Glycosaminoglycans and Proteoglycans in Physiological and Pathological Processes of Body Systems


52 figures and 49 tables, 1982

KARGER

Basel - München Pans London nEW York - Tokyo - Sydney

The Editors

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National Library of Medicine, Cataloging in Publication
Glycosaminoglycans and proteoglycans in physiological and pathological processes of body systems/
1. Glycosaminoglycans - metabolism
2. Proteoglycans - metabolism
I. Varma, Rajendra II. Varma, Ranbir S.
QU 55 G568
ISBN 3-8055-3440-X

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Preface

The human body is an organized, complex machine, in which various functional systems of the body act cooperatively for the homeostasis of the ’milieu interieur’ of the body, which is so essential to the function of biochemical and physical mechanisms for sustaining life. The organization of the human body from numerous minute functional units, called cells, into tissues, organs, and systems is dependent upon the binding and supporting functions of the intercellular matrix, which consists of the fibrous elements (collagen and elastin), structural glycoproteins, and proteoglycans. Depending upon the function performed by an organ, its tissues contain variable amounts and proportions
of these macromolecules. Because of
the intercellular location of the matrix, all
nutrients entering the cells and the metabolites
leaving the cells must pass through it.
The metabolism of the intercellular matrix
macromolecules is influenced by mechanical,
thermal, chemical, hormonal, and
psychosomatic factors. These factors produce
changes in physical properties (which include:
intermolecular interactions and aggregations,
viscosity, permeability, stability, water-binding
capacity, transparency, swelling,
and adherence properties) of the matrix as
adaptations to changing needs and environments
inside and outside the body tissues.
Similarly, disturbances in biosynthesis and
catabolism of the protein and glycosaminoglycan
components of the proteoglycans produce
a multitude of genetic and/or acquired
abnormalities. The intercellular matrix,
therefore, is an important site for influencing
the physiology and pathology of the surrounding
cells. Although the fibrous elements
and structural glycoproteins are also important,
this book is devoted exclusively to the
glycosaminoglycan-protein conjugates (proteoglycans)
and their aggregates in tissues of
the various systems of the body.
This volume is a collaborative effort by
experts from all over the world, who have
approached the problems of normal physiology
and pathology at the macromolecular
level of proteoglycans. We have sought specialists
from different medical fields, who
have presented up to date integrated concepts
on the role of glycosaminoglycans and proteoglycans,
based on their experience, authority
and expertise in their fields, in relation
to the pathophysiology of life, aging,
health, and disease. Each author has attempted
to provide a comprehensive discussion
within the space allowed. Because of
this, a little overlap became inevitable at a few places. While dealing with metabolism of these macromolecules in tissues, the contributors have attempted to promote the how and why of normal functions and the appearance of symptoms due to qualitative and quantitative changes in glycosaminoglycans and proteoglycans resulting from metabolic aberrations occurring in diseases and senescence.

X Preface

The introduction provides a concised overview of the nature and role of proteoglycans in physiology and pathology of the mammalian body. The first section of the book deals with general procedures used in isolation, analysis, and characterization of glycosaminoglycans and proteoglycans, while the second section describes the mechanisms involved in the control of biosynthesis and degradation of these macromolecules. The metabolism of these in normal and pathological states has been dealt with in the next section of the book. Defects in control mechanisms of degradation of proteoglycans have been found to be localized at the level of lysosomes. These lysosomal degradation disorders affect various systems of the body and these have been grouped in the next section. On the other hand, some pathological states, such as cancer, cystic fibrosis, amyloidosis, endocrinopathies, leprosy, and other mycobacterial infections affect the organs of the different systems of body simultaneously. Similarly, the degenerative changes in proteoglycan metabolism occur in senescence concomitantly in several systems of the body. The multiple system involvement in disease states and the senile changes have been explained in terms of proteoglycan metabolism in the next section.
The physiology and pathology of the special senses (especially sight and hearing) in relation to proteoglycan metabolism have been described in the last section of the book. A large amount of previous work has been on glycosaminoglycans isolated by proteolysis of the proteoglycans and their aggregates present natively in the tissues. For this reason, both the terms 'glycosaminoglycans' and 'proteoglycans' have been included in the title of the book, although the latter macromolecules and their aggregates are the functional ones in the tissues. The major portion of the work reviewed in this book is on the metabolism of these macromolecules in tissues. Additional information on these macromolecules in biological fluids has been summarized in our recent monograph Mucopolysaccharides (Glycosaminoglycans) of Body Fluids in Health and Disease (de Gruyter, Berlin 1982).

The book provides an introductory as well as an integrated, specialized information on the involvement of glycosaminoglycans and proteoglycans of the intercellular matrix in relation to physiology and pathology of the tissues in various systems of the complex mammalian body. It is hoped that this integrated information will be conducive to an understanding of the mammalian pathophysiology and development of diagnostic, prognostic, and curative procedures. Also, it is hoped that this book will be of a great help to pathologists, biochemists, physiologists, molecular biologists, and investigators in different medical specialities.

Warren, Pa., USA

R.S. Varma
R. Varma
Dedicated with love to our sons,
Rajeev and Sunil