The Gallery of Sweet Rendezvous

We are currently witnessing a shift in the long-held paradigm that genomics is the prime asset in biochemical information storage and transfer. The capacity offered by oligosaccharides is unsurpassed by any other class of biomolecules, a strong theoretical argument for the manifestation of the sugar code. But how are the messages read and turned into action? What are the chemical rules to distinguish the letters of the sugar language such as glucose, mannose, galactose, and its "Umlaut"-like derivative GalNAc? Here is an invitation to visit a well crafted art gallery on the encounter of carbohydrate molecules with (glyco)-protein receptors called lectins.

About 80 years ago, J. B. Sumner, a pioneer of lectinology, wrote: "If jack bean extracts are covered with toluene and simply allowed to stand exposed to the air for several weeks, this protein is precipitated as beautifully formed crystals having a diameter of about 0.1 mm. The author proposes to name this globulin concanavalin A."[1] Since this protein "unites with starch, glycogen, mucins, etc.," its binding partner was assumed to "be a carbohydrate group in a protein."[2] Viewed with hindsight, the classical assay to let "red blood-corpuscles fuse together into irregular masses acting like soft elastic colloid material"[3] (independently described as "Zusammenballung der rothen Blutkörperchen"[4]) was thus based on a specific protein–carbohydrate interaction. This blood-group-specific agglutination of erythrocytes by plant extracts and eel serum was crucial for "unravelling the biochemical basis of blood group AB0 and Lewis antigenic specificity."[5] This breakthrough in hematology won these proteins remarkable respect in the scientific community. It prompted W. C. Boyd to bestow an identity on them: "the present writer would like to propose the word *lectin* from the Latin *lectus*, the past principle of *legere* meaning to pick out, choose or select."[6] Sharing target specificity with antibodies, the lectins seek distinct determinants of the glycan part of cellular glycoconjugates. As alluded to above, it is "ideal for generating compact units with explicit informational properties."[7] Spurred by technical advances to detect and purify lectins, the days are now long past when they were portrayed as "unlikely to provide a general mechanism of recognition and communication."[8] In fact, work on the sugar code and functional lectinomics is making its mark on how we view fundamental processes in cell adhesion, migration, and growth regulation as well as infection.[9]

With the growing recognition received from medicinal chemists, biochemists, and biologists alike, the desire is stoked for a web site which concentrates on the essence of lectin structures without the need to wander around in the wide realm of the PDB without guidance. The "3D Lectin Database" satisfies this desire. It is a truly laudable endeavor which provides an authoritative collection of lectin structures with timely updates like an art gallery. Looking around in the sections on viral, bacterial, plant, and animal lectin families with their steadily growing complexity of classification gives a perfect sense of the intricacies of decoding the sugar code. One can view with amazement how carbohydrate ligands are accommodated by different folding patterns and architectures of the combining sites. Also, the same general folding pattern (the jelly-roll-like β-strand arrangement) is exploited more than once in lectin families with a different binding-site topology, and the versatile ways of how Ca^{2+} ions contribute to specificity are just amazing. Like on a visit to an art gallery, one tends to develop an interest in the context of the items on display. In this sense, the allurement emanating from the web site will truly be a boon for pertinent reviews detailing structural relationships, functions, and potential biomedical applications—and for the emerging mantra that lectin–glycan interaction matters!

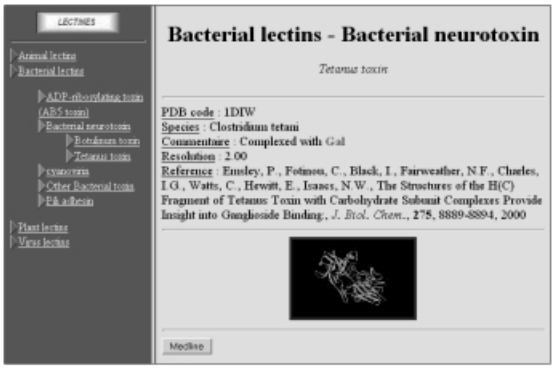

Figure 1. Galactose-complexed Tetanus toxin entry in the lectin database.

Suggest a web site or submit a review:
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