BIOLOGICAL STUDIES ON GLYCOSAMINOGLYCANS

Thesis

Submitted for the Degree of M.Sc.

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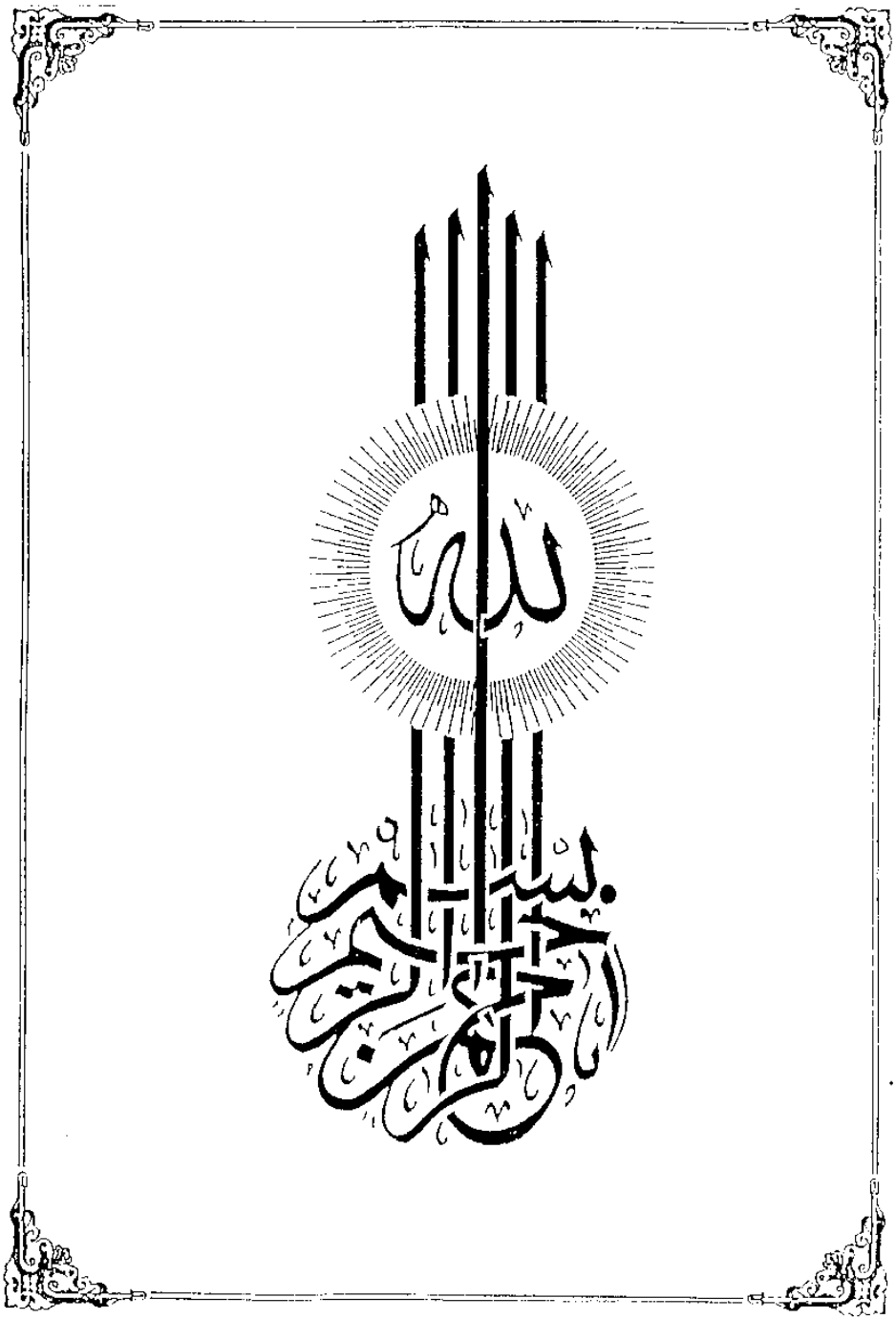

BIOLOGICAL STUDIES ON GLYCOSAMINOGLYCANS

COURSES

Studied by the Candidate in Partial Fulfilment of the Requirements for the Degree M.Sc.

1- Physiology

2- Histology

3- Histopathology

4- Invertebrate

5- English

6- Statistical

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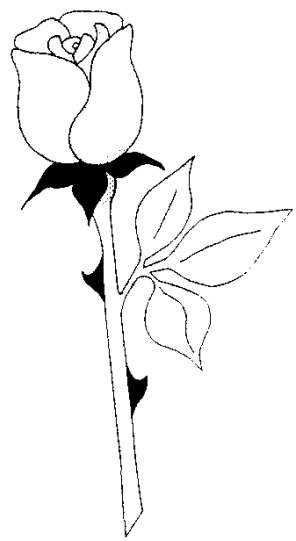
To My Parents
To My Husband Gouda
And To My Daughters
(Rehap, Eman & Amml)



ABSTRACT

Heparin (which is the most important member of glycosaminoglycan group) was isolated from beef, sheep and camel lungs and then subjected to purification. Chemical analysis and anticoagulant activity tests of the purified heparin samples comply well with the data of the international clinically used heparin.

From the biological studies of glycosaminoglycan it is found that, this group has an important role in cellular regulatory processes through gene regulation at the chromatin level and the enzymes involved in the breakdown of DNA and RNA.

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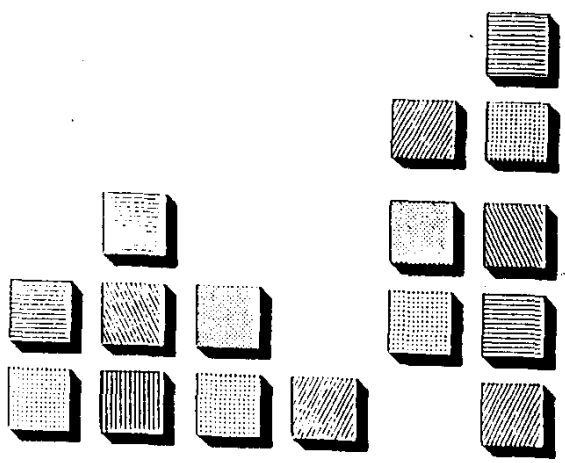

INTRODUCTION

A. General Introduction

As the advances of chemistry and biochemistry have permitted some insight into and understanding of our chemical natures and processes, new complexities, and complexities within complexities have been encountered.

One such group of complexities are the proteoglycans and glycosaminoglycans, which together constitute a group of macromolecules that clearly are important and essential, if not major, components of our bodies, but whose structures and functions are complex and far from being understood completely **(Kennedy, 1973)**.

As will be developed later, these macromolecules occur extensively in almost all, if not actually all, mammalian tissues along with collagen fibers whose positions they maintain and with which the tissue structure, type, and rigidity is produced and maintained.

Therefore they are of prime importance in health and disease.

Nomenclature of Glycosaminoglycans

The introduction in (1938) of the term mucopolysaccharide **(Meyer, 1938)** was to describe collectively 2-amino-2-deoxyhexose containing polysaccharide materials of animal origin occurring either as free polysaccharides or as their protein derivatives.

However, with the various subsequent discoveries of other types of carbohydrate containing macromolecules, the term has come to be used in so many ways that it is now in a sense quite vague.

Since the glycosaminoglycans have always come within the mucopolysaccharide category irrespective of the way in which that the term has been used, they were described widely as acidic mucopolysaccharides on account of their highly cationic nature.

However, this nomenclature arose at a time when it was not realized that the glycosaminoglycans, as we call them today, are attached covalently to protein, and at a time when the polysaccharide was isolated with some amino acid units attached.

Thus, acidic mucopolysaccharide means the glycosaminoglycan of a proteoglycan plus (some times) a few amino acid units, whereas glycosaminoglycans means purely the polysaccharide part of a proteoglycan.

On account of the apparent regularity of the polysaccharide chains in proteoglycans and the early belief that the protein present in preparations of the polysaccharide parts represented impurity, greatest attention has been given to the glycosaminoglycan chains themselves rather than to proteoglycans as a whole.

Thus the glycosaminoglycans have been named individualy, but not so much according to their component monosaccharides and their simplified disaccharide repeating structures (these were often unknown at the times of original isolation), but according to trival reasoning, e.g., by naming after the source.

In all, eight glycosaminoglycans of essentially different chemical structures have been identified.

Through the times, these glycosaminoglycans have been individually named in a number of ways shown in Table 1. Most of these names are used currently. Where the term chondroitin sulfate appears in the more recent literature, this can mean chondroitin 4-sulfate or chondroitin 6-sulfate or a mixture of the two.

The terms keratan sulfate 1 and keratan sulfate II are sometimes used to denote keratan sulfates of corneal and skeletal origin, respectively, there being, some differences between the two.