

Preface to First Edition

Many universities have recently introduced courses with a major content of biotechnology. In addition, many of the older courses in biological sciences have found it desirable to incorporate material which could properly be described as biotechnology. This book is written for students of such subject areas, but we hope will also be found useful by others who want a compact but reasonably comprehensive account of the rapidly growing biotechnology of polysaccharides.

Because it is undergoing such rapid growth, there will almost certainly be many examples of polysaccharide biotechnology in actual application when this book appears which had not reached that stage when it was written. For this reason, we have allowed ourselves to include some examples which look as if they are likely to find application in the near future, despite our endeavour to illustrate the technology by examples that are actually in use, rather than possible processes that might one day find application, but all too often really illustrate unfulfilled promise.

We have taken a broad view of the scope of biotechnology. In its early days, one might have got the impression that it consisted of large-scale fermentations for the production of a variety of small molecules. It is now far beyond that and could be broadly considered as any applied field for which more recent developments in molecular biology provide the underlying basis. Generally if there is a doubt we have included it.

A useful working definition of biotechnology is that it is what people calling themselves biotechnologists do. Our material would pass that test. There is a selection of references in the text, and they are chosen to be representative rather than particularly notable. More important we give some general references – mostly reviews. With the ready availability of databases, any student can find a more comprehensive list of references to the primary literature than we could ever include, given a few leads, and we have chosen not to clutter up the text by the inclusion of dozens of references included on a more or less ritual basis which will in practice never be used. Much better to give a way in to the necessary key words, which will probably survive an out of date reference list.

A major problem in biotechnology at present is that the useful properties of macromolecules, especially polysaccharides, can rarely be specified in terms of the molecular properties. On the other hand, molecular biology and the results of genetic manipulation are almost always described in molecular terms. For example, it is possible by suitable gene modification to alter the degree of branching of many polysaccharides while precisely what effect this will have on a product on the supermarket shelf is not predictable or even describable in such terms.

We have the slightly absurd situation, at first glance, that the results of complex DNA manipulation, and extremely detailed chemistry, may have to be assessed by a taste panel. Taste panels are not very good at this. There would be fewer new product failures if they were better, but there is all too often nothing else available. Much current effort is going to fill the gap for the food industry, and the situation is less bad in, for example, pharmaceuticals where the molecular basis of action is better understood.

For this reason, we have included a substantial amount on the characterization of polysaccharides, because this will offer the only way of assessing the suitability of novel materials for their potential use. This is largely based on their properties in solution because this is where most of them will find application. The contrast with heterologous expression of enzymes is obvious, since

in that case the activity of the enzyme is central to the novel application, while this easy test is completely lacking in the case of polysaccharides. They must be assessed on a different basis.

Each chapter includes a brief account of the basic chemistry, including size and shape, of the polysaccharide or group of polysaccharides and then sets the industrial scene with an account of uses and in some cases existing biotechnology-based processes. We then consider the biosynthetic pathways and opportunities for the modification of the molecular structures and the way in which this has been used, or in a few cases might be used to enhance the applications. Most polysaccharides derive from plants – the overwhelming bulk of those that have found useful applications certainly do – and so we have included modification to the source crops whether or not this has been done by conventional plant breeding.

Finally, we would like to thank Gudmund Skjåk Braek and Bjørn-Torger Stokke for their comments and suggestions. We must also apologize in advance for the omissions which are inevitable in such a fast-moving field with a diverse literature and worldwide interest. We have tried to include everything but there will certainly be something that we have missed.

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Preface to Second Edition

It has been nearly 20 years since the publication of the first edition. These two decades have seen two parallel developments. First, a huge growth in the application of carbohydrate-based technologies and second, an expansion of biotechnology-related courses taught at universities. At the Universities of Nottingham and Oslo for example we have seen in particular the growth of courses on biotechnology at not only undergraduate level but in particular at postgraduate Masters level as well, and also courses taken by PhD/DPhil students as part of their training. In this new edition, we have kept the successful format of the first edition but updated the content to reflect the growth of the subject, introducing students to new developments and applications in, for example, marker-assisted selection and other genetic technologies. We also consider the growth in (and our understanding of) the application of polysaccharide bioactivity, and a whole new chapter is devoted to this important area. This new edition also introduces students to the fascinating and hugely important area of polysaccharide and glycoconjugate vaccines against serious disease such as meningitis. Whilst keeping the book at an introductory level, key follow-up references to topics are given. *An Introduction to Polysaccharide Biotechnology* should be of interest not only to students but also to other new researchers and even experienced scientists. The student should be aware that there have recently been some changes in the nomenclature of plants – the sources of many polysaccharides used in biotechnology. Throughout the book, we have used the plant names corresponding to the time when the papers referred to were published. Finally, we would like to thank Professor Graham Seymour for his comments and suggestions on this new edition.

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Note for Second Edition

Following student feedback to the previous edition, in this current edition each chapter contains a Further Reading section as a follow up source for students, in addition to the Specific Reference section.