

**Cover illustration**

Polarized light micrograph showing crystalline glucose, one of the simplest sugars. (Courtesy of Science Photo Library.)

Editor, Nature

Philip Campbell

Insights Publisher

Sarah Greaves

Publishing Assistant

Claudia Banks

Insights Editors

Ritu Dhand

Karl Ziemelis

Production Editors

Davina Dudley-Moore

Sarah Archibald

Senior Art Editor

Martin Harrison

Art Editor

Nik Spencer

Sponsorship

Gerard Preston

Emma Green

Production

Susan Gray

Marketing

Katy Dunningham

Elena Woodstock

Editorial Assistant

Laura Shaw

GLYCOCHEMISTRY & GLYCOBIOLOGY

Carbohydrates have long been underappreciated by the scientific community, and many scientists approach the complex structures and elaborate nomenclature of carbohydrates with trepidation. Like amino acids and nucleic acids, sugars are abundant in nature: many natural products contain oligosaccharides that are vital for their biological activity, and carbohydrates have key roles in a broad range of biological processes, including signal transduction and immune responses.

Although fewer scientists work with carbohydrates than with other biopolymers, researchers in this field have been prolific. Chemists and biochemists have developed new methods to rapidly synthesize oligosaccharides, enabling them to generate complex polysaccharides and analogues of natural products that have increased activity *in vivo*. Biologists have explored the physiological roles of various sugars, discovering that many have essential roles in all of the major organ systems and are involved in several disease states. In addition to extending our knowledge of how the natural world works, these findings have been used to develop carbohydrate-based drugs and vaccines, some of which show great promise for treating or preventing various diseases, including malaria, cancer and AIDS.

The number of chemists, biochemists and biologists in this field is steadily increasing, and this interest underscores the fact that there are so many discoveries to be made. To quote Ajit Varki (see page 1023), it is “a fertile area for the new generation of young scientists”.

In this Insight, we present a collection of reviews that highlights some of the hottest areas in glycochemistry and glycobiology, including the chemical synthesis of carbohydrates, their biological functions and the therapeutic potential of carbohydrate-based drugs and vaccines. We hope that you enjoy it.

We are pleased to acknowledge the financial support of Vastox and Dextra Laboratories in producing this Insight. As always, *Nature* carries sole responsibility for all editorial content and peer review.

Joshua Finkelstein, Senior Editor

REVIEWS

1000 Chemical glycosylation in the synthesis of glycoconjugate antitumour vaccines

D. P. Galonić & D. Y. Gin

1008 Unusual sugar biosynthesis and natural product glycodiversification

C. J. Thibodeaux,

C. E. Melançon & H.-w. Liu

1017 Cycling of O-linked β -N-acetylglucosamine on nucleocytoplasmic proteins

G. W. Hart, M. P. Housley &

C. Slawson

1023 Glycan-based interactions involving vertebrate sialic-acid-recognizing proteins

A. Varki

1030 Heparan sulphate proteoglycans fine-tune mammalian physiology

J. R. Bishop, M. Schuksz &

J. D. Esko

1038 Exploiting the defensive sugars of HIV-1 for drug and vaccine design

C. N. Scanlan, J. Offer,

N. Zitzmann & R. A. Dwek

1046 Synthesis and medical applications of oligosaccharides

P. H. Seeberger & D. B. Werz

nature
insight