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طبيبة اختصاص في علم وظائف الجسم و الفسلجة العصبية

دكتوراه في طب وظائف الجهاز العصبي

رئيس فرع الفسلجة و الفيزياء الطبية | كلية الطب | جامعة بابل

مديرة وحدة تخطيط الدماغ-الأعصاب-العضلات في مستشفى

مرجان التعليمي

عضو الاتحاد الاوربي للعلوم العصبية

عضو الجمعية العراقية لأطباء الفسلجة العصبية


عضو الاتحاد البريطاني للعلوم العصبية/جامعة كامبرج

شهادة التدريب في مستشفى الجامعة الامريكية/بيروت

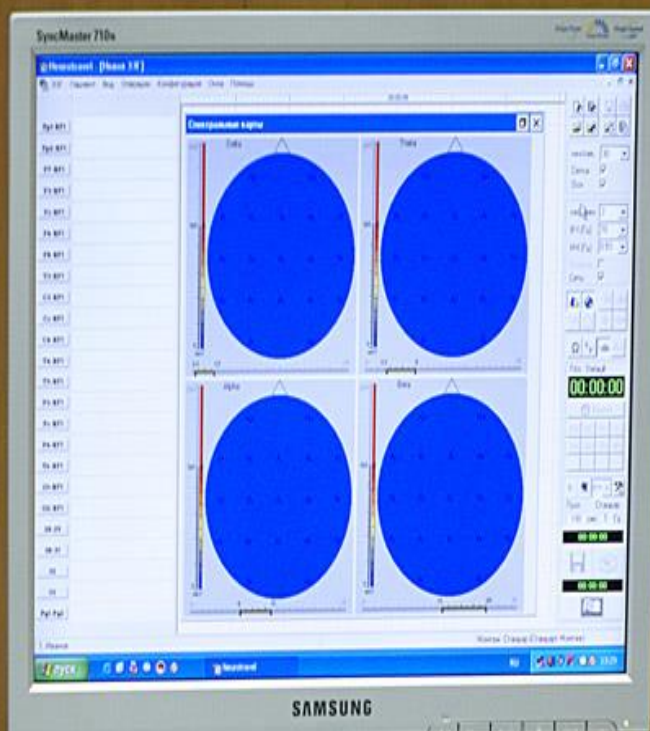
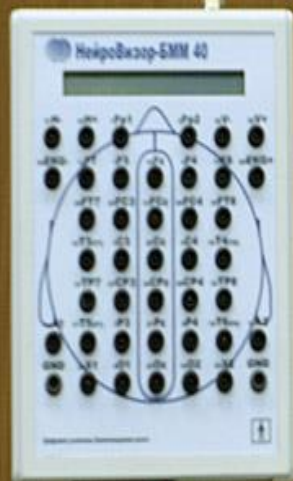
***MBChB, MSc, PhD, BNA, Neurophysiology***



# ELECTROENCEPHALOGRAPHY (EEG)



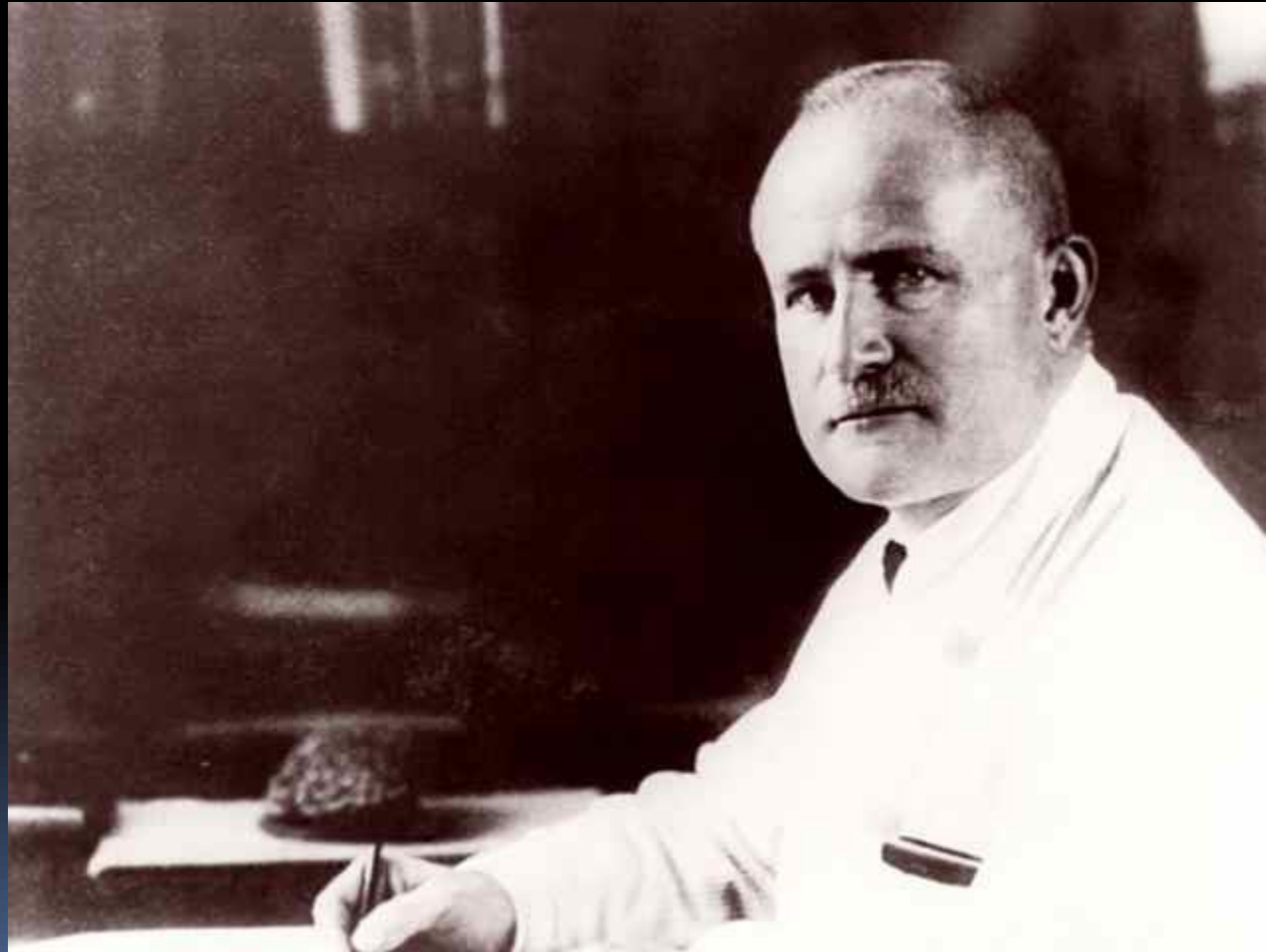
is typically a non-invasive method to record electrical activity of the brain along the scalp. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a period of time, as recorded from multiple electrodes placed on the scalp.



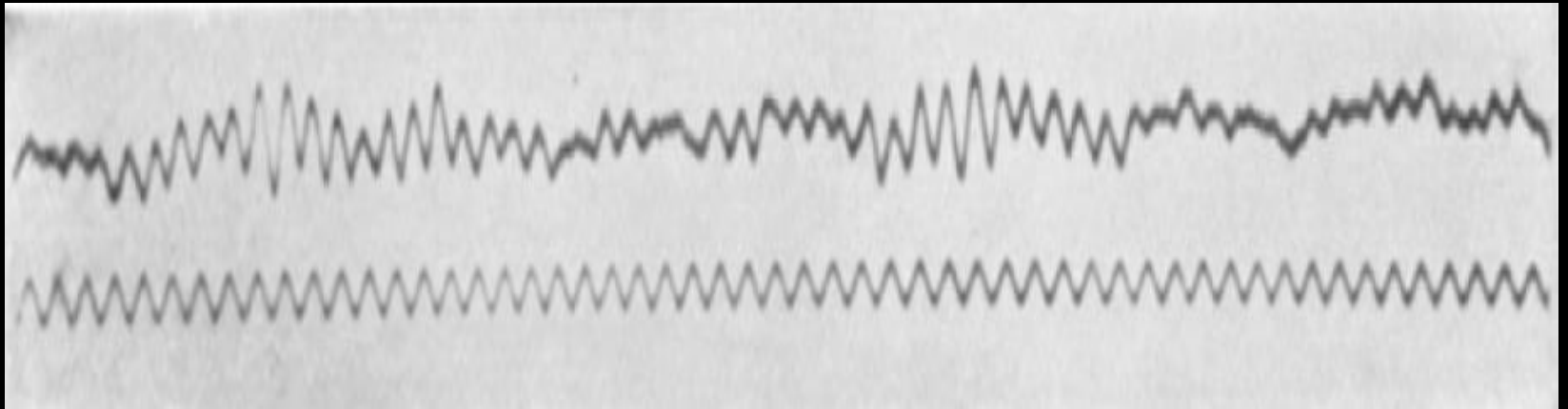
# Head cap



# Hens Berger




# 1<sup>st</sup> EEG record



# Medical use

- A routine clinical EEG recording typically lasts 20–30 minutes (plus preparation time) and usually involves recording from scalp electrodes. Routine EEG is typically used in the following clinical circumstances:
  - to distinguish epileptic seizures from other types of spells, such as psychogenic non-epileptic seizures, syncope (fainting), sub-cortical movement disorders and migraine variants.
  - to differentiate "organic" encephalopathy or delirium from primary psychiatric syndromes such as catatonia
  - to serve as an adjunct test of brain death
  - to prognosticate, in certain instances, in patients with coma
  - to determine whether to wean anti-epileptic medications



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- The normal Electroencephalography (EEG) varies by age. The neonatal EEG is quite different from the adult EEG. The EEG in childhood generally has slower frequency oscillations than the adult EEG.
  - EEG can be recorded either during sleep or during wakefulness.



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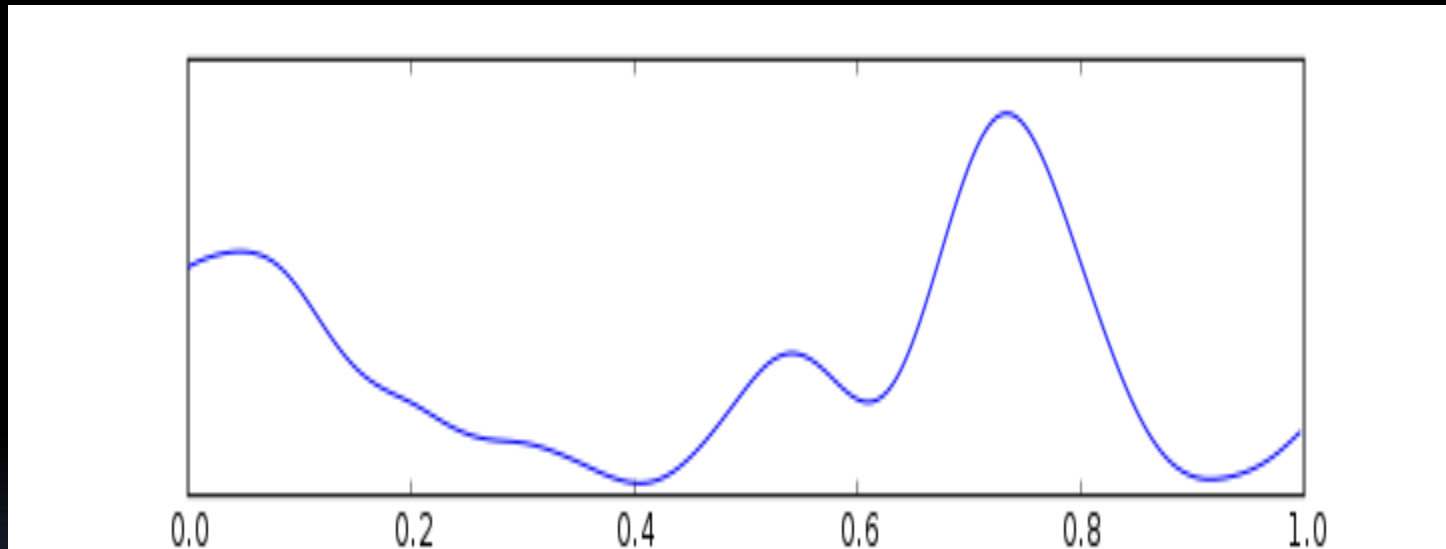


# Wave patterns

- **Delta wave**

is the frequency range up to 4 Hz. It tends to be the highest in amplitude and the slowest waves. It is seen normally in adults in slow wave sleep. It is also seen normally in babies. It may occur focally with subcortical lesions and in general distribution with diffuse lesions, metabolic encephalopathy hydrocephalus or deep midline lesions. It is usually most prominent frontally in adults (e.g. FIRDA - Frontal Intermittent Rhythmic Delta) and posteriorly in children (e.g. OIRDA - Occipital Intermittent Rhythmic Delta).

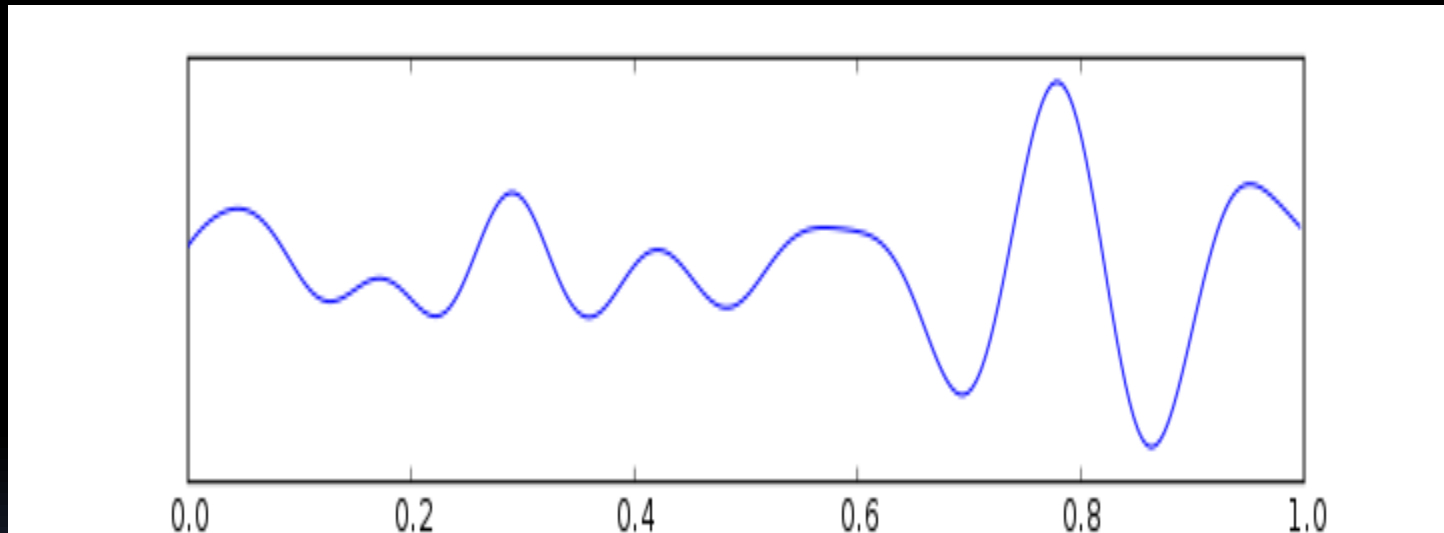
# Deta wave



# Theta rhythm

- is the frequency range from 4 Hz to 7 Hz. Theta is seen normally in young children. It may be seen in drowsiness or arousal in older children and adults; it can also be seen in meditation. Excess theta for age represents abnormal activity. It can be seen as a focal disturbance in focal subcortical lesions; it can be seen in generalized distribution in diffuse disorder or metabolic encephalopathy or deep midline disorders or some instances of hydrocephalus. On the contrary this range has been associated with reports of relaxed, meditative, and creative states

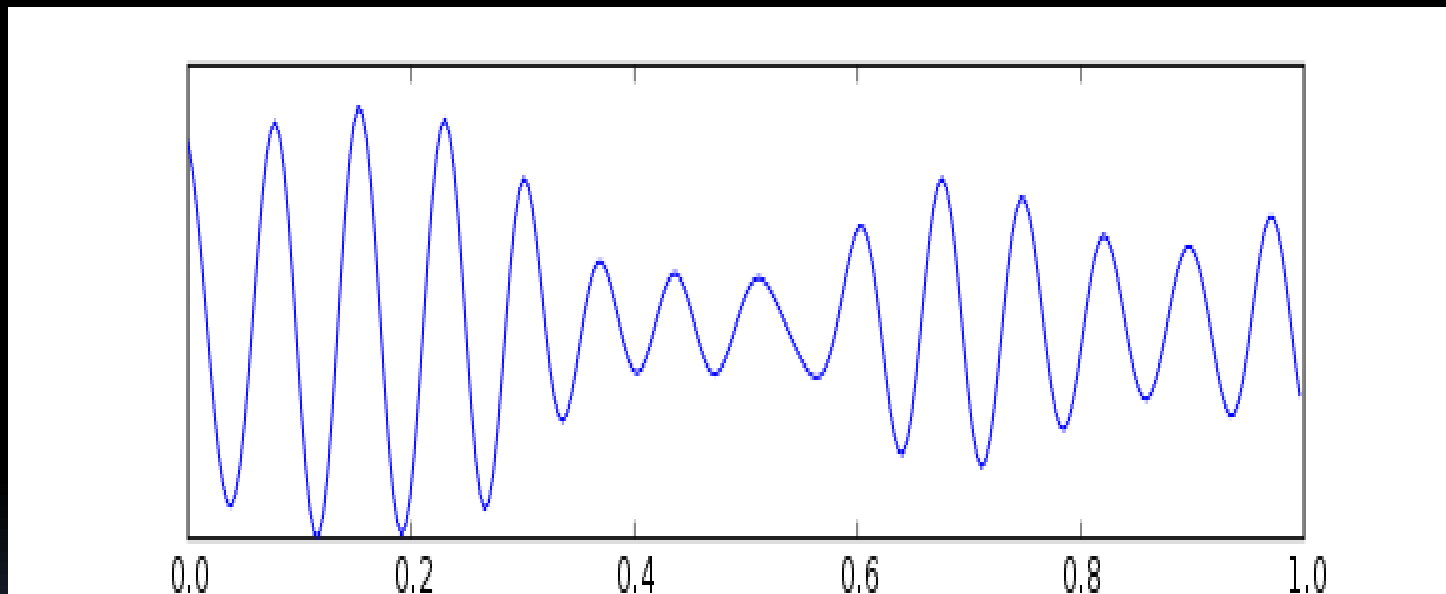
# Theta wave



# Alpha wave

- is the frequency range from 7 Hz to 14 Hz. This was the "posterior basic rhythm" (also called the "posterior dominant rhythm" or the "posterior alpha rhythm"), seen in the posterior regions of the head on both sides, higher in amplitude on the dominant side. It emerges with closing of the eyes and with relaxation, and attenuates with eye opening or mental exertion. The posterior basic rhythm is actually slower than 8 Hz in young children (therefore technically in the theta range).

# Alpha wave

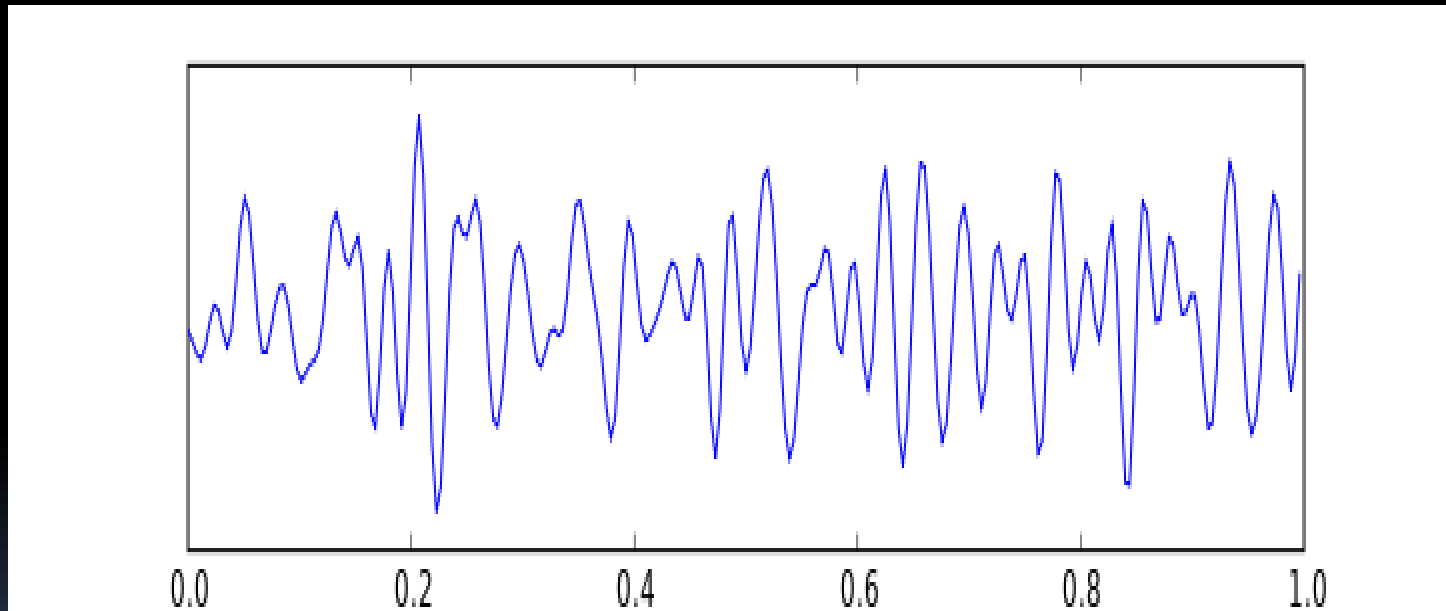




# Beta wave

- is the frequency range from 15 Hz to about 30 Hz. It is seen usually on both sides in symmetrical distribution and is most evident frontally. Beta activity is closely linked to motor behavior and is generally attenuated during active movements. Low amplitude beta with multiple and varying frequencies is often associated with active, busy or anxious thinking and active concentration. Rhythmic beta with a dominant set of frequencies is associated with various pathologies and drug effects, especially benzodiazepines. It may be absent or reduced in areas of cortical damage. It is the dominant rhythm in patients who are alert or anxious or who have their eyes open.

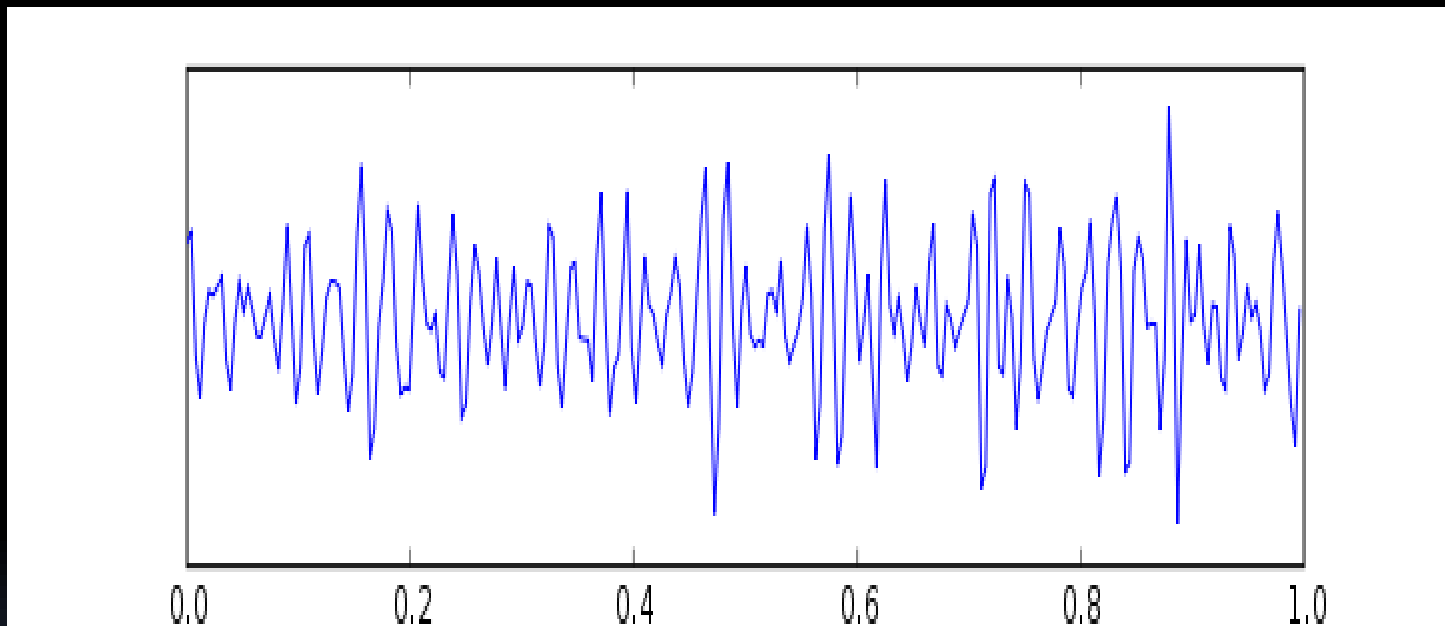
# Beta wave



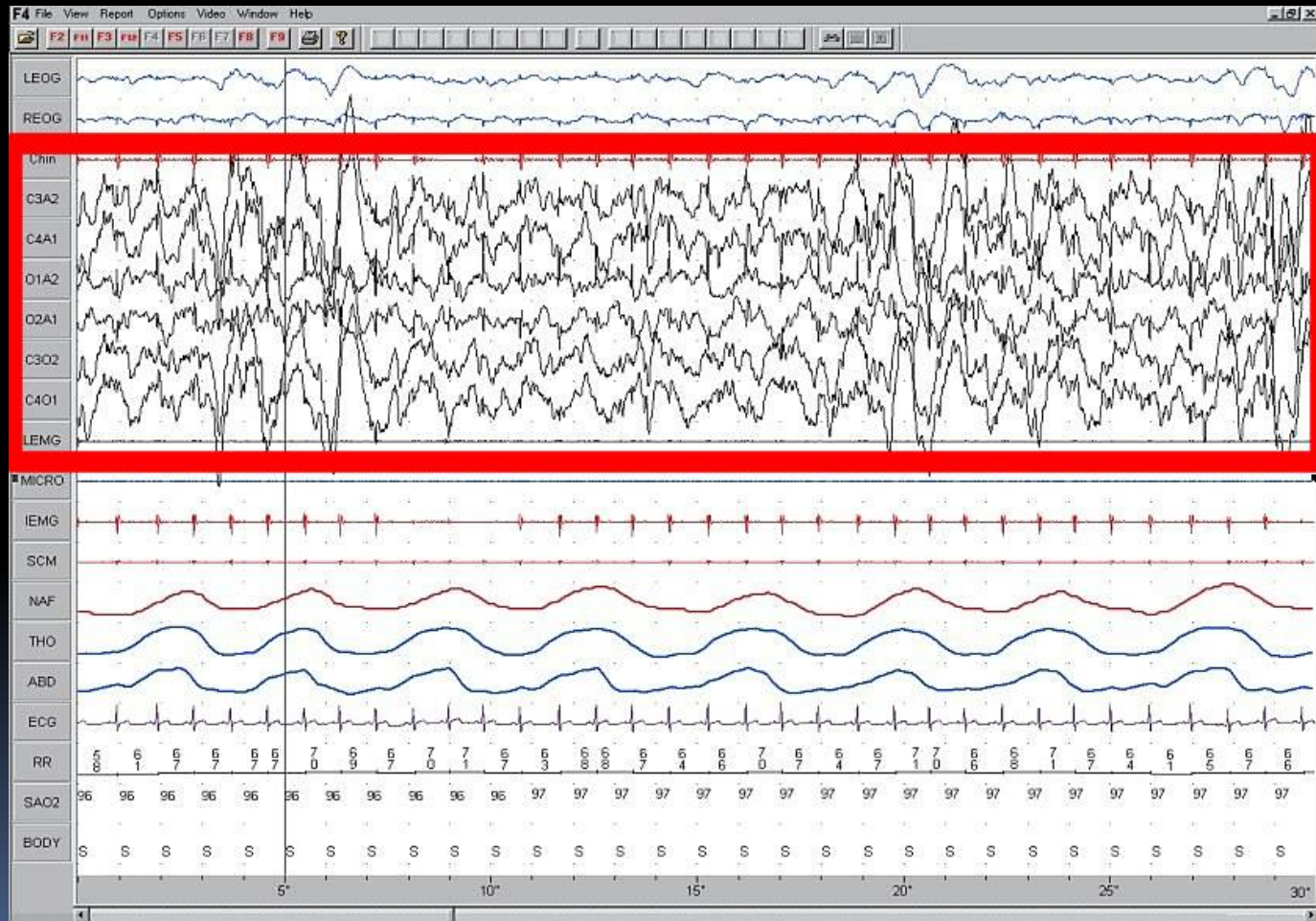
# Gamma wave

- is the frequency range approximately 30–100 Hz. Gamma rhythms are thought to represent binding of different populations of neurons together into a network for the purpose of carrying out a certain cognitive or motor function.
- Mu ranges 8–13 Hz., and partly overlaps with other frequencies. It reflects the synchronous firing of motor neurons in rest state. Mu suppression is thought to reflect motor mirror neuron systems, because when an action is observed, the pattern extinguishes, possibly because of the normal neuronal system and the mirror neuron system "go out of sync", and interfere with each other.

# Gamma wave



# Sleep



# Abnormal activity

- Abnormal activity can broadly be separated into [epileptiform](#) and non-epileptiform activity. It can also be separated into focal or diffuse.
- Focal epileptiform discharges represent fast, synchronous potentials in a large number of neurons in a somewhat discrete area of the brain. These can occur as interictal activity, between seizures, and represent an area of cortical irritability that may be predisposed to producing epileptic seizures. Interictal discharges are not wholly reliable for determining whether a patient has epilepsy nor where his/her seizure might originate.
- Generalized epileptiform discharges often have an anterior maximum, but these are seen synchronously throughout the entire brain. They are strongly suggestive of a generalized epilepsy.
- Focal non-epileptiform abnormal activity may occur over areas of the brain where there is focal damage of the cortex or [white matter](#). It often consists of an increase in slow frequency rhythms and/or a loss of normal higher frequency rhythms. It may also appear as focal or unilateral decrease in amplitude of the EEG signal.
- Diffuse non-epileptiform abnormal activity may manifest as diffuse abnormally slow rhythms or bilateral slowing of normal rhythms.
- Intracortical Encephalogram electrodes and sub-dural electrodes can be used in tandem to discriminate and discretize artifact from epileptiform and other severe neurological events.
- More advanced measures of abnormal EEG signals have also recently received attention as possible biomarkers for different disorders such as [Alzheimer's disease](#).

# Spike and wave

