STUDIES ON THE LACRIMAL GLAND

Thesis

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BY

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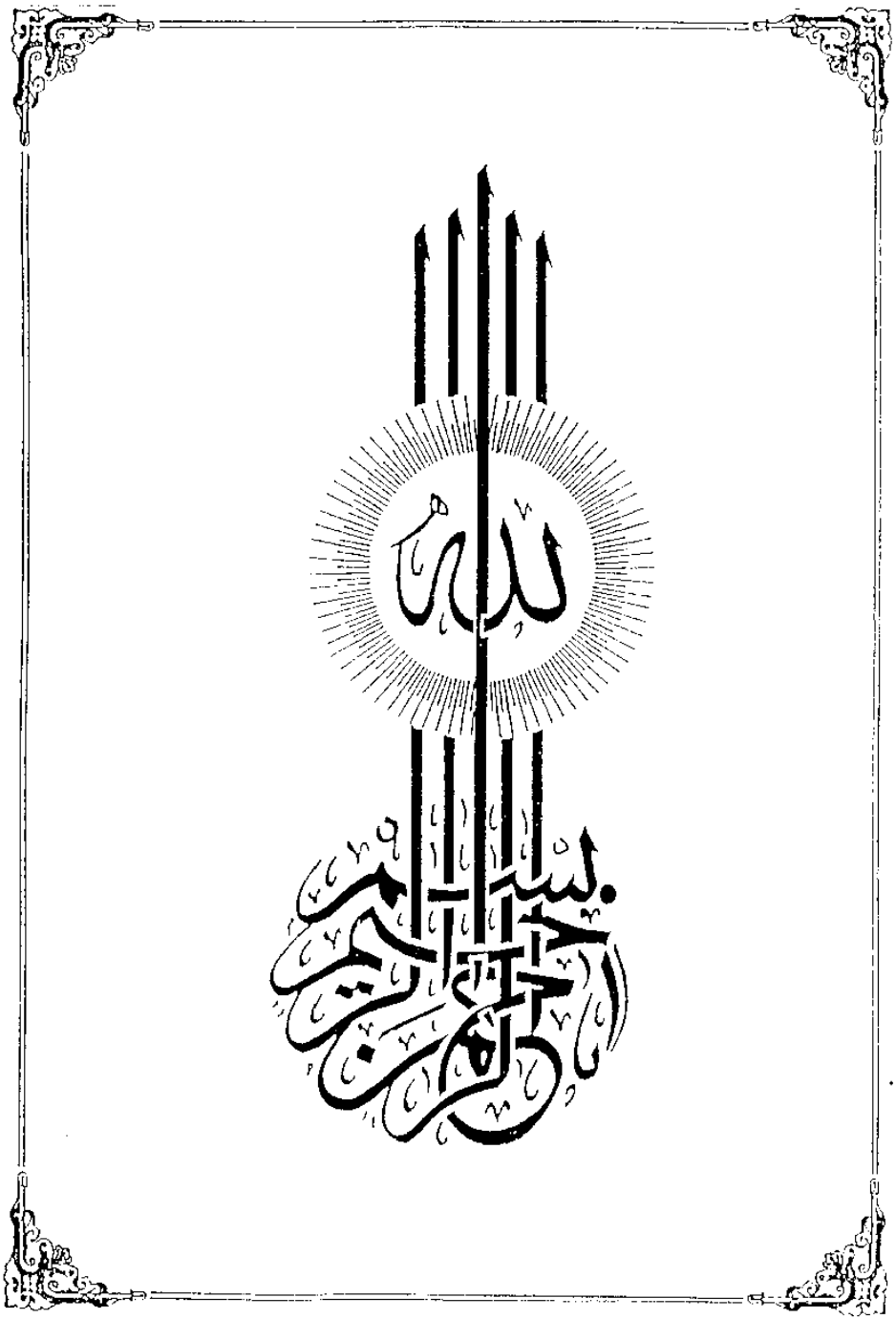

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INTRODUCTION

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Reviewing the literatures, it was found that the structure of the gland and its comparative study was investigated by Giacomini (1887), Flemming (1888), Hannes (1911), Kingsley (1917), Davis (1929), Katto (1955), Prince (1960), Babaeva (1966), Sinha (1966), Kessing (1967), Alexander et al (1973), and Huhtala et al (1977). However scanty work delt with the study of nerve terminals. Therefore, it became the aim of the present work to study the intrinsic nerve supply of the lacrimal gland of man and dog. Moreover an attempt was made to study in details the histological and histochemical features.

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REVIEW OF LITERATURE

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THE LACRIMAL GLAND AND HARDERIAN GLAND

Harder (1664) discovered a large gland situated in vicinity of the third eye lid of the deer; he termed it the Harderian gland.

Giacomini (1887) studied the Harder's gland which was present in all vertebrates except the primates. It opened by two ducts on the nasal side of conjunctival sac, and secreted an oily or mucous material. It was large in mammals especially in herbivora. It was rudimentary in the lower apes, but was absent in the anthropoids as in man. When the lacrimal gland was well developed Harder's gland was poorly developed and vice versa.

Kingsley (1917), mentioned that the vertebrate lacrimal gland and nictitating glands phylogenetically shared a common origin from the lower lid. And this might explain that the gland evoked secretion by few ducts to lower fornix of conjunctiva.

Davis (1929), described the Harderian gland as a large orbital gland which was present in most

vertebrates possessing a nictitating membrane . The function of this gland was poorly understood. Its lipid-containing secretion might lubricate the nictitating membrane.

Werner and Roberts (1951) described the Harderian gland in the dog as being surrounded by a layer of stratified squamous epithelium. Beneath this layer was a band of connective tissue from which septa extended inward dividing the gland into lobules. Two types of cells were present, the clear cells (pure serous variety) and the principal cells. The latter were more numerous. Only the principal cells reacted to specific tests for mucin.

Miller and Hable (1951) on their comment on the work of Werner and Roberts, postulated that "First, all domestic animals have a superficial gland of the third eye lid. This is not the Harderian gland. It surrounds the cartilage of the third eye lid. The cells are serous in horse and cat, mixed in the ox, sheep, and dogs, and mucous in the Pig. Secondly, the Harderian gland is the deep of the third eye lid. It

is a separate structure and is attached to the deep end of the superficial gland".

They mentioned that the Harderian gland was very large in the deer, in which species it had been described by Harder in 1664. It was absent in the horse, dog or cat and not clearly separated from the superficial gland in the ox. The Pig was the only domestic animal having the Harderian gland.

Boas and Bates (1954) studied the effect of hormones on the Harderian gland of the rat. They found that its weight was not changed by adrenalectomy, castration or stress nor was it changed by treatment with ACTH, cortisone, estradiol or testosterone. Following either thyroidectomy or hypophysectomy, the gland atrophied, and the atrophy and growth failure could be prevented by giving pituitary fractions, containing growth hormone and thyroid stimulating hormone, in case of hypophysectomy and thyroxine in case of thyroidectomy. They suggested that normal maintenance of Harderian gland in rat depended upon the presence of thyroid hormone and anterior pituitary factor, possibly the growth hormone.

Babaeva (1966) studied the post natal development of the external orbital lacrimal gland in white rats. The weight of the external orbital gland, the size of lobules, acini, nuclei and the mitotic activity of the secretory cells were determined. Up to the age of 40 days the increase in the gland weight was due to mainly to the formation of new acini, the latter took place by proliferation of the cells of the terminal portion. After 40 days, the formation of new terminal portions occurred to slight degree. The growth of the gland at 75 days onward was due to exclusively to an increase in the size of all structural components of the organ.

Eugene Wolff's (Anatomy of the Eye and Orbit, 1968)described the comparative anatomy of Harder's gland in different vertebrates. Fishes and aquatic amphibians had no lacrimal organs, the eyes being bathed by surrounding media. In the tortoise there was one gland for the two eyes. In the serpents the lacrimal gland was absent, but Harder's gland was very large, being placed in the medial angle or sometimes surrounding the globe. In birds, also, Harder's gland

was very big. Also mentioned that the gland of Harder was sebaceous in lower and marine mammals, while it tended to be more like the lacrimal gland as we passed to the higher mammals.

Startup (1969) described the canine lacrimal gland as being situated on the dorso-lateral aspect of the eye ball, within the periorbital tissues in the region of the orbital ligament. It was light red in colour, flat with rounded edges and slightly lobulated. The gland was blended with the surrounding tissues. The gland was approximately 12.5 mm wide and 15 mm. deep.

Wetterberg (1970) on his work on the Harderian gland of the rat found that some rats had a pink coloured gland, while the other had a white coloured gland. The pink colour was due to the presence of porphyrin pigments. The porphyrin content of the gland was changed by different hormonal treatment.

He also found that the circadian rhythm of pineal serotonin and the influence of the light on that rhythm

had been confirmed. Removal of the Harderian gland abolished the response to light in blinded animals, which suggested that this gland might act as the extraretinal transducer involved in the persistence of the pineal rhythm in the blinded suckling rats.

Wight et al (1971) studied the Harderian gland of domestic fowl. They examined the glands of 97 healthy fowls of light-weight laying strains. They described the gland as flattened, oval, or hour-glass shaped structure, situated ventral and posteromedial to the eye ball and having a solitary duct which opened in relation to medial angle of membrana nictitans.

Warwick and Williams (1973), described lacrimal gland as homologous with Harderian gland of lower mammals and was derived from a serous secreting element and a gland secreting an oily material. Also mentioned that in primates the lacrimal gland was serous and had migrated from its original position in the lower lid to the upper.

Getty (1975) in his book described the anatomy of the lacrimal gland of dog and considered the nictitating gland as an accessory lacrimal gland. The nictitating gland was related to the third eye lid and opened into the inferior conjunctival fornix by means of two to four ducts.

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THE STRUCTURE OF THE LACRIMAL AND THE HARDERIAN GLANDS

Structure Of The Harderian Gland Of The Birds:

Ballantyne and Fourman (1967) described the Harderian gland of marine birds and domestic ducks. They found that the gland in these species was large and its secretion was oily to protect the eye from sea water when spread by nictitating membrane. They described the gland as multilobular, and composed of many tubules lined with a single layer of tall columnar cells with basal nuclei. They mentioned that the most striking feature was the contrast between the paucity of cytoplasm staining in the peripheral lobular cells and its intensity in the central cells.

Bang and Bang (1968) described in the chickens Harderian glands numerous lymphocytic and plasma cell invasion in apparently healthy commercial stock chickens. The gland ducts were infiltrated by a series of invasive small lymphocyte nodules suggesting that this was an important component of avian-immune system.