STUDIES ON WHITE BLOOD CELLS IN CASES OF ALLERGY USING SEMITHIN SECTIONS

THESIS

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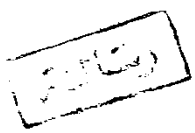

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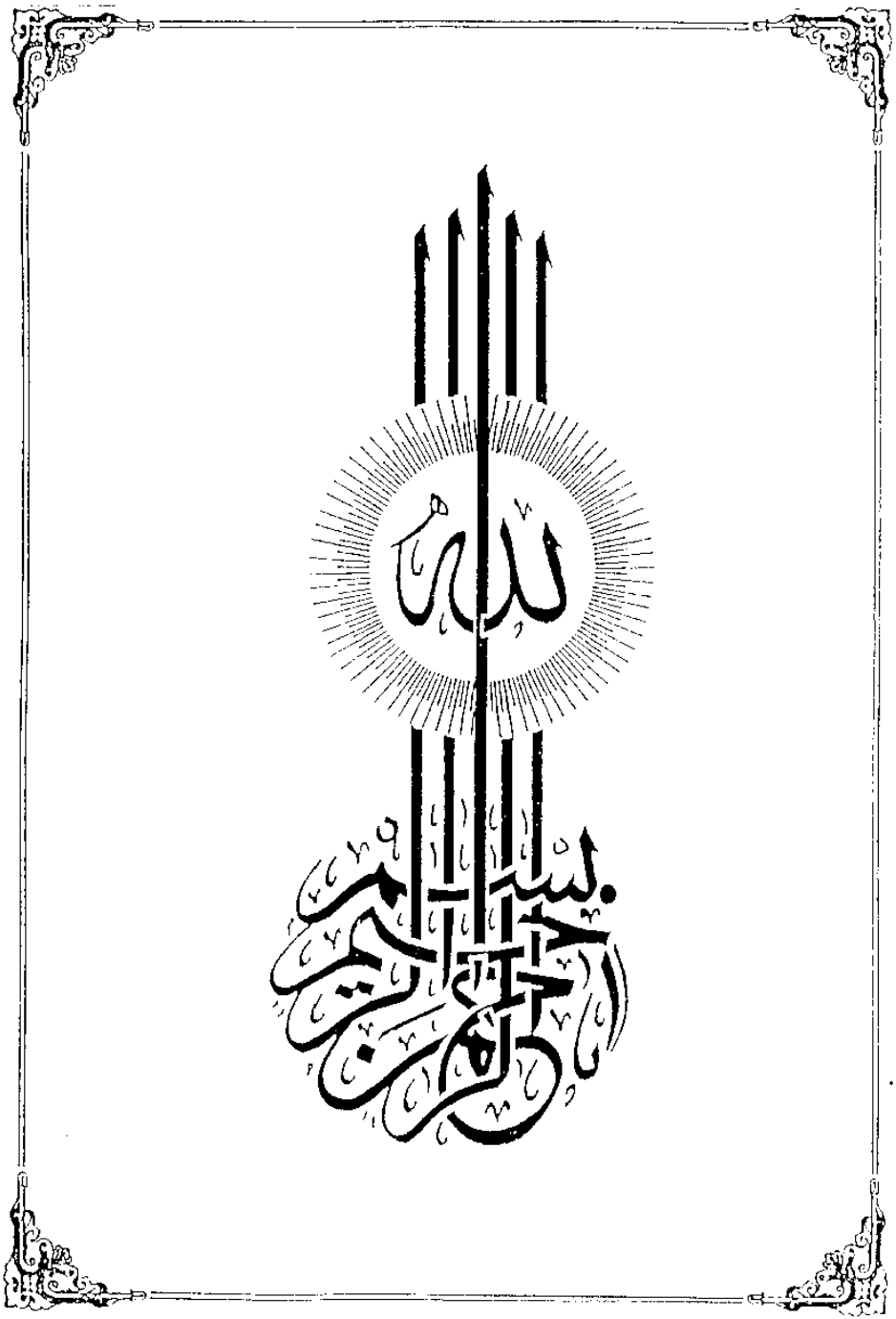

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Dvorak, Galli, Morgan, Galli, Hammond and Dvorak (1980), and Hastie, Levy and Weiss (1981) studied the role of basophils in cases of food allergy and mentioned the structural changes occuring in such cells as a result of degranulation and release of histamine and slow reacting substances.

Cline (1982) and Hubscher (1982) studied the role of eosinophils in cases of food allergy and the results of antigen antibody reaction occuring on their surface concerning the release of eosinophil derived inhibitor.

Stites, Stabo, Fundenberg and Wells (1984) studied the role of neutrophils in cases of food allergy concerning their ingestion of complexes of antigen antibody and complement, their destruction and release of lysosomes that were in great number in their cytoplasm.

Cardell and Pearson (1969) found increase in the number

of eosinophils in cases of intrinsic allergy. Johannson (1971) reported that the total serum immunoglobulin E (IgE) in cases of intrinsic asthma was low or normal in several series of patients.

Most of the above authors studied the role of leukocytes in cases of food and intrinsic allergy using ultrathin sections doubly stained with uranyl acetate and lead citrate to be studied afterwards by electron microscope

Since little was mentioned regarding the study of structural changes of different types of leukocytes in cases of food and intrinsic allergy by light microscope, it became the aim of this work to use semithin section of 1 Um stained by methylene blue and Hymphery and Pittman (1974) stain, to find out these structural changes.

REVIEW OF LITERATURE

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Classification of White Blood Cells

White blood cells were called leukocytes (Leukos, white) because when packed together they appeared white (Maximow and Bloom, 1953).

Leukocytes were classed as granular or non-granular. There were three kinds of granular leukocytes, so named because they differed from each other by the size and, in particular, the staining reaction of their cytoplasmic granules (Bailey, 1958).

White blood cells with granules that stained avidly with acid dyes were called acidophilic granular leukocytes, or since eosin is the dye generally used to colour them they were called eosinophilic granular leukocytes. The short name most commonly used for a cell of this type was eosinophil (Miller, De Harven and Palade, 1966). White leukocytes with granules that stained

avidly with basic dyes were called basophilic granular leukocytes. The short name most commonly used for a cell of this type was basophil (Downey, 1966).

On the other hand white cells with granules that were neither markedly acidophilic nor basophilic in solution of a normal pH were termed neutrophilic granular leukocytes. They had an affinity for the neutral stain of Romanowsky compound rather than for the acid or basic portions of the dye. The short term for a cell of this type was most commonly polymorph or even polymorph nuclear leukocytes (PMN), this term had no reference to their granules but to their nuclei which were formed of 1 to 5 lobes (Bloom and Fawcett, 1975).

The non-granular leukocytes were classified into two types. The more numerous and usually smaller ones called lymphocytes because they were found in lymph as well as in blood. The larger and less numerous ones were called monocytes (Rhodin, 1977).

Morphology of Leukocytes

I. Morphology of Granular Leukocytes

Neutrophils:

Neutrophils constituted from 60 to 70 percent of all leukocytes so they were the most numerous type. Mature neutrophils were approximately from 12 to 15 U in diameter and contained a prominent nucleus segmented into 3 to 5 lobes joined by thin, sometimes invisible strands of chromatin (Bailey, 1958).

The cytoplasm of polymorphs occupied more space than the nucleus and revealed little structural details except that it was fairly heavily sprinkled with fine granules which were more easily visualized under the phase microscope than by light microscope. These granules were of two types specific which were smaller in size and non-specific or azurophilic

granules which were larger in size than those of specific, they were so called azurophilic because they were stained by methylene azure to give a reddish purple colour (Cohn and Hirsch, 1960).

The electron microscope revealed that the lobes of the nucleus were seen to have condensed chromatin distributed along the inner surface of the nuclear envelope. The cytoplasm of a mature neutrophil contained a few mitochondria and a small Golgi apparatus, granules of glycogen were often scattered about in it (Bessis and Thiery, 1961).

Two granules had been described in neutrophils (Deams, 1968). The primary type, A granules corresponding to the azurophilic granules of light microscopy and these accounted for about 20 percent of the granules. They were large, dense, homogenous rounded or oval in shape and they were formed at earlier stage of development than the secondary granules. Approximately 80 percent of the granules were secondary type B. They were smaller and less dense than primary granules and were found later as the cell developed. Both primary and secondary granules were bounded by a unit membrane.

Eosinophils:

Eosinophils constituted from 1 to 4 percent of the leukocytes seen in a stained film of normal blood (Wintrobe, 1961). Mature eosinophils ranged from 10 to 15 U in diameter. They usually contained a bilobed nucleus which might be connected with strands of condensed chromatin. The cytoplasm of eosinophils had a somewhat irregular outline because of occasional pseudopodia.

The cells were characterized by striking large closely packed granules. The granules were also refractile circular in outline, uniform in size and stained a deep bright red or orange with eosin. They tend not to overlie the nucleus (Hudson, 1968).

Electron microscopic studies showed that condensed chromatin was distributed on the inner surface of nuclear envelope, and that the chief feature of the cytoplasm was its content of specific membrane-surrounded granules. They were from

0.5 to 1 U in diameter. In immature eosinophils they were composed of a homogeneous material of considerable density while in mature eosinophils some of the granules were seen to contain still denser bodies in their more central parts (Miller et al., 1966).

The eosinophilic granules contained Histamine and such enzymes as peroxidase and hydrolases (Bainton and Farquhar, 1970).

Basophils:

Basophils comprised only about 0.5 percent of the blood leukocytes. They were usually from 10 to 12 U in diameter. Their nuclei contained two or three lobes which filled about half of the cell and were often less distinctly segmented than those in neutrophils or eosinophils. The chromatin network was also looser and paler than in the eosinophilic leukocytes (Jordan, 1938).

In blood films stained with blood stains, the nucleus was overshadowed by the large dark blue stained granules of the cytoplasm which might be seen lying over the paler nucleus. These granules were found to contain histamine and heparin along with serotonin (Ackerman, 1963).

The Basophilic granules appeared by the electron microscope as dense structures about 0.5 U in diameter which might contain granular material, myelin figures, crystalloids and were bounded by unit membrane (Anderson, 1966). When well preserved the granules appeared spherical, uniform in size and tightly packed. Although they took up the basic dye the granules were water-soluble and might appear as empty vacuoles (Terry, Bainton and Farquhar, 1969).