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Book reviews

J.P. Kamerling, G.-J. Boons, Y.C. Lee, A. Suzuki, N. Taniguchi, A.G.J. Voragen (Eds.)., Comprehensive Glycoscience—From Chemistry to Systems Biology, vols. 1–4, Elsevier Ltd, Oxford, UK (2007). (xcvi + 3551 pp., £1325.00, ISBN: 0-4445-2746-2)

Glycans are an incredibly varied and structurally diverse family of molecules, which are constantly under intense scientific investigation due to the important roles they play in biological systems, from cell recognition and energy storage, to formation of structural components. As such, they are vital to many aspects of modern science, medicine, and industrial processes and technologies. In recent years, this has led to the creation of numerous new fields, such as glycomics, glycobioinformatics and glycochemistry, to name only a few, all encompassed by the blanket term 'glycoscience'. Glycoscience is therefore a complex subject, requiring knowledge of aspects of biology, chemistry (and thus biochemistry). *Comprehensive Glycoscience* aims to provide an in depth analysis and understanding of this extensive, and highly important field.

The first volume in this set begins with 5 chapters that provide an introduction to glycoscience, covering the basic concepts and nomenclature in carbohydrate chemistry, and the structures of glycoprotein glycans, glycosphingolipids, microbial polysaccharides, and cell wall polysaccharides. This is followed by 18 chapters dealing with the synthesis of carbohydrates. Topics covered include protecting group manipulation, O-glycosidation, 2-deoxy glycosides, polymer-supported oligosaccharide synthesis, synthetic strategies, enzymatic approaches using glycosyltransferases and glycosidases, sialic acid glycosides, glycopetides and glycoproteins, C- and S-glycosides, lipopolysaccharides, peptidoglycan and lipoteichoic acid fragments, glycosaminoglycans and their oligosaccharides, glycolipids, glycosidase and sialidase inhibitors, and microbial oligosaccharide production.

The second volume is concerned with the analysis of glycans, and polysaccharide functional properties. There are numerous techniques and technologies available for glycan identification. Such analytical aspects of glycoscience are dealt with by 13 chapters, which discuss structural analysis strategies, mass spectrometry, NMR spectroscopy, diffraction methods, X-ray crystallography, 2D/3D HPLC mapping, HPAEC-PAD, databases and informatics, molecular modelling, capillary electrophoresis, and DNA microarrays. The 10 chapters that discuss polysaccharide functional properties will be of particular interest to the readership of this journal, with particular topics including chitin and chitosan, bacterial exopolysaccharides, yeast and fungal polysaccharides, starch, plant storage xyloglucans, galactomannans and glucomannans, plant cell wall xylans, seaweed polysaccharides, and the biosynthesis of cellulose, and starch.

The penultimate volume deals with the biochemistry of glycoconjugate glycans (20 chapters), and carbohydrate-mediated interactions (16 chapters). Chapters of particular interest in this volume cover the biosynthesis of glycosaminoglycans and proteoglycans, the degradation of glycosaminoglycans, hyaluronan biosynthesis, sialic acids, blood group antigens, natural product glycodiversification, plant, mushroom and microbial lectins, and antibody structures. The final volume in this set covers cell glycobiology and development (18 chapters), and health and disease in glycomedicine (18 chapters). Glycans play a major role in cell recognition and signalling, and therefore in embryogenesis and development. Glycans play an important role in the immune systems of animals, and bacteria possess surface antigens and cell wall polysaccharides, the nature of which can strongly affect pathogenicity. Specific topics of interest include skin, and yeast glycobiology, and the roles of glycoconjugates in inflammation and inflammatory disease, cancer, viral, bacterial and parasitic infections, neurological diseases, vaccines, and therapeutic antibodies. Particular attention is also given to milk oligosaccharides, and fructo-, galacto-, galacturono- and xylo-oligosaccharides as prebiotics.

Through more than one hundred chapters in 4 volumes, highly recognised glycoscientists give an insight into their glycoworld, with glycoknowledge discussed on a basic (tutorial) level, as well as on a more advanced level, depending on the topic. In conclusion, *Comprehensive Glycoscience* can be considered as an essential encyclopaedic reference work for all academic and industrial students and scientists interested in the state of the glyco-art.

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Biologically Inspired Textiles, A. Abbott, M. Ellison (Eds.). Woodhead Publishing Limited, Cambridge, UK (2008). (xxi + 219 pp, £115.00), ISBN: 978 1 84569 247 6

Textiles are flexible materials consisting of a network of natural or artificial fibres which are often referred to as thread or yarn. The textile industry is one of the biggest industries in the world because it is responsible for the production of the basic items required by mankind. Textiles have a variety of uses, the most common of which are for clothing and containers such as bags and baskets. In the household, they are used in carpeting, upholstered furnishings, window shades, towels, coverings for tables, beds, and other flat surfaces, and also in art. In the workplace, they are used in industrial and scientific processes such as filtering.

Textiles used for industrial purposes, are chosen for characteristics other than their appearance, and are commonly referred to as technical textiles. These include textile structures for automotive

applications, medical textiles (e.g. implants), geotextiles (reinforcement of embankments), agro textiles (textiles for crop protection), protective clothing (e.g. against heat and radiation for fire fighter clothing, against molten metals for welders, stab protection, and bullet proof vests). In all these applications stringent performance requirements must be met.

There are four different types of textiles, the natural textiles which consist of the animal textiles (from fur and hair), plant textiles (from cotton, grass and hemp), and mineral textiles (from asbestos and basalt fibres used in making vinyl tiles, sheeting and adhesives), and the synthetic textiles, which are used primarily in the production of clothing.

Biologically inspired textiles is comprised of 10 Chapters that are divided into two parts. Part one involves the production, properties and biometric principles of textiles and consists of the first five chapters. Part two deals with biometric applications in textiles and includes chapters six to ten.

The introductory chapter covers the characterisation and production of protein-based fibres using recombinant DNA technology (Chapter 1). The purification and separation methods used for these biologically inspired textile proteins are dealt with next (Chapter 2). The spinning techniques used for processing pure silk, collagen and elastin fibrous proteins from both natural and artificial protein-based fibre sources as well as the properties of the products are discussed in Chapter 3. The mechanical properties of silk are studied as well as the relationship between its structure and composition (Chapter 4). The biometric approach in the production of structural composites using plant fibres is discussed (Chapter 5). Biometric principles in the design of clothing, problems facing the clothing industry and the future requirements of the industry are explored (Chapter 6). Other aspects of textile technology, such as those with self-cleaning properties (based on the lotus effect) and methods used to test the hydrophobicity of such textiles are presented (Chapter 7). The thermal properties of animal fur and artificial furs are analysed and compared (Chapter 8). The structural analysis and mechanical properties of some plant stem materials, and the transfer of their physical properties into technical applications is presented (Chapter 9). Finally topical bionic research activities of fibre based materials is discussed (Chapter 10).

In conclusion, this book is aimed at professionals doing research and development and designers in areas of industrial technology especially those dealing with clothing. This volume also gives manufacturers of the future an insight into producing novel textile materials for different applications using environmentally friendly materials and technologies.

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Starch Chemistry and Technology, J. BeMiller, R. Whistler (Eds.), third edition Academic Press, Burlington, MA, USA (2009). (xx + 879 pp, £125.00, ISBN 978-0-12-746275-2)

Starch is a polysaccharide which consists of a large number of glucose units linked together by glycosidic bonds. The general chemical formula of starch is $(C_6H_{10}O_5)_n$. Starch is produced by all green plants as an energy source, and is composed of two types of macro molecules, namely amylose, which is linear and helical, and amylopectin which is branched. The relative quantities of these macro molecules in starch varies significantly depending on the type of plant but is normally in the range of 20–25% amylose and 75–80% amylopectin.

During the process of photosynthesis, plants obtain light energy to produce glucose from CO_2. The glucose is then stored in the form of starch granules.

Starch has a variety of uses but the major use is as a food source since it is the most important carbohydrate in the human diet. In industry, it is used in paper making as a surface coating and sizing agent, for the production of corrugated board adhesives and in the construction industry where it is used in gypsum wall board. Human consumption of starch dates back as far as 115,000 ago, from trace amounts of rice found under excavations and carbon dating gave this age.

This volume is composed of 22 chapters and covers all aspects of starch chemistry and technology. The history and future of starch including the uses of speciality starches and other products of starch is covered in Chapter 1. The expansion of the starch industry in the USA and other countries of the World including the increase in demand and uses of starch in a range of industrial products is the focus of the second chapter. The next chapter deals with the occurrence, genetics and physiology of starch genetics focusing on the non-mutant starch granule; its composition and development. Particular attention is also given to plant species which are important sources of commercial starch such as maize. The biosynthesis of starch and enzyme-catalysed reactions involved in starch synthesis in higher plants and algae is discussed in Chapter 4. Comparison of the enzymes of glycogen synthesis to analogous plant enzymes is also provided. Structural analysis of starch granules, the molecular organisation of the crystalline structure and the use of imaging techniques such as scanning electron microscopy (SEM) and atomic force microscopy (AFM) to analyse the detailed surface structure of granular starch is presented in Chapter 5. This is followed by discussion of the structural features of starch granules with emphasis on their general characteristics and molecular composition, the structures of amylose and amylopectin and molecular components in the granule (Chapter 6). The study of the action of enzymes on starch especially the amylases, the mechanism of enzymatic hydrolysis of glycosidic bonds and the enzymatic characterisation of starch molecules is detailed in the next chapter (Chapter 7), whilst the structure, properties and physical methods of analysis of starch including some aspects of phase transition behaviour are covered in Chapter 8. There is also an extensive study on the different sources of starch, these include: Corn and Sorghum starches, their structure, composition and grain quality, and derived products (Chapter 9); Wheat starch; production, properties, modification and uses (Chapter 10); Potato starch; the history of potato processing, potato starch production and the structure and chemical composition of potato starch (Chapter 11).

Other sources of starch covered include cassava starch (Chapter 12), rice starch (Chapter 13), rye starch (Chapter 14), oat starch (Chapter 15) and barley starch (Chapter 16).

Modifications of starch involving enzyme-catalysed reactions, thermal treatment, physical and chemical modifications to make them more suitable for particular applications by enhancing their properties (Chapter 17).

This volume also covers a variety of uses of starch including the following:

Uses of starch in the paper industry, the application requirements for starch (viscosity, purity, etc.), dispersion of starch and various uses in the industry (Chapter 18). The use of starch as a polymer material, as starch graft copolymer and in rubber starch foams (Chapter 19). Uses of starch in the food industry (Chapter 20), Sweeteners derived from starches, their production, properties and uses (Chapter 21).