EEGLAB and ERPLAB
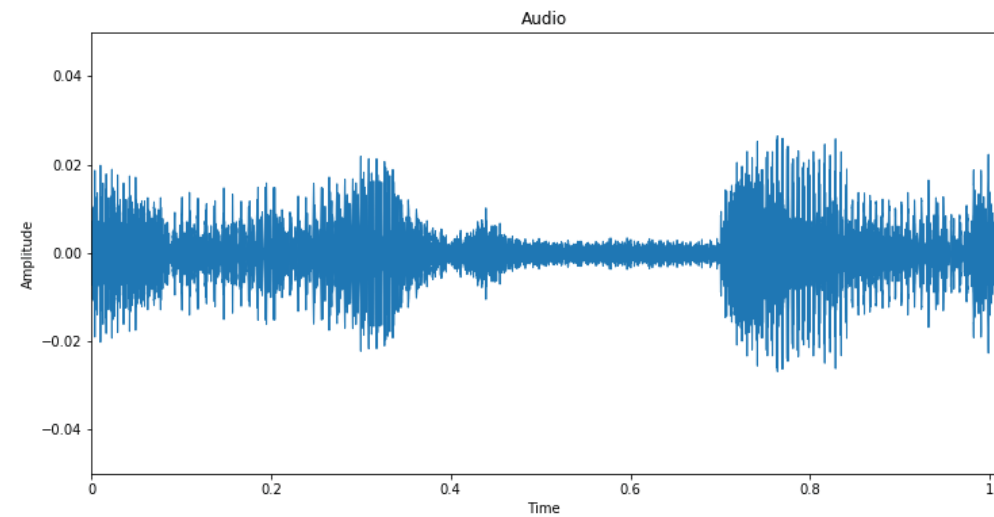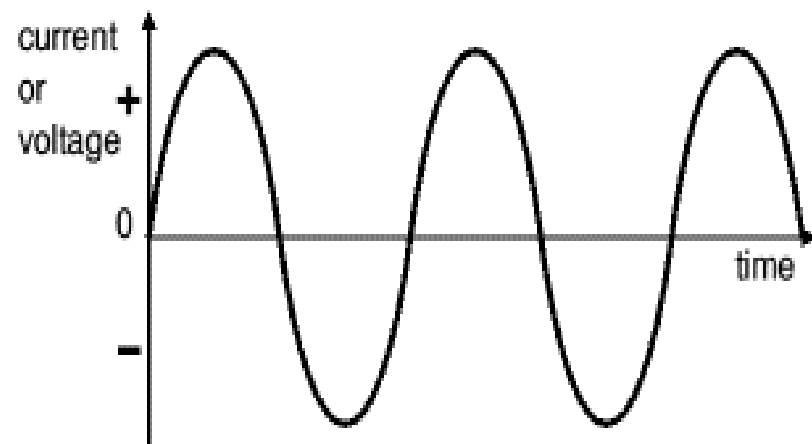
Interdisciplinary Schools

Signal Processing Department

Parisa Khoorahe
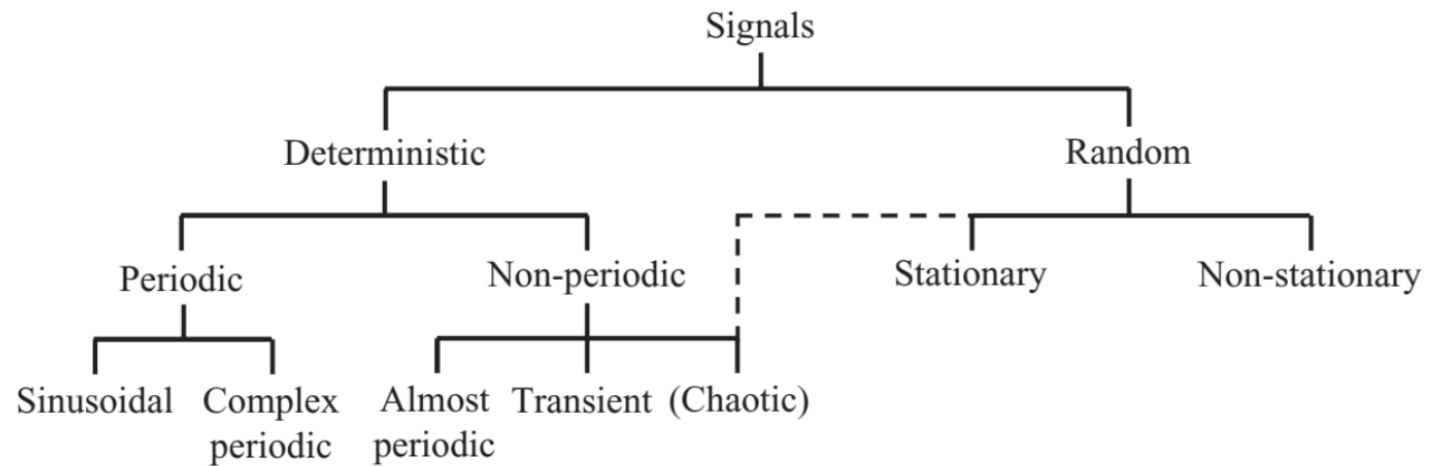
EEGLAB and ERPLAB

+ Introduction (session 1)

+ EEGLAB (sessions 2 & 3)
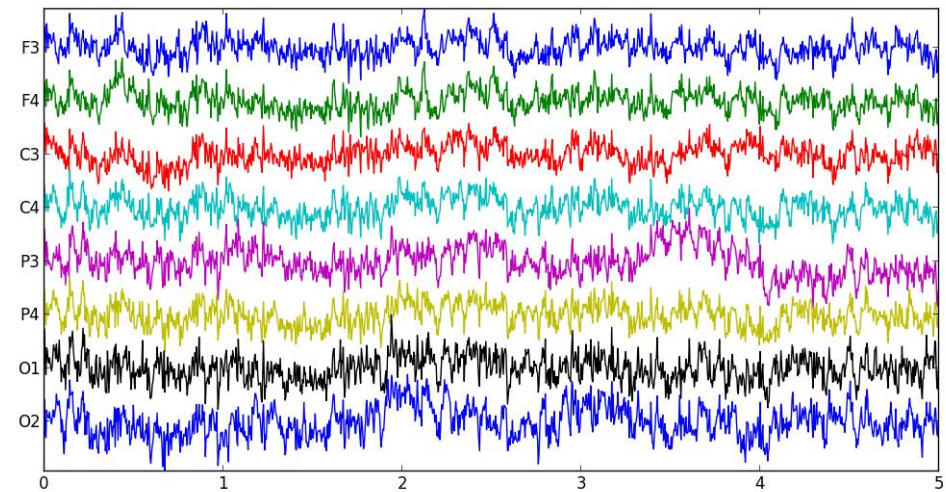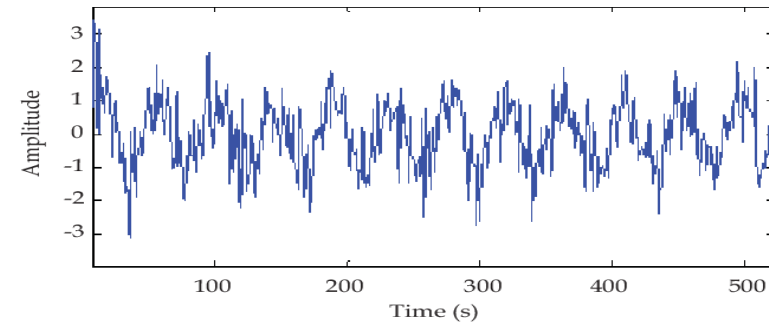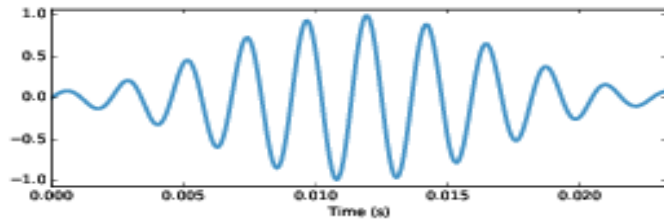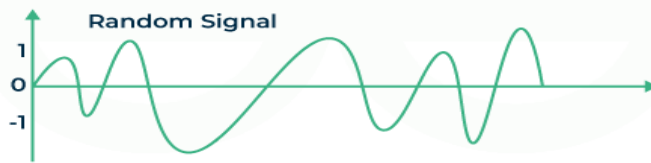
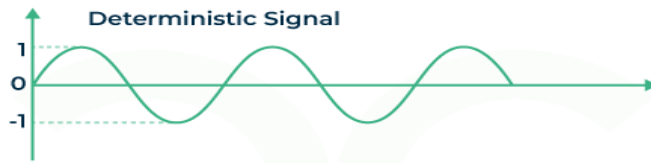+ EEGLAB-ICA (session 4)
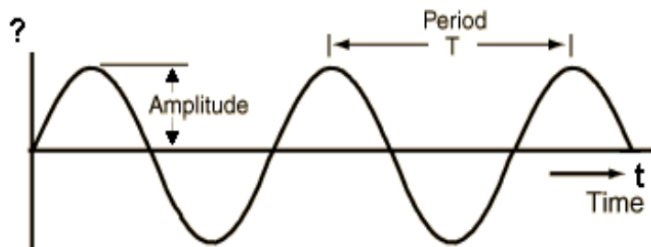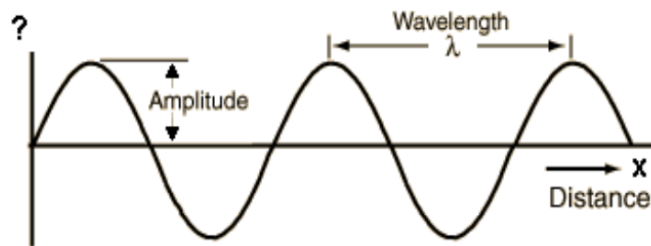
+ ERPLAB (sessions 5 & 6)

Signal

Signal Classification

Signal Classification

Signal Characteristics

Characteristics of a sinusoidal signal

$$f = \frac{1}{T}$$

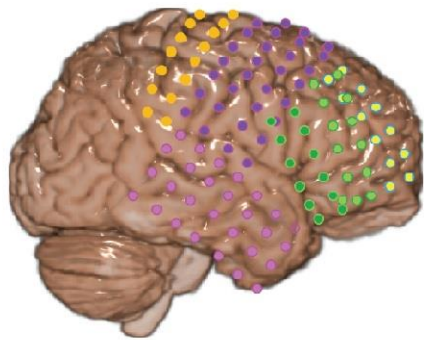$$f = \frac{v}{\lambda}$$

$$f = \frac{\omega}{2\pi}$$

where,

→ f is the frequency in hertz, and

→ T is the time to complete one cycle in seconds

→ v is the wave speed, and

→ λ is the wavelength of the wave

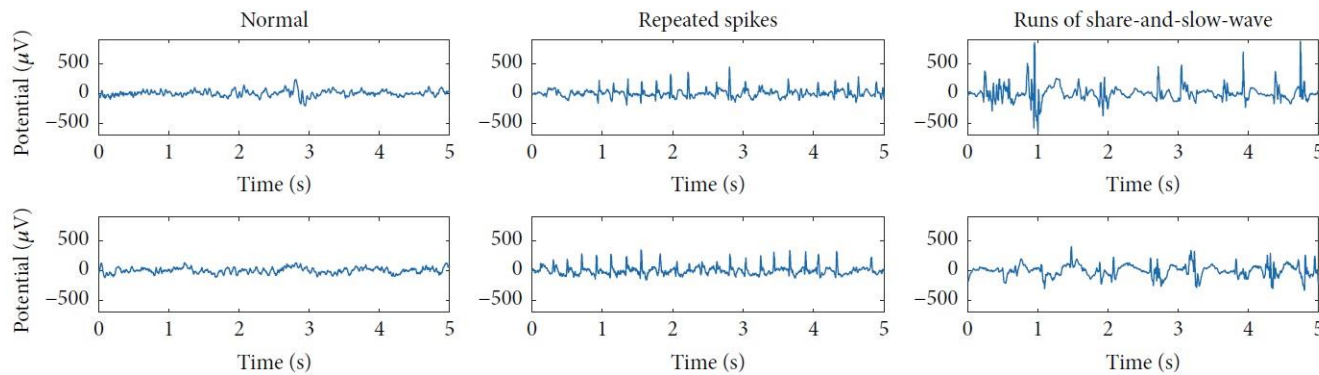→ ω is the angular frequency

$$x(t) = A\sin(2\pi f t + \phi)$$
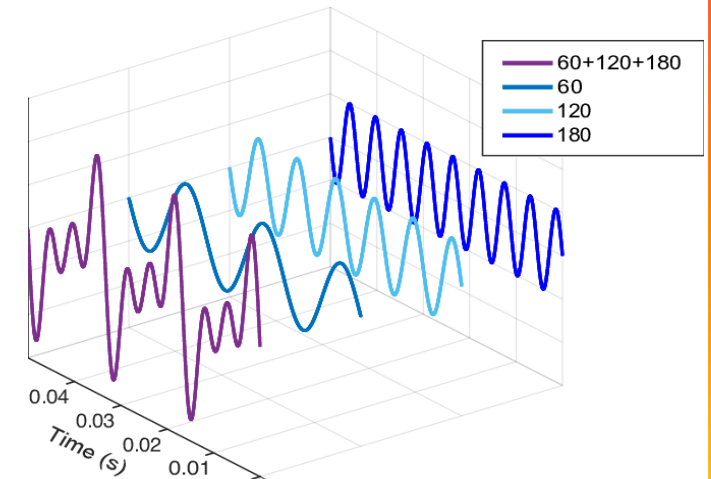
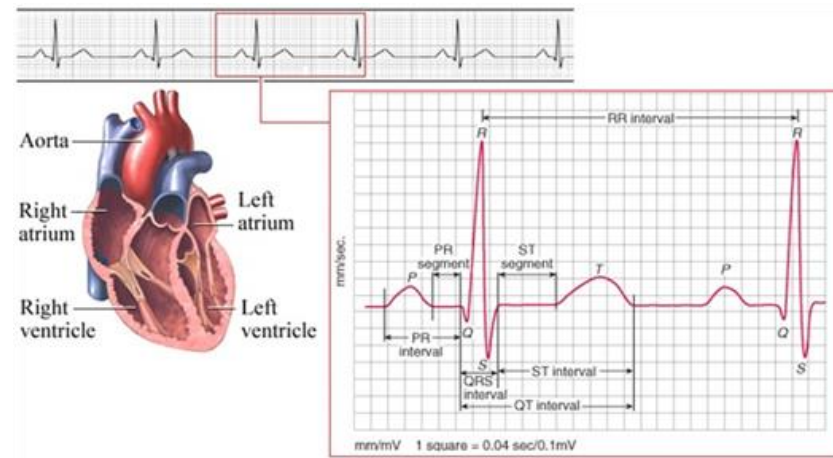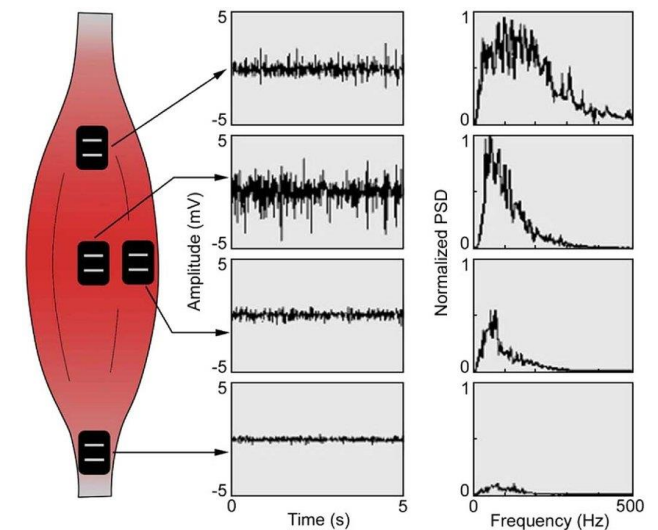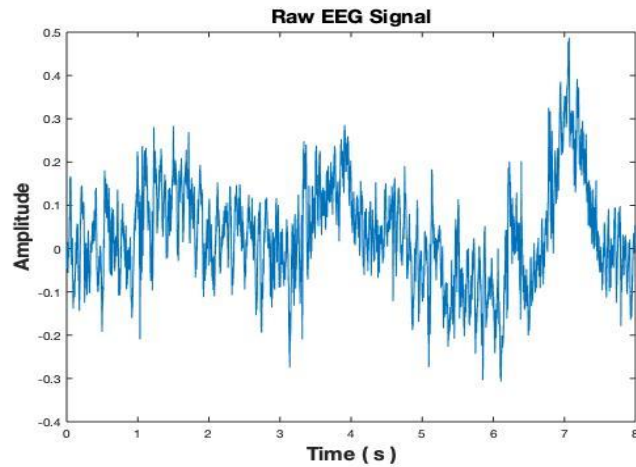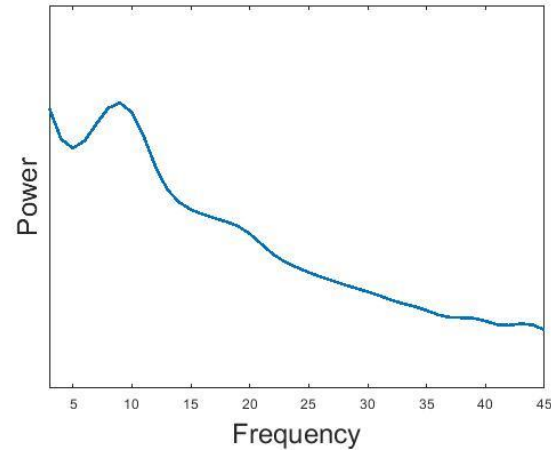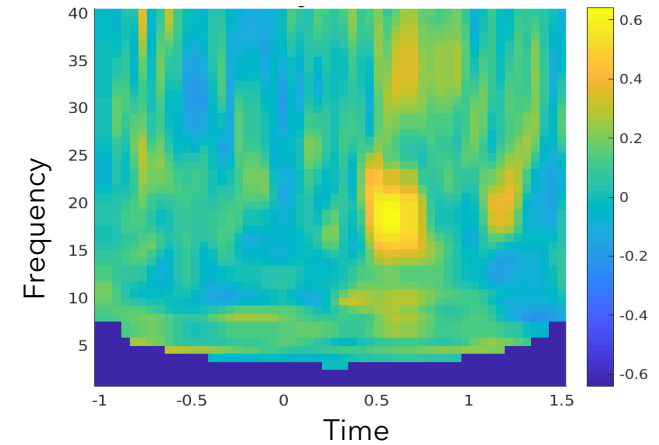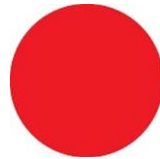$$x(t) = \sum_{n=1}^{N} A_n \sin(2\pi f_n t + \phi_n)$$
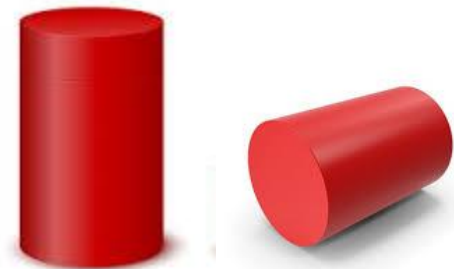
Biosignals

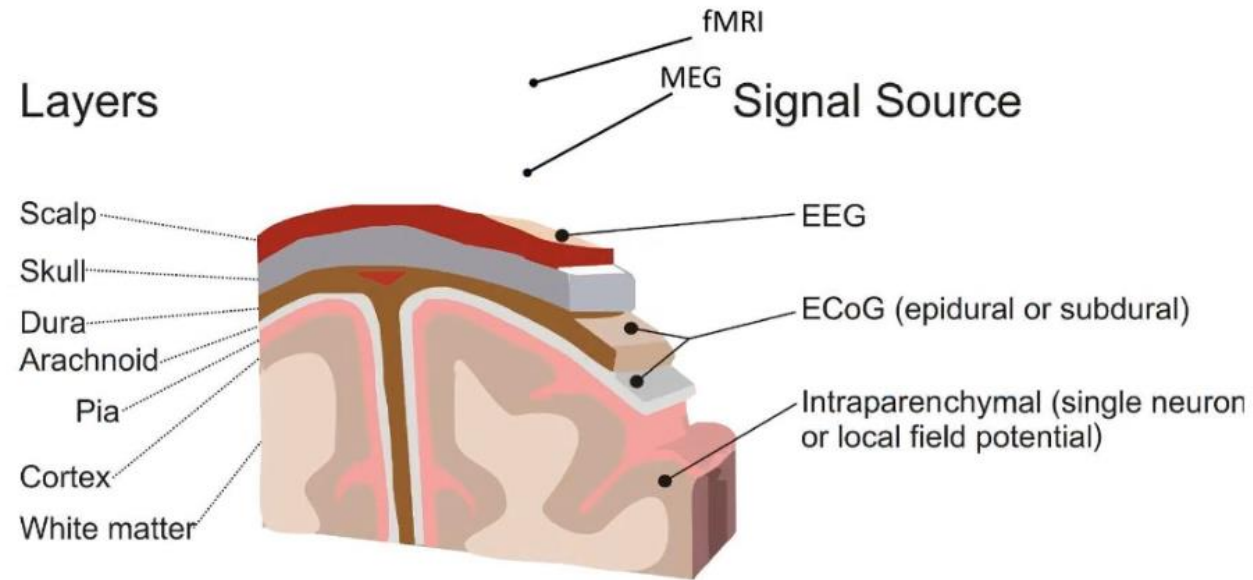ECG/EKG

EEG

EMG

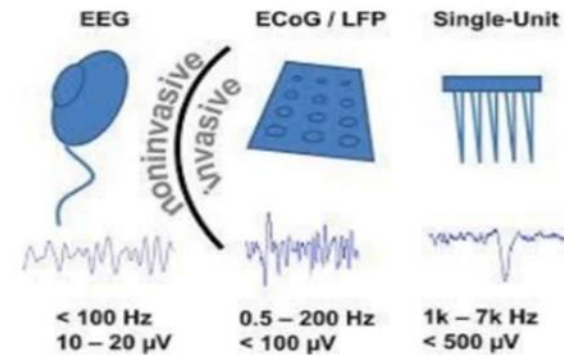# Signal Characteristics
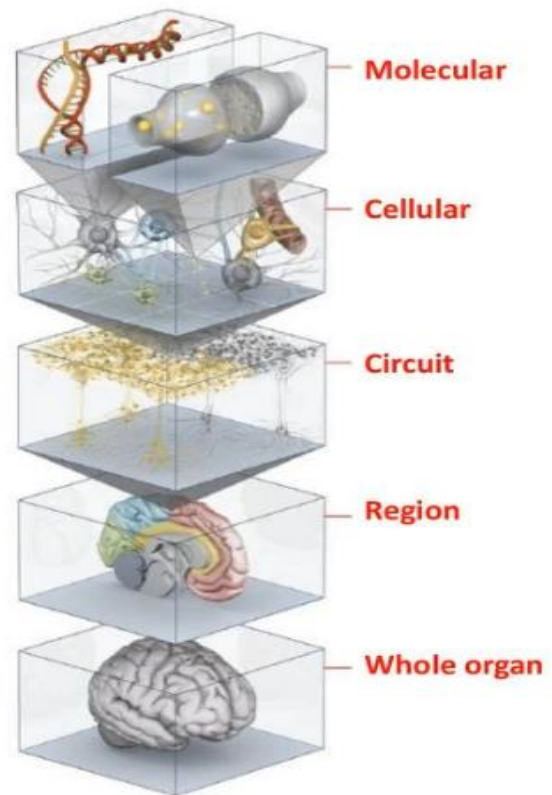

Time-domain
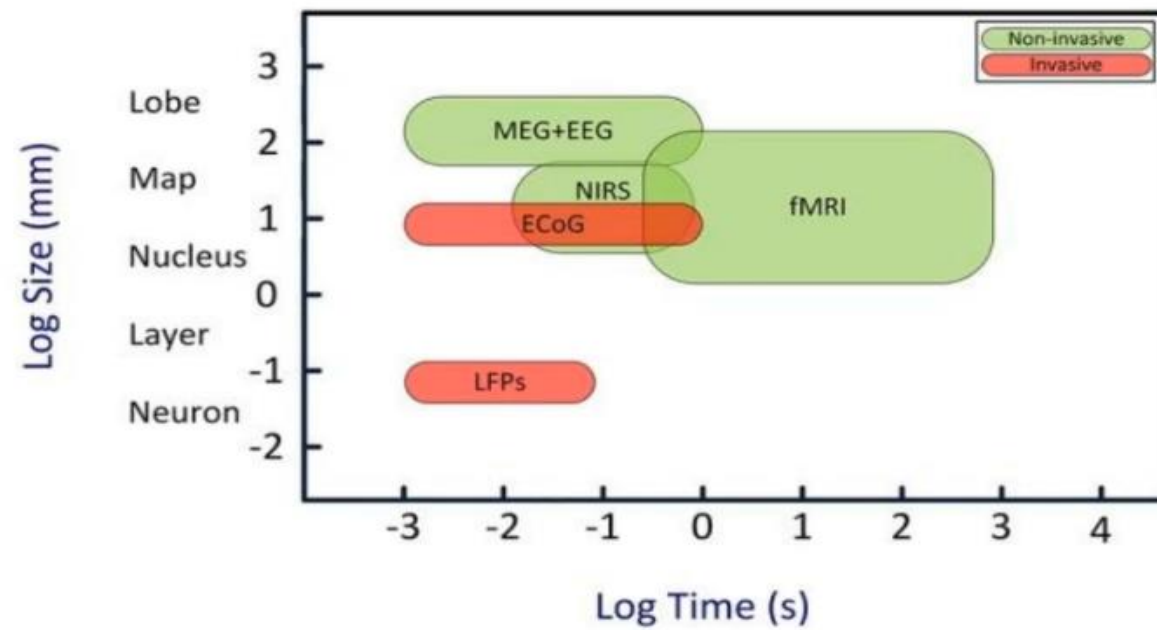
Frequency-domain

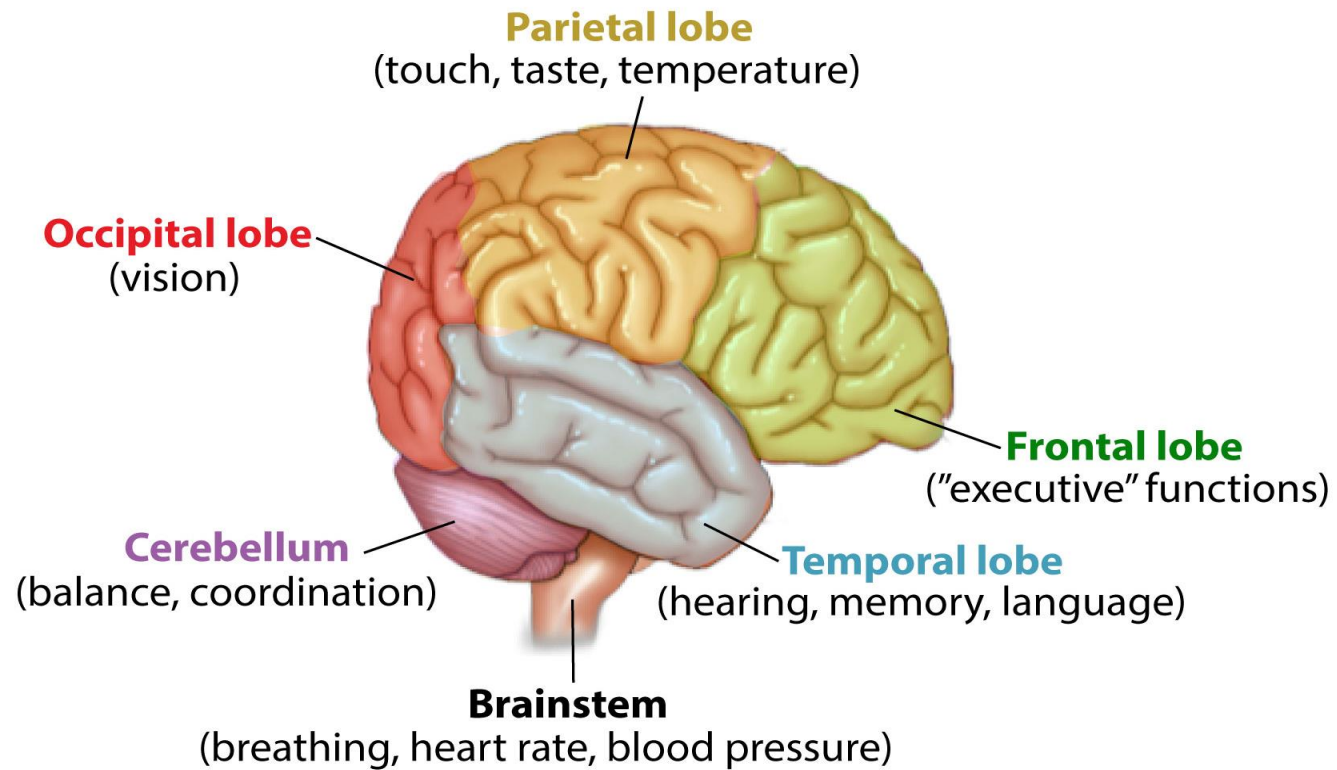Time-frequency domain

Brain Signal Recording
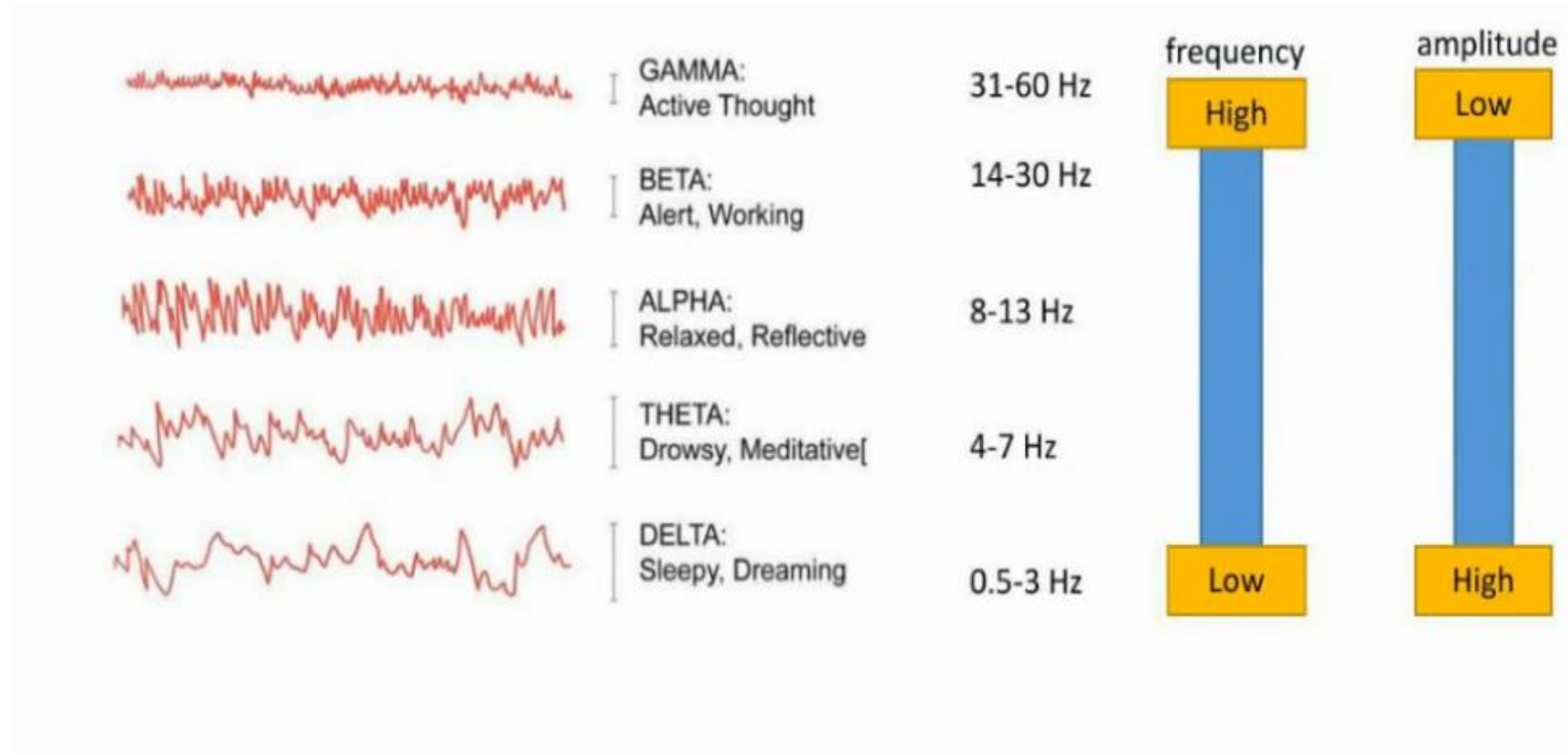
Brain Signal Recording
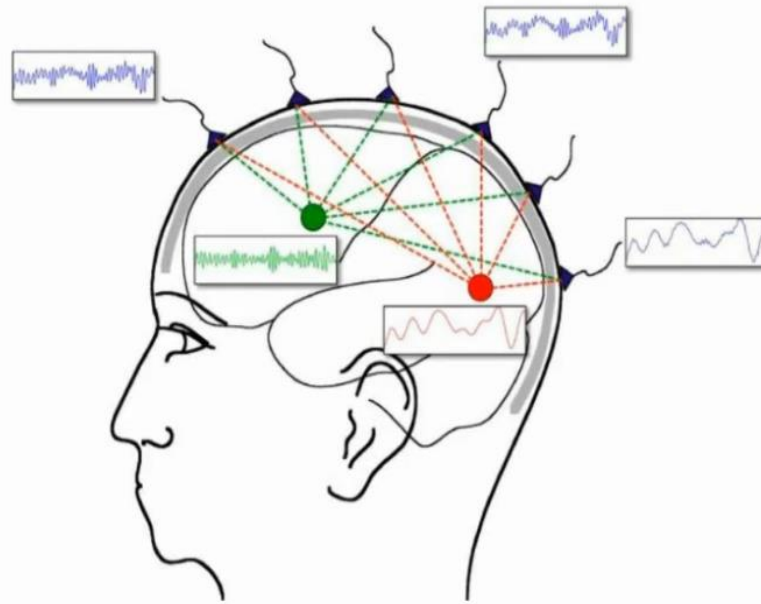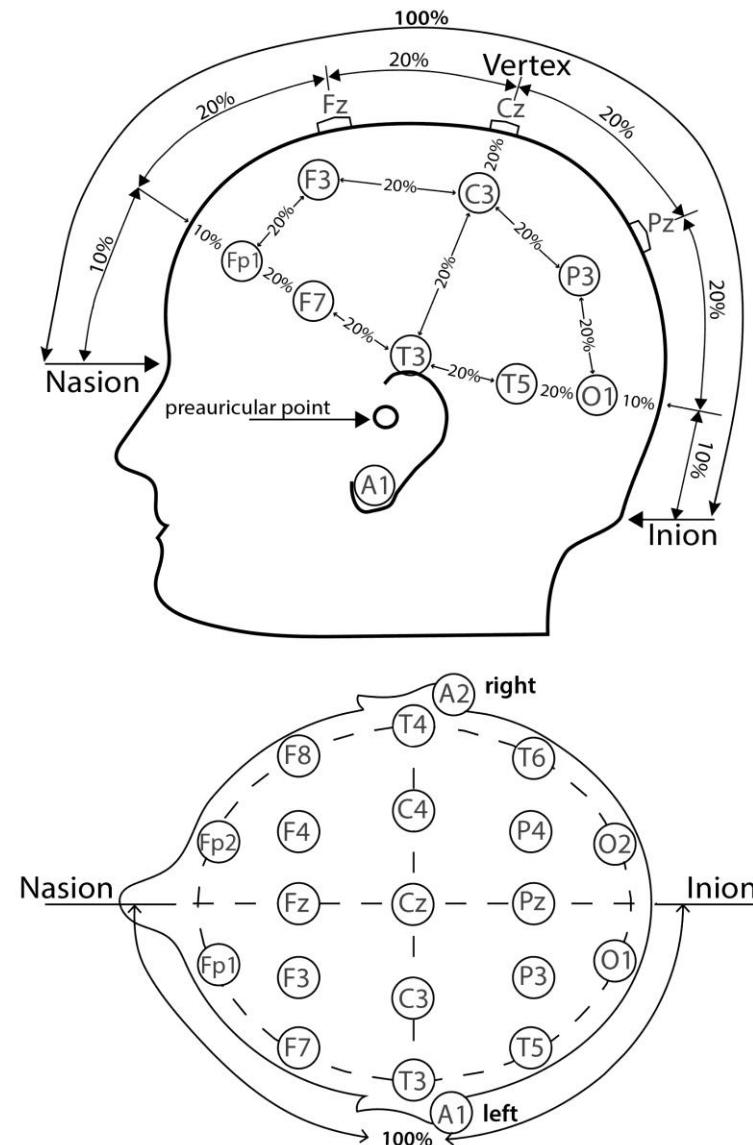
Brain Signal Recording
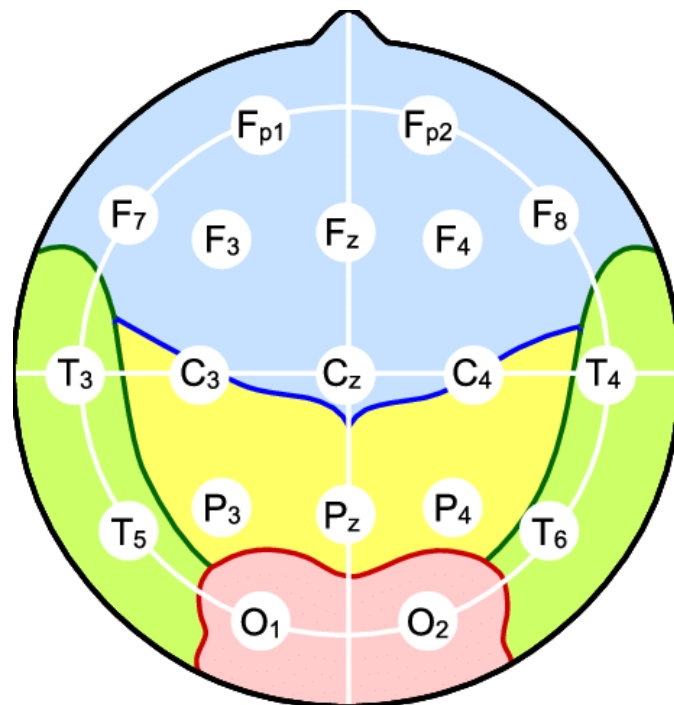
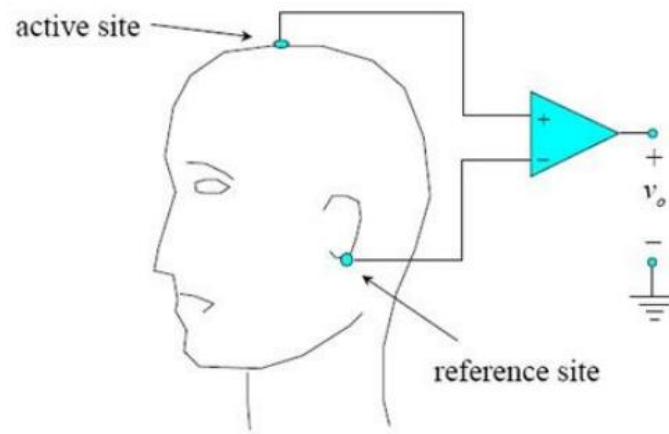# Brain Lobes

Brain Frequencies

EEG

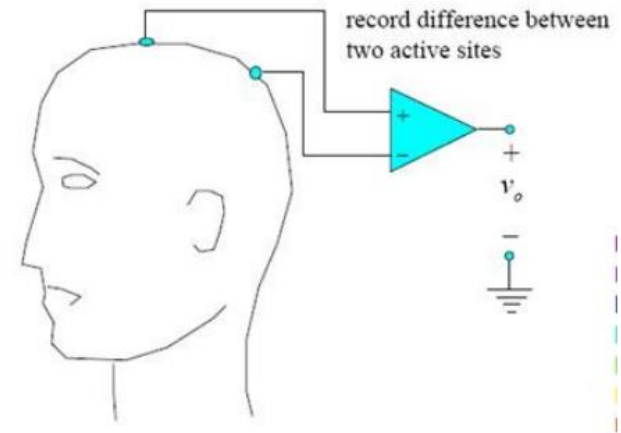

Sensor vs. Source

EEG

10-20 system of EEG recording

EEG

Unipolar EEG Recording

active site

reference site

Bipolar EEG Recording
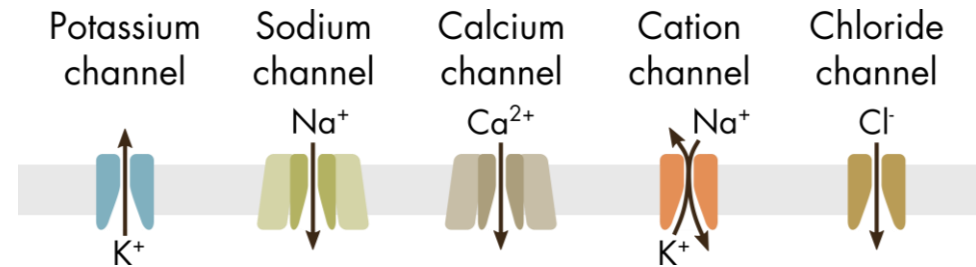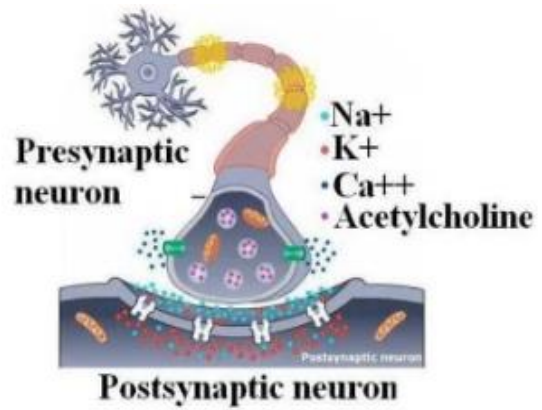
record difference between two active sites

EEG
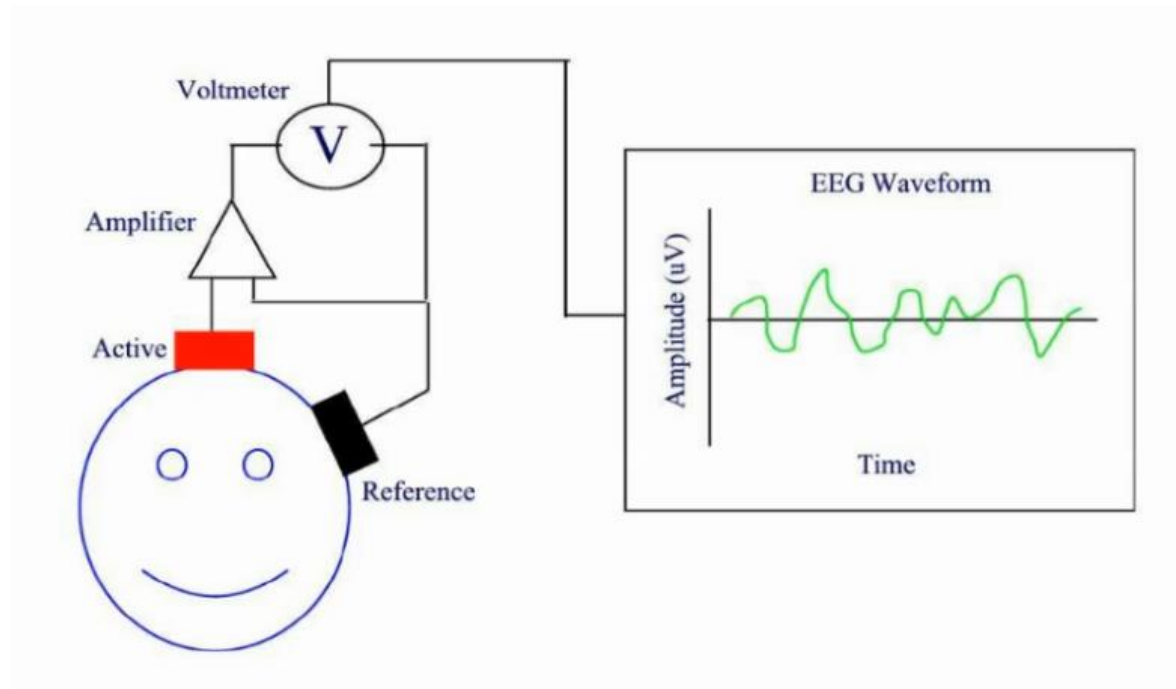
EEG

Main source of EEG signals

EEG

Frequency and Amplitude

At cranial surface
EEG amplitude ≈ 0 to 100 μV
EEG frequency ≈ 0.5 to 100 Hz

Effective Factors

- Age
- Fatigue (level of consciousness)
- Level of blood oxygen, glucose, …
- Mind state (mental effort)
- …

EEG

Sources of EEG noise and artifacts

- **Nonphysiologic**
  - Electrodes
  - Headbox
  - Amplifier
  - Cable
  - Environment
  - Laptop and electronic devices
  - Intravenous Fluids drip
  - Respirator
  - Phone ringing
  - Bed/patient movements

- **Physiologic**
  - Respiration artifact
  - Eye blinks
  - Eye movements
  - ECG
  - EMG
  - Glossokinetic

EEGLAB

https://sccn.ucsd.edu/eeglab/

https://sccn.ucsd.edu/eeglab/download.php