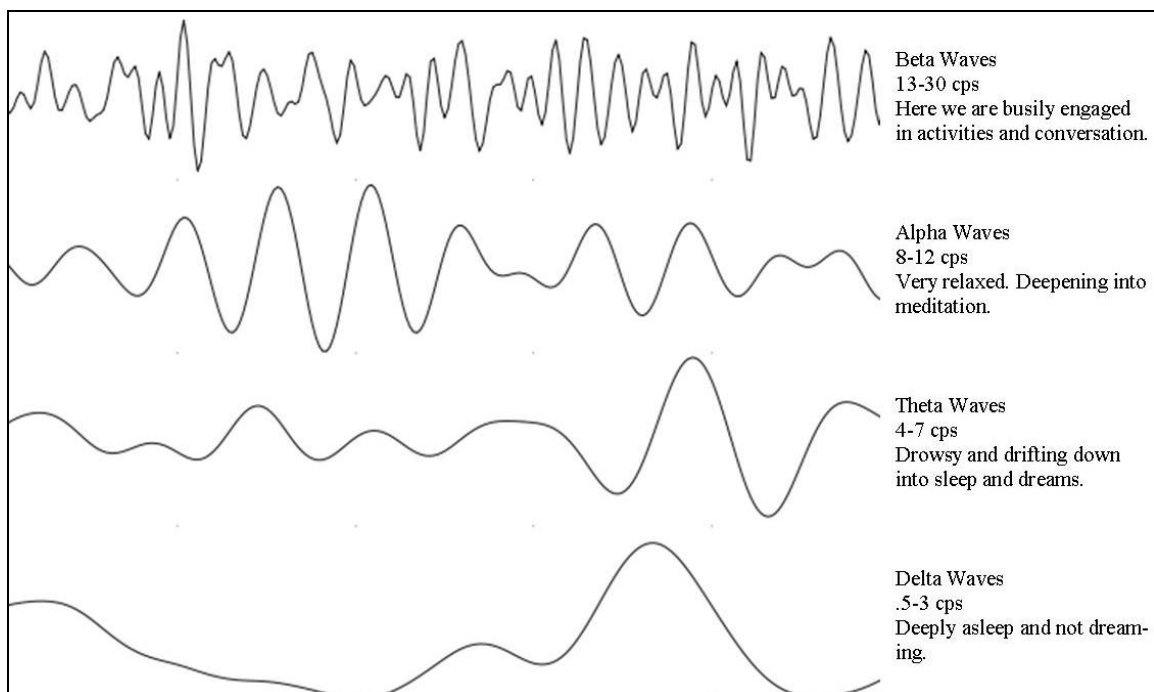


## Unit VIII – Problem 7 – Physiology lab: EEG

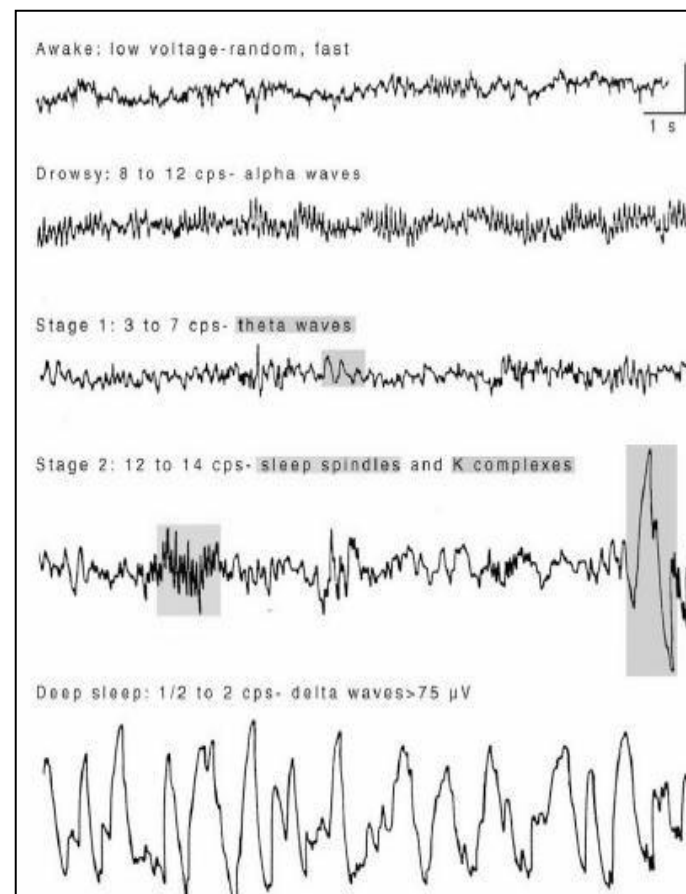
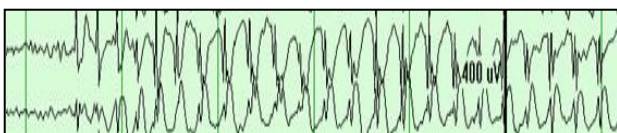


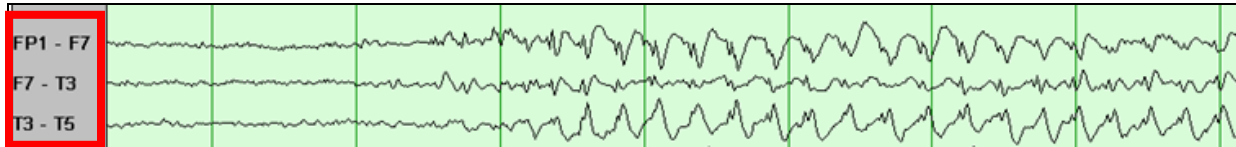
- **EEG stands for:** electro-encephalo-graphy. It is recording the electrical activity of the brain generated by pyramidal cells of the cortex.
- **EEG is classified to:**
  - **Spontaneous:** this refers to normal activity of the brain (when there is no stimulation) which is detected as soon as we place electrodes.
    - ✓ In spontaneous EEG, a lot of electrodes are placed on the head of the patient → so signals are recorded from everywhere (if there is a focal area with abnormal electrical activity → it will be detected).
  - **Evoked:** in which the examiner/doctor is stimulating the generation of a specific signal.
    - ✓ **Example:** evoked EEG is important to test for hearing → providing a sound to the patient → and if he hears it you ask him to press on a button → until you reach the threshold of hearing (you check the threshold of the patient).
- The patient is also asked to close his eyes (so the occipital lobe will not be functioning and thus alpha waves of the brain will be detected by occipital electrodes → then you ask the patient to open his eyes → therefore, you will know if there is synchronization or desynchronization of waves.
- **Routine EEG recording:** disc electrodes are applied according to 10-20 system of electrode placement (recording continues for 20 minutes).
- **Strength and advantages of EEG:**
  - Supplement neuro-imaging studies.
  - Providing direct evidence of epileptic abnormality.
  - Only test to show abnormalities in epileptic patients.
  - Low cost.
  - Low morbidity.
  - Readily repeatable.
  - Portable.
- **The signal recorded by EEG is very tiny** → measured in  $\mu\text{V}$  (so it must be augmented and therefore a lot of artifacts will appear).





- **EEG is used for (memorize 3-4 points for the exam):**
  - Sleep disorders (polysomnography).
  - Cortical depression (when the cortex is depressed → the detected waves will have low frequency and big amplitude “delta waves”).
  - Intracranial hemorrhage: no waves will be detected at the side where hemorrhage exist.
  - Focal cortical lesion.
  - Generalized epilepsy.
  - Focal epilepsy.
  - Following the health of the fetus during difficult delivery: slow electrical activity of the brain of the fetus indicates anoxia of the brain and thus the route of delivery will be shifted to cesarean.
  - Brain death → it is diagnosed mainly by evoked EEG.
  - Follow up of patients in emergency rooms, and operating theaters.
- **Notice that in identical twins → electrical activity of the brain might be similar.**
- **Usually in epilepsy** → EEG is normal unless you are recording during the attack or there are interictal spikes or focal epilepsy.
- **Activation procedures:** in which we induce weakness of electrical activity in a known epileptic patient who shows negative EEG:
  - **Routine:**
    - ✓ Eye opening and closure.
    - ✓ Intermittent photic stimulation.
    - ✓ Hyperventilation (for 2 minutes): which will cause washout of CO<sub>2</sub> (notice that carbon dioxide is important for cerebral vasodilatation and when it is washed out the blood flow to the brain will be decreased).
  - **Optional:**
    - ✓ Sleep deprivation.
    - ✓ Sedated sleep.
    - ✓ Withdrawal of antiepileptic drugs.
    - ✓ Video games or visual patterns.
- **The image shows waves appearing during different states of alertness and sleep (this comes as a matching question in OSPE exam):**
  - **When a person is awake** → beta waves.
  - **When a person becomes drowsy** → alpha waves appear.
  - **1<sup>st</sup> degree sleep** → theta waves.
  - **2<sup>nd</sup> degree sleep** → characterized by the presence of sleep spindles and K-complexes.
  - **Deep sleep** → delta waves.
  - **REM-sleep (not shown in the image):** similar to waves appearing in awake state but characterized by the presence of saw-tooth waves.
- **Absence seizure:** it is a type of generalized seizure in which the EEG is characterized by “domes and spikes” or “slow waves and spikes” at a frequency of 3/sec.





- **How to read an EEG?**

- **Letters:** each letter is corresponding to an area in the brain:

- ✓ PF: prefrontal.
- ✓ F: frontal.
- ✓ P: parietal.
- ✓ O: occipital.
- ✓ T: temporal.
- ✓ C: central.

- **Numbers:**

- ✓ Odd number: left side of the brain.
- ✓ Even number: right side of the brain.

- **Hypsarrhythmia:** there is no rhythm for the electrical activity of the brain (irregular rhythm).

- **How to put the electrodes (oral station in OSPE exam):**

- **There are 3 electrodes:**

- ✓ Ground: it is placed on the ear (away from the brain).
- ✓ Black and white electrodes: they are placed on both sides of the occipital bone (these are the recording electrodes).

- =====
- **To treat epilepsy** → there is an option of surgical excision of the temporal lobe → but if excised temporal lobe is in the dominant area of the brain → there will be a risk of losing the speech center.

- **How to investigate the language-dominant hemisphere?**

- **Functional MRI:** in which the patient is asked to speak → and the doctor observe where the blood flow is going.
- **Wada test (there will be a question about this test in MCQ):** you anesthetize half of the patient's brain and you check if he can talk or not.

- **Craniotomy and electrodes:**

- You place number of electrodes over the brain surface of the patient after you remove his skull → you ask the patient to say his name and you stimulate each electrode at every he says his name until an interruption appears → this indicates that the speech center of the patient is under that specific electrode.