

L03 - Electroencephalography (EEG) I (4.1.2 Jan 11 2017)

File name: NoName03-L03

12/02/2019

12:28

First recording (starts at event labelled 'EEG with changing eye conditions'):  
Subject was relaxed with eyes closed for about 20 seconds, then opened eyes for  
20 seconds, then closed eyes until end of recording.

The EEG data is shown as follows:

CH 1 recorded EEG

CH 40 alpha rhythm: 8-13 Hz

CH 41 beta rhythm: 13-30 Hz

CH 42 delta rhythm: 1-5 Hz

CH 43 theta rhythm: 4-8 Hz

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## L03 DATA REPORT

Student's Name: Michael Lenehan

Lab Section: Lab 03

Date: 12/02/2019

### I. Data and Calculations

Subject Profile

Name: Michael Lenehan    Height: 1.78m    Weight: 89.8kg

Age: 22    Gender: Male

#### A. EEG Amplitude Measurements

Table 1: Table 3.2 Standard Deviation [Stddev]

<i>Rhythm</i>	<i>CH Measurement</i>	<i>Eyes Closed</i>	<i>Eyes Open</i>	<i>Eyes Re-closed</i>
Alpha	40 Stddev	7.306776uV	3.227038uV	6.918106uV
Beta	41 Stddev	3.407296uV	2.941546uV	3.481899uV

<i>Rhythm</i>	<i>CH Measurement</i>	<i>Eyes Closed</i>	<i>Eyes Open</i>	<i>Eyes Re-closed</i>
Delta	42 Stddev	4.530827uV	3.700014uV	3.908542uV
Theta	43 Stddev	5.008476uV	2.817929uV	4.516996uV

## B. EEG Frequency Measurements from first ‘Eyes closed’ data.

Complete Table 3.3 with the frequencies for each rhythm and calculate the mean frequency. Freq measurement applies to all channels since it is calculated from the horizontal time scale, but you must select the correct area in each band.

Table 2: Table 3.3 Frequency (Hz)

<b>Rhythm</b>	<b>CH Measurement</b>	<b>Cycle 1</b>	<b>Cycle 2</b>	<b>Cycle 3</b>	<b>Mean</b>
Alpha	40 Freq	11.764705Hz	11.111111Hz	10.526315Hz	11.13404Hz
Beta	41 Freq	22.222222Hz	18.181818Hz	28.571428Hz	22.991823Hz
Delta	42 Freq	05.000000Hz	05.000000Hz	05.714285Hz	5.238095Hz
Theta	43 Freq	09.523809Hz	07.692307Hz	07.407407Hz	8.207841Hz

## II. Questions

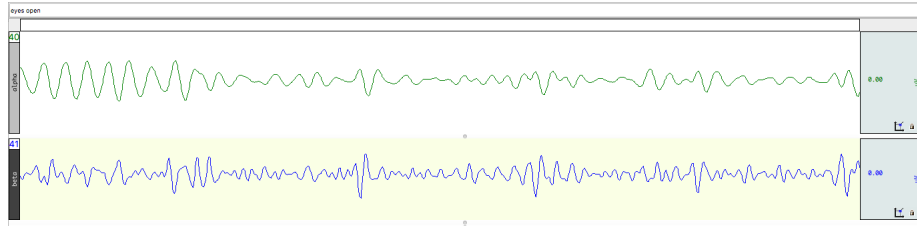
### C. List and define two characteristics of regular, periodic waveforms.

Regular, periodic waveforms are characterised by their amplitude, given in microvolts, i.e. the magnitude of the wave, and their frequency, given in Hertz, i.e. the number of complete cycles per seconds.

### D. Compare and contrast synchrony and alpha block.

Synchrony is when the peaks and troughs of the brain waves occur at the same time, giving constructive interference, and an overall greater sum of activity for alpha waves. Alpha block is the term used to describe destructive interference, or counterbalance which occurs in the electrical activity giving an overall sum value which is not truly representative of the beta wave activity.

**E. Examine the alpha and beta waveforms for change between the “eyes closed” state and the “eyes open” state.**



- i. Does **desynchronization** of the alpha rhythm occur when the eyes are open?

Desynchronization does occur when the eyes are open. This is described as alpha block, as explained in section D.

- ii. Does the beta rhythm become more pronounced in the “eyes open” state?

The beta rhythm does not become more pronounced in the eyes open state, contrary to the expected results of increased beta wave amplitude with concentration.

**F. The amplitude measurements (Stddev) are indicative of how much alpha activity is occurring in Subject. But, the amplitude values for beta do not truly reflect the amount of mental activity occurring with the eyes open. Explain.**

The values measured for the beta waves amplitude are not truly reflective of the mental activity occurring, as, due to desynchronization, the negative and positive activities counterbalance, causing it to appear as if less electrical activity is taking place. It can be seen from the measurements that the beta wave amplitude decreased when the subjects eyes were open. This may be an indication of the desynchronization, or may have been due to experimental error in the measurements.

**G. Examine the delta and theta rhythm. Is there an increase in delta and theta activity when the eyes are open? Explain your observation.**

There is a decrease in both delta and theta waves when eyes are open. Delta wave activity decrease from approximately 4/4.5uV to 3.7uV when the subjects eyes are open. Theta waves decrease from approximately 4.5/5uV to 2.8uV.

These decreases in amplitude are due to the relationship between delta and theta waves, and REM and deep sleep stages respectively. While there is also a

relationship between these rhythms and intense concentration, the subject was in a relaxed state with their eyes open, and, as such, no stimulus occurred.

**H. Define the following terms:**

i. Alpha rhythm

Alpha rhythms are the most prominent EEG waves in a relaxed, but awake adult with their eyes closed. With eyes open, the amplitude of the alpha waves are reduced. Alpha rhythms are different in each area of the brain, with the highest amplitudes found in the occipital and parietal regions. The frequency of alpha waves ranges from 8-12Hz.

ii. Beta rhythm

Beta rhythms occur during deep sleep, or during periods of alertness and concentration. Their amplitudes are lower than that of alpha waves. Beta wave activity is associated with retrieval of memory. The frequency at which beta waves occurs is in the range of 12 to 30Hz.

iii. Delta rhythm

Delta waves are high amplitude, low frequency brain waves. They are associated with deep sleep, however, can also increase during intense concentration. The frequency of delta waves ranges from 1-5Hz.

iv. Theta rhythm

Theta rhythms again are high amplitude, low frequency waves, which occur during deep sleep. The frequency ranges between 4 and 8 Hz.

***End of Lesson 3 Data Report***