



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

PROGRAMA DE DOCTORAT EN ENGINYERIA BIOMÈDICA
DEPARTAMENT D'ENGINYERIA DE SISTEMES,
AUTOMÀTICA I INFORMÀTICA INDUSTRIAL
CENTRE DE RECERCA EN ENGINYERIA BIOMÈDICA

Tesis Doctoral por compendio de publicaciones

Muscular pattern based on multichannel surface EMG during voluntary contractions of the upper-limb

Mislav Jordanic

September 2017

Directores:

Miguel Angel Mañanas Villanueva

Mónica Rojas-Martínez

Abstract

Text here

Resumen

Texto aqui!

Contents

Abstract	i
Resumen	ii
List of Tables	v
List of Figures	vii
1 Introduction	1
1.1 Muscle anatomy	1
Bibliography	4

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Muscle anatomy

Movement is achieved using over 600 skeletal muscles, the ones that can be controlled voluntarily.

Smooth muscles - mostly in internal organs

cardiac muscle

Elementary building block of a muscle is muscle cell, or muscle fiber - *myocyte*. Myocytes are ensheathed by *endomysium*, a connective tissue that contains nerves and capillaries. They are organized in bundles of 10 to 100, *fascicles*, and surrounded by sheath of connective tissue, *perimysium*. Group of fascicles is finally grouped together and enveloped by *epimysium*, forming a muscle.

Sarcolemma is the cell membrane of myocyte, consisting of a lipid bilayer.

myoplasm sarcomeres

Smallest functional unit is called motor neuron, and it was firstly defined by Liddell and Sherrington in 1925 (Liddell and Sherrington, 1925; Sherrington, 1925). It is composed of motor neuron with axon and dendrites, and muscle fibers that axon innervates (Duchateau and Enoka, 2011). Since motor neuron with a single action potential usually evokes action potentials simultaneously in all belonging muscle fibers, by observing action potentials of the muscle fibers,

information on activity of motor neurons in spinal cord or brain stem can be inferred (Merletti and Farina, 2016).

The central nervous system (CNS) is responsible for processing information received from all parts of the body. The two main organs of the CNS are the brain and the spinal cord and are entirely composed of two kinds of specialized cells: neurons and glia. The brain is the most complex part of the human body and exerts a centralized control over the other organs. Neurons, the basic working units of the brain, are designed to transmit information within the brain to other nerve cells and to communicate with muscles and gland cells. The complex architecture of the brain is built on the extensive number of interconnected neurons sharing information through specialized connections called synapses. This connection allows neurons to communicate through an electrical or chemical signals, producing ionic currents that generate electric and magnetic fields.

The CNS is organized in multiple levels, from simple connections between cells to coordinated cell populations, building a complex architecture of interconnected brain regions. The neural processes at this last level are produced by the dynamic coordination of smaller elements. In the cerebral cortex, all this brain activity is summated and its electric and magnetic fields can be measured on the scalp surface.

Notes

Bibliography

- Duchateau, J. and Enoka, R. M. Human motor unit recordings: Origins and insight into the integrated motor system. *Brain Research*, 1409:42–61, 2011.
- Liddell, E. G. T. and Sherrington, C. S. Recruitment and some other Features of Reflex Inhibition. *Proceedings of the Royal Society of London B: Biological Sciences*, 97(686):488–518, 1925.
- Merletti, R. and Farina, D. *Surface Electromyography: Physiology, Engineering, and Applications*. Wiley-IEEE Press, Hoboken, New Jersey (USA), 2016.
- Sherrington, C. S. Remarks on some Aspects of Reflex Inhibition. *Proceedings of the Royal Society of London B: Biological Sciences*, 97(686):519–545, 1925.