Physiology Lessons
for use with the
Biopac Student Lab

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or Macintosh® 8.6 – 9.1

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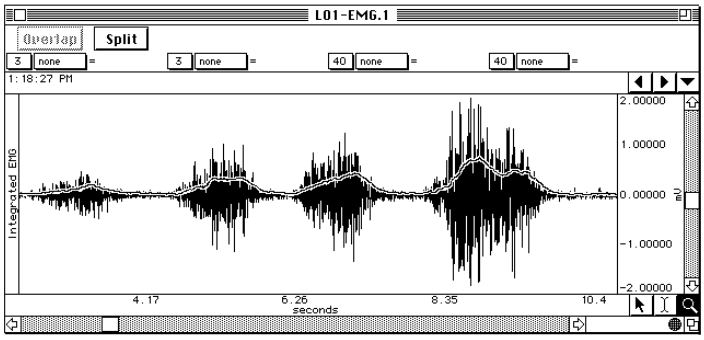
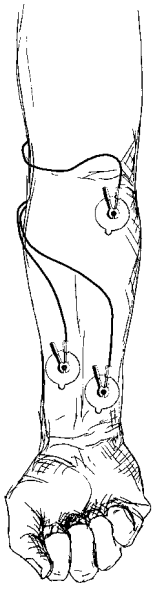
Lesson 1 Data Report
ELECTROMYOGRAPHY I
Standard and Integrated EMG





ELECTROMYOGRAPHY I

Standard and Integrated EMG

DATA REPORT

Student's Name: 解正平、劉維凱、張景程

Lab Section: MD303 Group 3

Date: 2018/3/23

I. Data and Calculations

Subject Profile

Name 張景程 Height 178cm

Age 21 Weight 67kg

Gender: (Male) / Female

A. EMG Measurements

Cluster #	*Forearm 1 (Dominant)*				*Forearm 2*			
	Min [3 min]	**Max [3 max]**	**P-P [3 p-p]**	**Mean [40 mean**	**Min [3 min]**	**Max [3 max]**	**P-P [3 p-p]**	**Mean [40 mean]**
1	-0.13977	0.10925	0.24902	0.02701	-0.14282	0.10742	0.25024	0.02504
2	-0.19403	0.19470	0.38513	0.05098	-0.18433	0.14587	0.33020	0.03544
3	-0.40466	0.34119	0.74585	0.07619	-0.20569	0.21362	0.41931	0.05761
4	-0.48462	0.51514	0.99976	0.11153	-0.37109	0.42175	0.79285	0.08358

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:

(0.11153 - 0.02701) / 0.02701 = 3.1292

Answer: 312.92 %

C. Tonus Measurements

Cluster #	*Forearm 1 (Dominant)* P-P [3 p-p]	*Forearm 1 (Dominant)* Mean [40 mean]	*Forearm 2* P-P [3 p-p]	*Forearm 2* Mean [40 mean]
1	0.04028	0.00890	0.00916	0.00146
2	0.03601	0.00411	0.01526	0.00196
3	0.04028	0.00717	0.02319	0.00314
4	0.02441	0.00741	0.03418	0.00517

II. QUESTIONS

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

_____ Same ✓ Different

Which one suggests the greater clench strength?

✓ Right _____ Left _____ Neither

Explain.

一般而言，在日常生活中慣用手的使用率和鍛煉會比非慣用手要來得多，以至於慣用手的肌肉會較為發達、肌纖維數量較多，且肌肉的運動是由於肌肉纖維群受到刺激，以電位差的形式傳遞訊號，因此具有較多肌纖維的慣用手離子交換量越大，所產生的總電位差也較高，也能產生較大的力量，和我們實驗結果也較為符合。

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

1. 年齡：尚未發育完全的兒童和青少年，其肌肉纖維較少，所以肌力也會比較少；此外，當人從中壯年逐漸步入老年時，肌力也會隨著年齡的增加而逐漸下降。 2. 肌肉組成：包含肌纖維的面積、肌肉纖維收縮時的長度、肌肉收縮時所牽扯的肌纖維數量、肌腱連接的方式等等也會影響肌力的表現。 3. 受試者的心理狀態：如果受測者處在壓力、疲勞、緊張、肌肉傷害的狀態下，也會影測響試結果。 4. 其他：環境的溫度、濕度、體溫、皮膚含水量等等因素也會影響測量時所量測到的肌肉電位。

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.

從實驗數據可觀察出慣用手(右手)的力量明顯大於非慣用手，由於慣用手較常受到刺激，藉由去極化和再極化產生動作電位傳遞之後，需要更快速地恢復以便進行下一個動作。

此外，和女性所量測到的數據相比，由於男性的肌纖維較多，因此量測到的肌力較大。

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

此訊號的產生是由於肌肉收縮時，肌肉兩端的電位差所產生出來的訊號，而造成肌肉纖維群收縮的原因主要是因為動作電位 (Action Potential)的傳遞。透過細胞膜內外離子的進出使細胞膜產生電位差而產生「去極化」、「再極化」的現象，其中去極化為細胞膜上鈉離子通道打開使鈉離子進入膜內，造成細胞膜電位上升，膜內外電位差由負轉為正，反之則為再極化。

肌肉收縮時，這些現象都會產生不同的動作電位，所以EMG所量測的就是這些不同頻率的動作電位所組成的肌電訊號。

H. What does the term "motor unit recruitment" mean?

motor unit recruitment可看作為肌肉逐漸增加運動單元(motor unit)來達到充足力量的過程。一個運動單元(motor unit)是由一個motor neuron和附近受它刺激的肌肉纖維群所組成，而肌肉是由數個motor unit組成，肌肉纖維則分散在motor unit之中，當某個motor unit被刺激後，周遭與其相連的unit也會逐漸被刺激起來，因而使肌肉纖維產生足夠的電位。

I. Define skeletal muscle tonus.

skeletal muscle tonus 是指在正常情形下，骨骼肌收縮放鬆時仍然會保持在準備狀態而維持一定的輕微張力，並不會一次達到最大力量限度，一般而言此種現象是由中樞神經所控制，使舒張肌肉得以維持正常的長度和張力並保持靈活性，以便進行快速的反應。

J. Define electromyography.

Electromyography is a technique which can detect and record the muscle's electrical activities by measuring the voltage changes of the muscle cells when these cells are electrically or neurologiclly activated with electrodes.

End of Lesson 1 Data Report