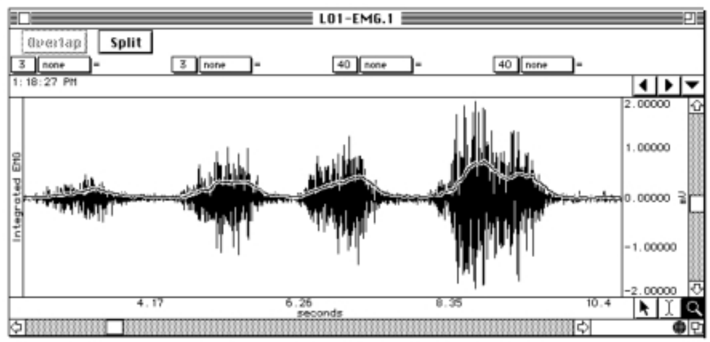
BIOPAC Systems, Inc.

Lesson 1 Data Report

ELECTROMYOGRAPHY I

Standard and Integrated EMG



ELECTROMYOGRAPHY I

Standard and Integrated EMG

DATA REPORT

Student's Name: ______________________________

Lab Section: ______________________________

Date: ______________________________

I. Data and Calculations

Subject Profile

Name 熊政凱 Height 178

Age 20 Weight 73.5

Gender: Male

A. EMG Measurements

Cluster #	***Forearm 1***				***Forearm 2***			
	Min [3 min]	**Max [3 max]**	**P-P [3 p-p]**	**Mean [40 m**	**Min [3 min]**	**Max [3 max]**	**P-P [3 p-p]**	**Mean [40 mean]**
1	-0.12756	0.25085	0.37842	0.02786	-0.44739	0.44983	0.89722	0.10103
2	-0.17273	0.21240	0.368513	0.03463	-0.71655	0.58594	1.30249	0.11991
3	-0.31433	0.33264	0.64697	0.06764	-1.01990	0.94605	1.96594	0.21187
4	-0.91248	1.09436	2.00684	0.20748	-1.43311	1.56982	3.00293	0.33158

Note: "Clusters" are the EMG bursts associated with each clench.

B. Use the mean measurement from the table above to compute the percentage increase in EMG activity recorded between the weakest clench and the strongest clench of Forearm 1.

Calculation: 0.02786/0.20748=13.4%

Answer: 13.4%

C. Tonus Measurements

Cluster #	*Forearm 1* P-P [3 p-p]	*Forearm 1* Mean [40 mean]	*Forearm 2* P-P [3 p-p]	*Forearm 2* Mean [40 mean]
1	0.04700	0.00449	0.08911	0.01098
2	0.12268	0.00868	0.07985	0.01129
3	0.04517	0.00564	0.14038	0.01396
4	0.14038	0.00875	0.09216	0.01142

II. QUESTIONS

D. Compare the mean measurement for the right and left maximum clench EMG cluster. Are they the same or different?

_____ Same ___v__ Different

Which one suggests the greater clench strength?

_____ Right ___v__ Left _____ Neither

Explain.

1. 電極黏貼造成的不同，可能因為位置偏差或黏貼緊密與否，使得接收到的訊號強弱有所區別
2. 慣用手的區別或者是神經活性的差異導致

E. What factors in addition to sex contribute to observed differences in clench strength?

1.電極的黏貼良好與否
2.電極位置使否處於可以接收到良好訊號的位置
3.肌肉量與使用程度
4.量測時其它身體部分產生的電訊號造成誤差
5.量測到噪音干擾

F. Does there appear to be any difference in tonus between the two forearm clench muscles?

_____ Yes _____ No

Would you expect to see a difference? Does subject's sex influence your expectations? Explain.

No. 因為雖然兩隻手雖然肌肉發達程度雖然不一樣,但是有可能兩隻手放鬆時肌肉張力的程度相差無幾,因此在實驗上量不太到區別.

G. Explain the source of signals detected by the EMG electrodes

偵測到的電訊號來源於肌肉運動時的神經電訊號，當施力較小時，只有部分的神經被激活產生動作電位，施力較大時越多的神經加入導致可以量測到較大的電訊號。

H. What does the term “motor unit recruitment” mean?
指藉由激活越多的動作單元來達成肌肉收縮強度的提升。

I. Define skeletal muscle tonus.
即使沒有用力時,脊髓仍然會釋放化學物質維持肌肉張力.

J. Define electromyography.
量測與紀錄並繪製出骨骼肌的電訊號活動的技術

End of Lesson 1 Data Report

Physiology Lessons
for use with the
Biopac Student Lab

PC under Windows® 98SE, Me, 2000Pro
or Macintosh® OS 8.6-9.1

Manual Revision PL3.6.7-ML3.0.7/112403

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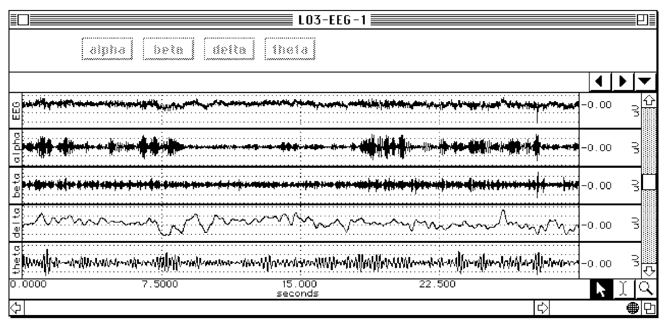
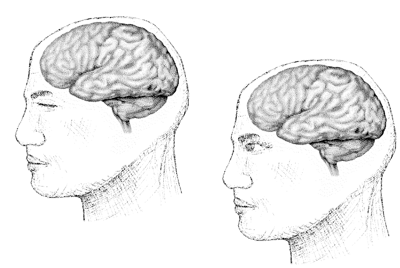
Lesson 3 Data Report ELECTROENCEPHALOGRAPHY I
EEG I

Relaxation and Brain Rhythms Alpha, beta, delta, and theta rhythms





Lesson 3

ELECTROENCEPHALOGRAPHY I

EEG I

DATA REPORT

Student's Name: ______________________________

Lab Section: ______________________________

Date: ______________________________

I. Data and Calculations

Subject Profile

Name 王人出 Height

174 Age 20

Weight 72

Gender: Male or Female

A. EEG Amplitude Measurements

Complete Table 3.2 with Standard Deviation measurements:

Table 3.2 Standard Deviation [stddev]

Rhythm	Channel	Eyes Closed	Eyes Open	Eyes Re-closed
Alpha	CH 2	3.932867	3.511744	4.474750
Beta	CH 3	5.017601	5.708230	4.731302
Delta	CH 4	18.039831	10.510510	6.953399
Theta	CH 5	1.932180	1.330200	1.236516

B. EEG Frequency Measurements

Complete Table 3.3 with the frequencies for each rhythm and calculate the mean frequency:

Table 3.3 Frequency (Hz)

Rhythm	Channel	Cycle 1	Cycle 2	Cycle 3	Mean
Alpha	CH 2	11.1111	11.764706	12.5000	11.7914
Beta	CH 3	25.000	28.571429	28.571429	27.3810
Delta	CH 4	3.389631	3.125000	4.1666	3.5604
Theta	CH 5	4.081633	5.714286	6.060606	5.2855

II. Questions

C. List and define two characteristics of regular, periodic waveforms.
$F(t + T) = F(t)$ for a function of period T
F is non-zero.

D. Compare and contrast synchrony and alpha block.
當張開眼睛時,alpha 波稍稍較為抑制,包絡線比較沒有週期性的起伏.閉起眼睛時,alpha 波看起來比較有起伏.

E. Examine the alpha and beta waveforms for change between the “eyes closed” state and the “eyes open” state.
Alpha 波是較為放鬆的時候產生的腦波.因此在眼睛閉起時,比較可以看到 alpha 波的活躍.然而在張開眼睛時,總體而言人們較為緊張,因此 beta 波較為強烈,而 alpha 波受到抑制.

I. Does **desynchronization** of the alpha rhythm occur when the eyes are open? Yes

II. Does the beta rhythm become more pronounced in the “eyes open” state? Yes

F. The amplitude measurements (stddev) are indicative of how much alpha activity is occurring in the subject. But, the amplitude values for beta do not truly reflect the amount of mental activity occurring with the eyes open. Explain.
Beta波容易對視覺回饋產生影響.然而因為如此容易受到影響,在眼睛張開的時候,我們難以觀察單純從腦部活動給予的影響.

G. Examine the delta and theta rhythm. Is there an increase in delta and theta activity when the eyes are open? Explain your observation.
Theta波以及delta則沒有明顯變化的傾向.theta波是人在冥想時產生的腦波,因此在因為都是處於放空的時候,所以沒有太大差別.delta波則是深度睡眠時產生的.因為沒有進入深度睡眠,因此沒有太大影響.

H. Define the following terms:

- Alpha rhythm
  人們腦部在有意識,以及放鬆時產生的腦波.
- Beta rhythm
  人們腦部在忙碌或是焦慮的狀況下產生的腦波.
- Delta rhythm
  人們腦部在第三階段睡眠時會產生的腦波.
- Theta rhythm
  人們腦部在冥想或是被催眠時會產生的腦波

Question1 The simple bipolar configuration was used in measuring EEG of a specific brain region in this experiment. Please compare and discuss on the different kinds of configuration used in measuring EEG.

國際上常常使用10-20貼片的方法,在頭上總共貼20片電極.此種方法較為精準因此是醫學上的benchmark.此外也有運動用貼片,外型像是一個頭窟/.

Question2 It is a consensus that EEG ahs better temporal resolution than the functional MRI, hwoever, functional MRI has better spatial resolution. Please explain.

因為EEG在量測的時候根本就直接貼在頭上.因此會有比較好的局部的頭部影像,然而MRI利用的空間中磁場的擾動來偵測腦部的活動,因此可以有比較好的空間解析度.

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PC under Windows® 98SE, Me, 2000
P or Macintosh® OS 8.6-9.1

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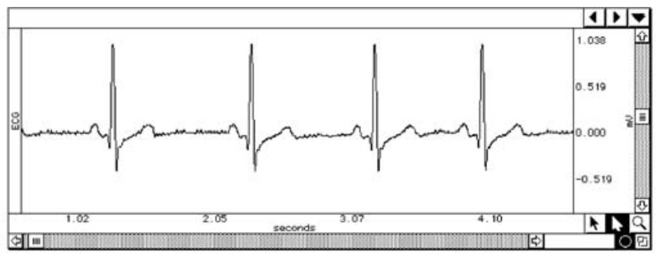
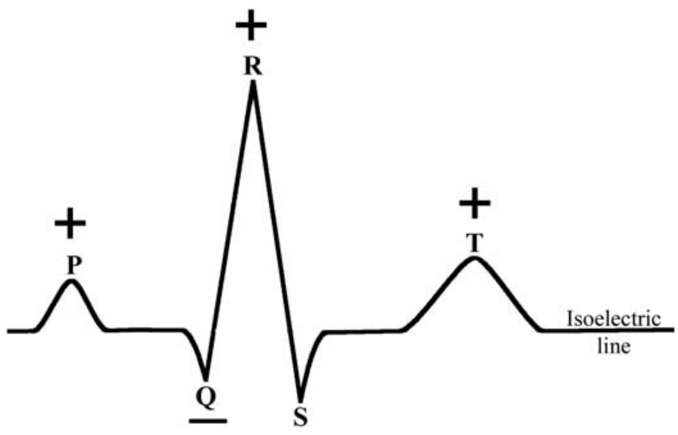
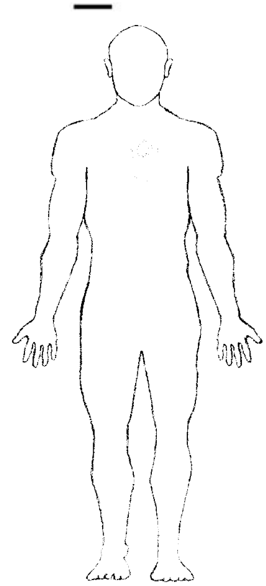
Lesson 5 Data Report

ELECTROCARDIOGRAPHY I

Components of the ECG







Lesson 5

ELECTROCARDIOGRAPHY I

ECG I

DATA REPORT

Student's Name: ______________________________

Lab Section: ______________________________

Date: ______________________________

I. Data and Calculations

Subject Profile

Name 熊政凱 Height 178 cm

Age 20 Weight 73.5 kg

Gender: Male

A. Supine, Resting, Regular Breathing (using *Segment 1* data)

Complete the following tables with the lesson data indicated, and calculate the Mean and Range as appropriate.

Table 5.3

Measurement	From Channel	Cardiac Cycle 1	2	3	Mean	Range
ΔT	CH 2	0.98500	0.95400	0.91200	0.95033	0.07300
BPM	CH 2	60.91371	62.89808	65.78947	63.50499	4.87576

Table 5.4

ECG Component	Duration Δ T [CH 2]				Amplitude (mV) Δ [CH 2]			
	Cycle 1	Cycle 2	Cycle 3	Mean	Cycle 1	Cycle 2	Cycle 3	Mean
P wave	0.12800	0.12800	0.12700	0.12767	0.12024	0.09216	0.08301	0.09847
PR interval	0.165	0.19800	0.18800	0.18367	0.1202	0.09216	0.08301	0.09846
PR segment	0.06100	0.05700	0.05700	0.05834	0.01740	-0.00671	-0.01648	-0.00193
QRS complex	0.10800	0.10900	0.10400	0.10700	0.33966	0.28596	0.29205	0.30589
QT interval	0.38300	0.39700	0.41000	0.39667	0.36285	0.32440	0.32928	0.33884
ST segment	0.08000	0.09000	0.11300	0.09433	0.14343	0.12115	0.13519	0.13326
T wave	0.18800	0.20800	0.19400	0.19667	0.36285	0.32440	0.32928	0.33884

Table 5.5

Ventricular Readings	CH 2 Δ T			
	Cycle 1	Cycle 2	Cycle 3	Mean
QT Interval (*corresponds to Ventricular Systole*)	0.38300	0.39700	0.41000	0.39667
End of T wave to subsequent R wave (*corresponds to Ventricular Diastole*)	0.64700	0.59000	0.57600	0.60433

B. Seated, deep breathing

Table 5.6

Rhythm	CH. #	Cycle 1	Cycle 2	Cycle 3	Mean
Inspiration					
Δ T	CH 2	0.932	0.876	0.827	0.878
BPM	CH 2	64.378	68.499	72.551	68.476
Expiration					
Δ T	CH 2	0.900	0.915	0.913	0.909
BPM	CH 2	66.667	65.288	65.717	65.891

C. Sitting

Table 5.7

Heart Rate	CH. #	Cycle 1	Cycle 2	Cycle 3	Mean
Δ T	CH 2	0.820	0.770	0.837	0.809
BPM	CH 2	73.170	77.320	71.685	74.058

D. After exercise

Ventricular Readings	CH 2 Δ T			
	Cycle 1	Cycle 2	Cycle 3	Mean
QT Interval (*corresponds to Ventricular Systole*)	0.301	0.377	0.295	0.324
End of T wave to subsequent R wave (*corresponds to Ventricular Diastole*)	0.350	0.353	0.347	0.350

II. Data Summary and Questions

A. Heart Rate (BPM)

Condition	Mean	Range
Supine, regular breathing	63.50499	4.87576
Seated, deep breathing, inhalation	68.476	8.173
Seated, deep breathing, exhalation	65.891	1.379
Sitting, regular breathing	74.058	5.635
After exercise – start of recording	113.34359	4.325
After exercise – end of recording	98.43536	6.342

Explain the changes in heart rate between conditions. Describe the physiological mechanisms causing these changes.

心跳由速度由腦幹控制，含氧量會決定心跳速度。當需氧量高時會提高心跳速度或BPM。

比較躺著、坐著深呼吸、坐著正常呼吸、運動的結果，躺著時平靜呼吸需氧量最低，深呼吸明顯比正常呼吸慢，因此BPM會小於正常呼吸。運動時全身肌肉運作大量耗氧，因此需要快速呼吸來彌補，因此BPM上升至100附近。

B. Duration (Δ T)

Rhythm

Measurement	Mean	Range
Seated, regular breathing		
Inhalation Exhalation	0.809	0.067
Seated, deep breathing		
Inhalation	0.878	0.105
Exhalation	0.909	0.015

Are there differences in the cardiac cycle with the respiratory cycle?

深呼吸時呼吸較長，因此也放慢心跳速度，與數據相符

Measurement	Mean	Range
Supine, regular breathing		
Ventricular systole	0.39667	0.027
Ventricular diastole	0.60433	0.071
After Exercise		
Ventricular systole	0.324	0.082
Ventricular diastole	0.35	0.006

What changes occurred in the duration of systole and diastole between resting and post-exercise?

運動後由於肌肉消耗大量氧氣，因此血液含氧量大幅下降，需要提升心跳速度來滿足氧氣需求。由表格可以發現為使週期縮短，心室收縮和舒張期都變短。然而週期縮短主要在舒張期，原因應為每個階段所需的最短時間有上限，收縮時間很難有大幅減少，為使整個週期能有效縮短，因此舒張期只能大幅降低來滿足需求。

C. Review your Data

1. Is there always one P wave for every QRS complex? Yes
2. Describe the P and T wave shapes: P wave has two peaks with amp = 0.05mV ; while T wave only has a peak and left side is steeper, amp. Is three times bigger than P.
3. Do the wave durations and amplitudes for all subjects fall within the normal ranges listed in Table 5.2? Almost No (only out of range a little)
4. Do the ST-segments mainly measure between –0.1 mV and 0.1 mV? Yes
5. Is there baseline "drift" in the recording? No
6. Is there baseline "noise" in the recording? Yes

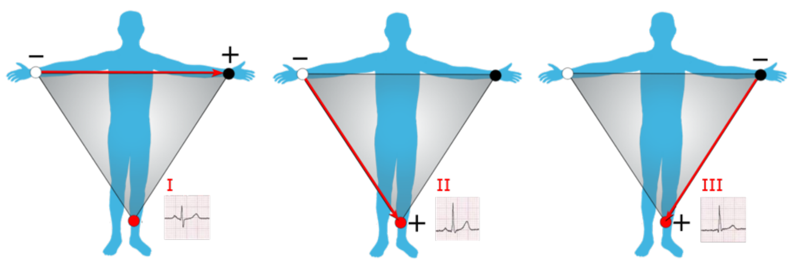
End of Lesson 5 Data Report

Question 1

The most common configuration used in measuring ECG is Lead II. What are the key features and advantages of this configuration? What are the key features and advantages of other configurations?

By Wikipedia

- Lead I is the voltage between the (positive) left arm (LA) electrode and right arm (RA) electrode:
- Lead II is the voltage between the (positive) left leg (LL) electrode and the right arm (RA) electrode:
- Lead III is the voltage between the (positive) left leg (LL) electrode and the left arm (LA) electrode:



Lead II
優勢在於連線與右心房左心室連線平行，能量測最清楚的心律脈衝信號而且只需連接四肢末端

Lead I 因橫跨心臟可以量測心室外壁訊號
Lead III 與 Lead II 橫跨心室內側可以量測心室內壁資訊
Reference: Clinical ECG The ECG Leads: electrodes, limb leads, chest (precordial) leads, 12-Lead ECG

Question 2

Based on the ECG observation, please discuss the relationship between the 'heart sounds' (心音) and the 'ventricular pressure' (心室壓力)

第一心音 由二尖瓣和三尖瓣發出，生於心縮期，由於心室收縮壓力增加為避免血液逆流二尖瓣與三尖瓣關閉時發出
第二心音 由主動脈半月瓣、肺動脈半月瓣產生。心室舒張實為避免血液由動脈逆流因此主動脈半月瓣、肺動脈半月瓣關閉而發出聲音