Chapter 48: Glycomics

1. What is the “glycome” of an organism? Does it differ for individual cells in that organism?

2. Is the human glycome known? What is needed to establish the human glycome? Or the glycome of a cell?

3. Propose an experimental strategy to characterize different glycan subtypes that comprise the glycome. For example, how might glycolipid-associated glycans and protein-associated N- and O-glycans be physically separated and structurally characterized?

4. What information from the genome and the proteome might be useful in predicting a cell’s glycome?

5. What are some of the limitations of using glycan microarrays for determining the specificity of a glycan-binding protein?

Chapter 49: Chemical and Enzymatic Synthesis of Glycans and Glycoconjugates

1. β-Glucosides are readily synthesized by exploiting protecting groups at C-2 capable of neighboring group participation. Without such protecting groups, the preferred product in most chemical glycosylation reactions is the β-glycoside. Explain this finding.

2. Why are β-mannosides so difficult to generate chemically?

3. In solid phase synthesis of glycans, glycosidic bonds are most often constructed with the glycosyl acceptor bound to the solid support and the activated glycosyl donor in solution. Why is this situation preferred to the alternative approach in which the glycosyl donor is bound to the solid support?

4. We think of glycosidases as enzymes that cleave rather than synthesize glycosidic bonds. How are the substrates and reaction conditions of glycosidases manipulated in order to convert them from degrading enzymes to synthetic enzymes?

5. Enzymatic synthesis of glycans can be far more efficient than chemical synthesis of the same structures, but there are limitations in the enzymes available and the ability of enzymes to use unnatural analogs of sugars. What is needed to make a versatile enzymatic toolbox for carbohydrate synthesis.

6. What are potential advantages of combining chemical and enzymatic
approaches for synthesis of glycan based reagents for glycobiology research.