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“Glycosyltransferases: Converting GlycoPHOBIA into GlycoPHILIA”

There are only four major macromolecules in all of nature: the proteins, the lipids, the nucleic acids, and the carbohydrates (“glycans”). In truth, however, there are only three biologic macromolecules because “nucleic acids” are, actually, glycans – the simplest of all glycans, comprised of linear chains of the monosaccharides ribose (RNA) or deoxyribose (DNA) held together by a phosphodiester bond. Yet, let us accept that nucleic acids are, for now, considered to be different from glycans. All this said, the glycans comprise the overwhelmingly largest biomass of planet Earth. However, ironically, the educational curriculum of the vast majorities of universities, graduate schools, and medical schools are deficient in providing students any background whatsoever on this family of macromolecules. The major reason why inordinate attention is given to proteins, lipids, and nucleic acids is because they are rather simple structures, most generally comprised of linear chains of covalently linked building-block units (e.g., amino acids in proteins), whereas glycans consist of chains of multiply-branched, covalently-linked monosaccharide units. As such, fear of this structural heterogeneity permeates both the teaching and the learning about glycans, and this condition is called “glycoPHOBIA”. This presentation will instruct on the exquisite specificity of the enzymes called “glycosyltransferases” that convert monosaccharide units into the “complex” glycans found in all prokaryotic and eukaryotic cells. In so doing, this presentation will draw attention to the roles of glycosyltransferases in yielding the remarkably precise and elegant structural biology of glycans, with intent to inform on how knowledge of glycosyltransferases can convert glycoPHOBIA into glycoPHILIA.