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Multi-author Reviews

Proteoglycans

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Proteoglycans. Introduction

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My first acquaintance with the world of proteoglycans dates from the time I was involved in molecular and phylogenetic studies concerning the lysozyme family. Indeed, many colleagues active in the area of proteoglycans (at that time termed acidic mucopolysaccharides) were puzzled by the frequent presence of lysozyme in their so-called purified proteoglycan fractions. Later on, I was engaged in a series of studies involving sugar-containing compounds, starting with various lysozyme substrates and several active glycopeptides and glycoproteins. I was fascinated by the great diversity of the prosthetic sugar groups, their microheterogeneity, the variability they sometimes showed as a function of development. At this stage, I was attracted to work with some more complex sugar-containing compounds – although still with molecules possessing a peptide part, in order not to forget my first research field.

Proteoglycans belong to a versatile protein family whose potential functions proceed from either the glycosaminoglycan chains they bear or from specific regions of their protein cores. The first studies of our laboratory on proteoglycans in 1978 were devoted to components of the human and bovine nasal cartilage proteoglycan complex; to the hyaluronic acid-binding region, and to the 'link'-porteins and their sugar moieties that belong to this complex. A homology – unexpected at that time – was observed between link proteins and immunoglobulin-like proteins: thus these studies joined other investigations of our laboratory devoted to the evolution of proteins. In collaboration in our laboratory with P. Alliel, F. Bonnet, P. Maillet and J.-P. Périn, we were later on interested by a series of other proteoglycans: we established the complete sequence of a human platelet proteoglycan, studied the expression of the 'Serglycine' gene in human leukemic cell lines, and recently characterized a glycosaminoglycan-bearing polypeptide from human seminal plasma.

As a section editor of Experientia, I found it appropriate to organize a multi-author review on proteoglycans and to ask some well-known colleagues to highlight some aspects of this exciting and rapidly growing research area, more particularly as proteoglycans fortunately can no longer be considered, as they were only a few years ago, as simple, inert building blocks.

After a brief historical survey of work on proteoglycans by M. Yanagishita, N. S. Fedarko discusses recent aspects of their purification. The large 'aggrecans' are reviewed by W. B. Upholt et al.: the large aggregating chondroitin sulfate proteoglycan of cartilage, aggrecan, has served as a prototype of proteoglycan structure; the latter is consistent with the concept of exon shuffling, and aggrecans serve as suitable prototypes for comprehending the evolution of multi-domain proteins. The present state of knowledge concerning the associated link-proteins and related molecular domains is reported by P. J. Neame and F. P. Barry. Smaller proteoglycans, particularly the serglycin proteoglycans characterized by repeat sequences of serine and glycine, are reviewed by H. Kresse et al.

Proteoglycans contribute to maintaining an essential microenvironment for cell adhesion, migration and proliferation. In this connection R. Timpl reports on proteoglycans of basement membranes and particularly on the most prominent one, perlecan.

There has been an exponential increase in publications on the neurobiology of proteoglycans. R. K. and R. U. Margolis focus their contribution on reports which have appeared since 1988, and especially on these concerning the properties of individual characterized nervous tissue proteoglycans.

Recent evidence indicates that significant changes in proteoglycan content occur in the tumor stroma, and that these alterations could support tumor progression and invasion as well as tumor growth: R. V. Iozzo and I. Cohen summarize recent data in this research field.

Cytokines are polypeptide mediators produced by a variety of cells. J. J. Nietfield discusses those proteoglycans which have been found to be affected by cytokines, and describes the activities of these proteoglycans and their connections with the cytokine network.