HISTOQUANTITATIVE STUDIES ON THE CERVICAL & THORACIC GANGLIA OF THE SYMPATHETIC CHAIN

Thesis

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By

Nagy Abd El-Malek Mekhail
M.B.B.,Ch.; M.Sc. (Anatomy)

FACULTY OF MEDICINE

AIN SHAMS UNIVERSITY

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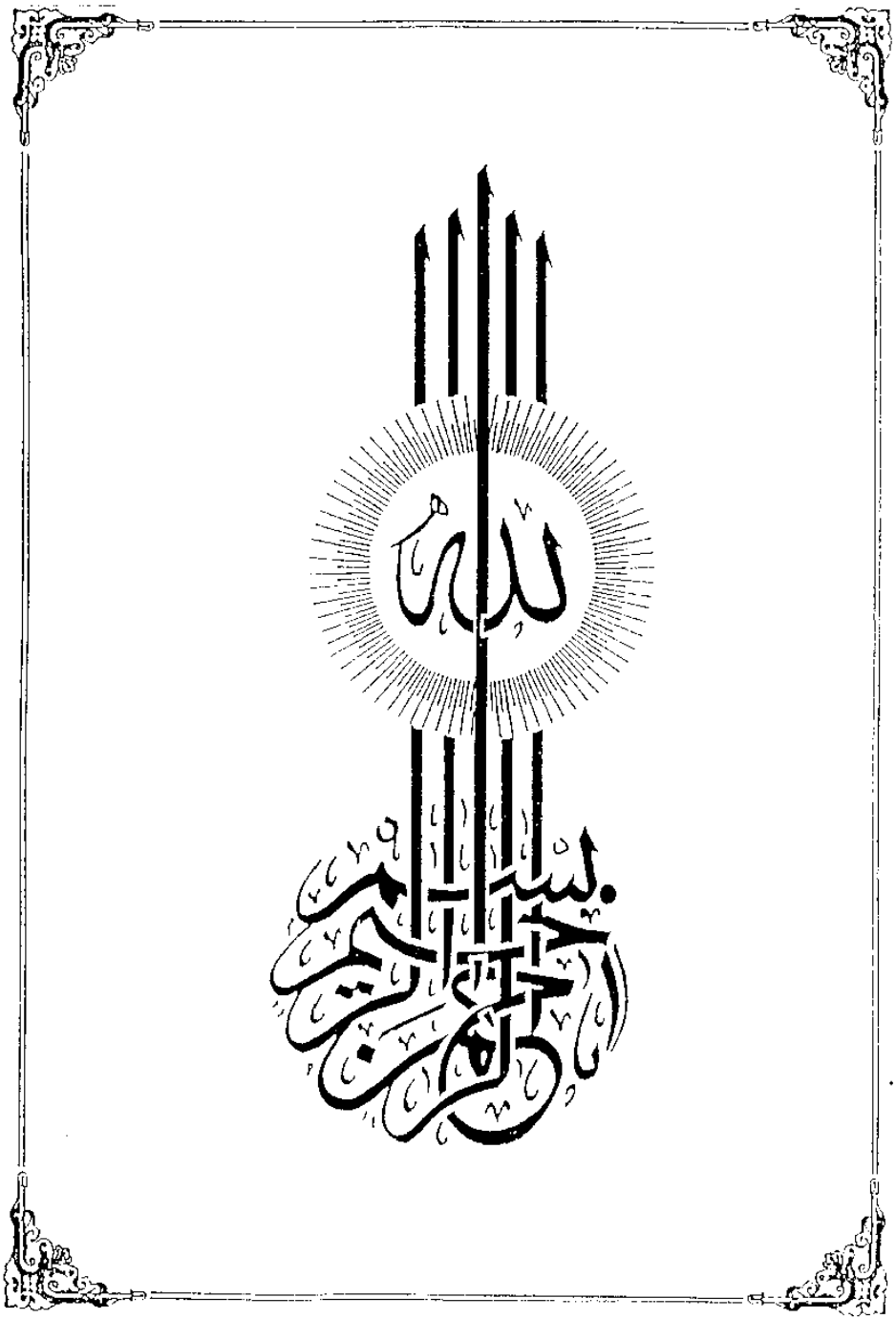

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PART I

HISTOQUANTITATIVE STUDIES ON THE CERVICAL AND THORACIC GANGLIA OF THE SYMPATHETIC CHAIN

INTRODUCTION

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During the last years there has developed an ever increasing interest in the physiology, biochemistry and pharmacology of the adrenergic innervation, adrenergic neurons and various adrenergic mechanisms (Birks and MacIntosh , 1961 ; Kobayashi and Libet, 1970; Minker, Blazsó and Kőhegi, 1980, and Fozard, Spedding, Palfreyman, Wagner, Mohring and Koch-Weser, 1980). The morphological aspects of the work in that field was rather scanty. With the development of the new techniques in the research of the nervous system and adrenergic neurons (Falck, Hillarp, Thieme and Torp, 1962; Grillo, Jacobs and Comroe, 1974, and Heym and Forssmann, 1981), it became possible to demonstrate directly the presence and the interneuronal distribution of the adrenergic transmitters. Therefore, it became necessary to re-examine the sympathetic ganglia to study the fine structure and the fundamental morphological characteristics of the adrenergic neurons in the sympathetic ganglia.

In the literature, although there were some quantitative studies on the principal ganglion neurons

of the sympathetic ganglia, yet most were concerned with the diameters of the neuron (DeCastro, 1932) and its nucleus (Spiegel and Adolf, 1922),but volume studies were lacking. Therefore, it became the aim of the present study to determine all the quantitative parameters of the ganglia, perikarya of the neurons and their nuclei and cytoplasm, with special reference to the nucleo-cytoplasmic ratio in the superior, inferior cervical, upper and lower thoracic ganglia, together with statistical analysis of such data.

Dogiel (1896), claimed to discover connector cells in the sympathetic ganglia, located in series between the pre and postganglionic neurons. Uncertainty and controversy regarding the existence of such an autonomic interneuron remained unsolved. Billingsley and Ranson (1918) and Lawrentjew (1924), had indirect evidence of their existence, while Langley (1904), Wolf (1941) and Samuel (1951), concluded that there were no such interneurons at all. On the basis of some pharmacologic and histochemical studies providing evidence about the localization of catecholamines in the sympathetic ganglia, Eccles and Libet (1961), suggested that catecholamines might

have an important role as an inhibitory modulator of the impulse transmission in the autonomic ganglia. In the meantime, a type of small catecholamine containing cells (small intensely fluorescent, SIF, cells) was reported in the sympathetic ganglia (Eränkö and Härkönen, 1965; Norberg, Ritzén and Ungerstedt, 1966; Jacobowitz,1967, and Björklund, Cegrell, Falck, Ritzen and Rosengren, 1970). The identity of such cells was not fully understood. They possessed properties similar to both, chromaffin cells and nerve cells (Siegrist, Dolivo, Dunant, Kerameus, Ribaupierre and Rouiller, 1968). Later on,afferent cholinergic synapses were reported in relation to such cells (Williams, Black, Chiba and Jew, 1976). Therefore, it became the aim of the present work to reinvestigate the catecholamine containing cells using light microscopic and ultrastructural histochemical methods, with special reference to the synaptic complexes in relation to such cells and to the principal ganglion neurons in the rat sympathetic ganglia.

The neuroglia cells of the central nervous system and sensory ganglia were studied (Ortiz-Pićon, 1955; Blunt, Wendell-Smith and Baldwin, 1965, and