TOPOGRAPHIC BRAIN MAPPING IN NORMAL EGYPTIAN CHILDREN

THESIS

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بســم اللـــه الرحمـــــن الرحيم

* سبحــانك لا علم لنا الا ما علمتنا انك انت العليم الحكيم *

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LIST OF ABBREVIATION

Adenosine Triphosphate	**ATP**
Brain Electrical Activity Mapping	**BEAM**
Electroencephalography	**EEG**
Electromyography	**EMG**
Excitatory Postsynaptic Potential	**EPSP**
Fast Fourier Transform	**FFT**
Gamma Amino Buteric Acid	**GABA**
Hertz	**HZ**
Inhibitory Postsynaptic Potential	**IPSP**
Significance probability Mapping	**SPM**

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INTRODUCTION

Electroencephalography (EEG) has proven to be an important diagnostic tool in the identification of certain neurologic diseases that produce focal and/or paroxysmal abnormalities ***(Duffy et al., 1981)***.

Brain Electrical Activity Mapping (BEAM) is a term applied to specific computer - based on electroencephalographic techniques which include (a) EEG frequency analysis (b) topographic displays (c) statistical comparison to a normative data (significance probability mapping) ***(Nuwer, 1988)***.

Significance probability mapping was developed by ***Duffy et al (1981)*** to visualize the statistical differences in topographical distribution of EEG activities between normal controls and patients.

AIM OF THE WORK

The aim of this work is to standardize brain mapping for normal Egyptian children aged from 7 to 12 years.

REVIEW

ANATOMY AND PHYSIOLOGY OF THE CEREBRAL CORTEX

The electroencephalography (EEG) is an integral part of the evaluation of patients of suspected seizures and other central nervous system abnormalities. It may contribute supportive evidence for the diagnosis and anatomical localization of pathology, and follow up after treatment ***(Critichley, 1978)***.

In order to understand the origin of electrical activity that can be recorded in the surface of the head, it is necessary to study the structure and function of the cells in the cerebral cortex generating this activity and the anatomy of the subcortical structures that modify the cortical activity ***(Jasper et al., 1978)***.

1- The Cortical Neurons:

The neuron is the basic building block of the nervous system. Neurons vary greatly in their detailed structures, but typically comprise a cell body (soma) containing a nucleus, a long nerve fiber (axon hillock) and many short branching processes (dendrites) [fig. 1] ***(Stevens, 1979)***.

In the cerebral cortex the cells are either conical, star or spindle shaped and accordingly the cells are classified as pyramidal, stellate and spindle cells respectively ***(Kiloh et al., 1981)***.

The pyramidal cells which are the main cells responsible for the cortical electrical activity have extensive vertical dendrites that may reach to the cortical surface, the axons of these cells usually give off recurrent collaterals that turn back and synapse on the superficial portion of the vertical dendrites [fig. 2] ***(Szentagothia, 1977)***.

The Synapse:

Synapses are the junction points between two neurons, the presynaptic neuron and the post synaptic neuron ***(Peters et al., 1976)***.

By electrone microscopic studies, the presynaptic terminals dilate at their ends forming the synaptic knobs which contain synaptic vesicles containing the neurotransmitters and the mitochondria which provide Adenosine Triphosphate (ATP) that supplies energy for neurotransmitter synthesis. The small distance which separates the presynaptic neuron from the postsynaptic neuron is known as synaptic cleft having a wedth usually of 200 to 300 Angstroms [fig 3] ***(Trubatch, 1981)***.

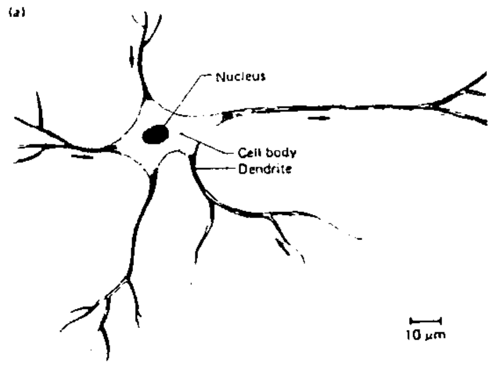

Fig. (1) : The structure of a neuron (Schmidt, 1978)

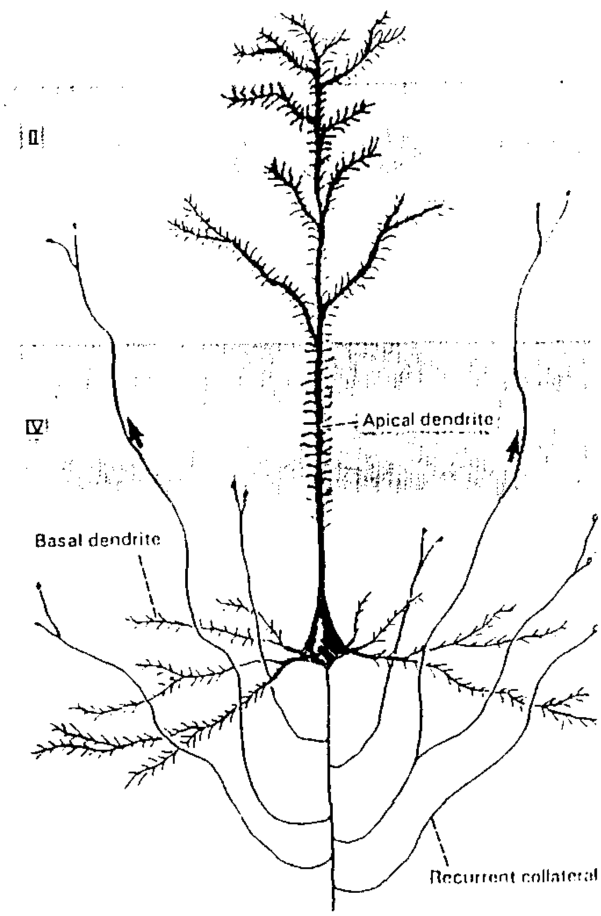

Fig. (2) : The structure of pyramidal neuron from lamina V (Charpenter, 1976)

Electrical Activity of the Neuron:

Inside the neuron there is a high concentration of potassium ions (K^+) relative to outside, the reverse is true about Sodium ions (Na^+) which have a much lower concentration within the cell than outside ***(Brazier, 1973).***

Potassium and Sodium ions have natural tendency to diffuse down their concentration gradient, however the cell membrane has the property of being selectively much more permeable to K^+ ions than to Na^+ ions, consequently K^+ ions diffuse out of the cell while Na^+ ions cannot diffuse inside. This imbalance of ionic movement causes a net loss of positive charges from the cell setting up a difference of electrical potential across the cell membrane, that is the resting membrane potential which is about -70 mv in the nerve cell, with the inside is negative relative to outside ***(Lauger, 1987)***.

The neurons generate two types of potentials, synaptic potential which occurs in the dendritic portion of the nerve cell and the axonal potential which occurs in the axon hillock of the neuron [fig. 4] ***(Jasper et al., 1978)***.