Overview

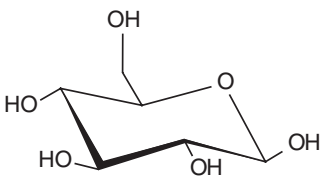
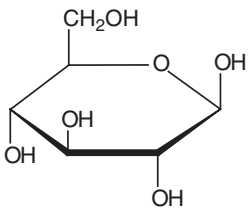
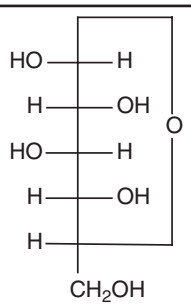
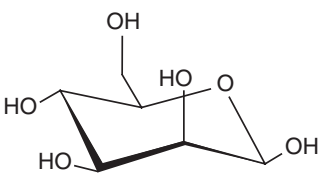
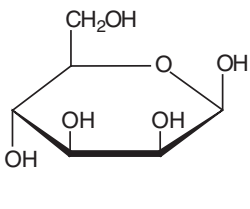
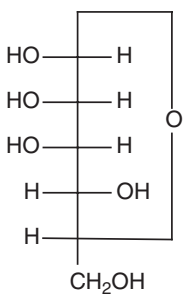
One of the distinguishing features of the proteome in eukaryotic cells is that most proteins are subject to post-translational modification, of which glycosylation is the most common form. It is estimated that more than half of all proteins that have been characterized are glycoproteins. The carbohydrate components of glycoproteins perform critical biological functions in protein sorting, immune and receptor recognition, inflammation, pathogenicity, metastasis, and other cellular processes.

Mammalian glycoproteins contain three major types of oligosaccharides (glycans): N-linked, O-linked, and glycosylphosphatidylinositol (GPI) lipid anchors. N-Linked glycans are linked to the protein backbone via an amide bond to asparagine residues in an Asn-X-Ser/Thr motif, where X can be any amino acid, except Pro. O-Linked glycans are linked to the hydroxyl group of serine or threonine. GPI-anchored proteins are attached at their carboxy-terminus through a phosphodiester linkage of phosphoethanolamine to a trimannosyl glucosamine core structure. The reducing end of the latter moiety is bound to the hydrophobic region of the membrane via a phosphatidylinositol group.

Variations in structure and degree of glycosylation site saturation can contribute to overall mass heterogeneity. The terminal residues of these glycans are commonly *N*-acetylneuraminic acid (sialic acids). The degree of sialylation affects both the mass and charge of a glycoprotein. Other modifications to the protein such as sulfation or phosphorylation also affect charge. O-Linked glycans often have lower mass than N-linked structures, but can be more abundant and heterogeneous.

Key to Monosaccharide Symbols, Abbreviations, and Projections

Symbols, Structure Projections, and Abbreviations for Monosaccharides

Monosaccharide	3-D Chair projection	Haworth projection	Fischer projection	Symbol
β-D-Glucose (Glc)				
β-D-Mannose (Man)				

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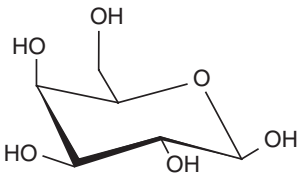
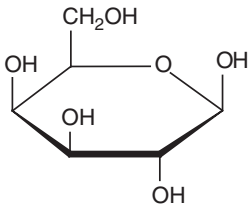
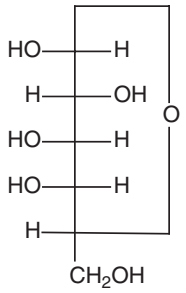
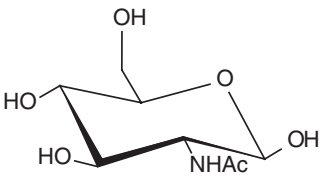
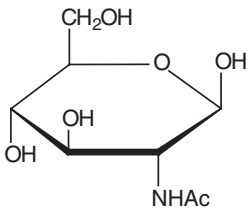
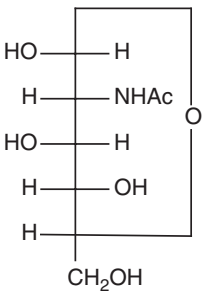
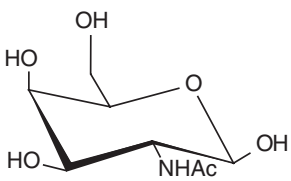
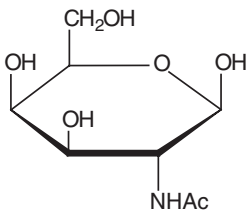
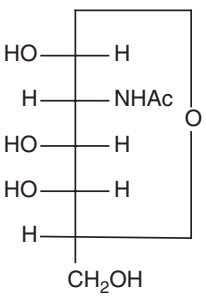
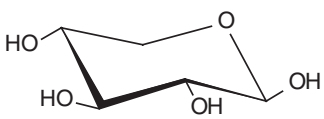
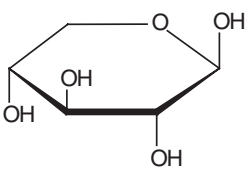
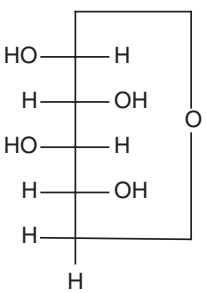
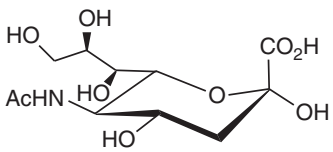
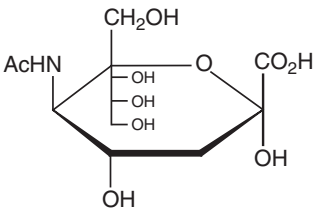
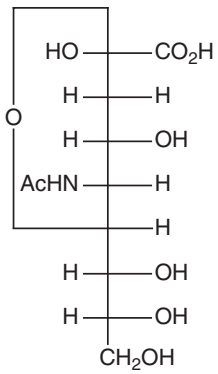
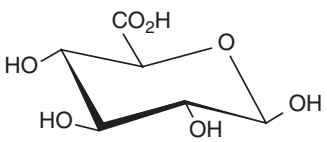
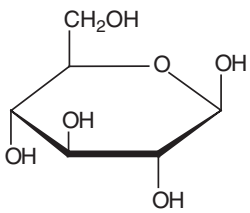
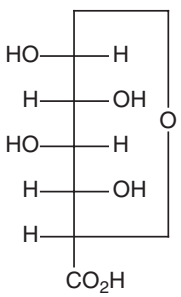
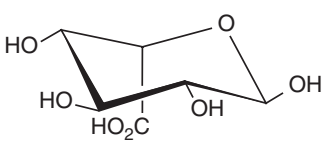
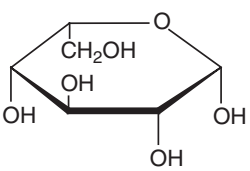
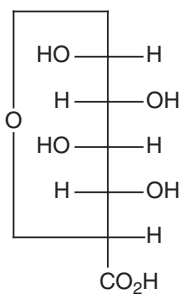
Monosaccharide	3-D Chair projection	Haworth projection	Fischer projection	Symbol
β-D-Galactose (Gal)				
β-D-*N*-Acetylglucosamine (GlcNAc)				
β-D-*N*-Acetylgalactosamine (GalNAc)				
β-D-Xylose (Xyl)				

Key to Monosaccharide Symbols, Abbreviations, and Projections

Symbols, Structure Projections, and Abbreviations for Monosaccharides

Monosaccharide	3-D Chair projection	Haworth projection	Fischer projection	Symbol
α-*N*-Acetylneuraminic acid Sialic Acid (NeuNAc)				
β-D-Glucuronic acid (GlcA)				
α-L-Iduronic acid (IdoA)				
α-L-Fucose (Fuc)