- Disulfide bridges: The covalent linkage of two cysteine amino acids
- Proteolytic cleavage: The cleavage of a protein at a peptide bond
- Racemization
- Structural changes of proline by prolyl isomerase
- Structural changes of serine by a protein-serine epimerase
- Structural changes of alanine in dermorphin, a frog opioid peptide
- Structural changes of methionine in deltorphin, also a frog opioid peptide

1.5.1 Glycosylation

One of the more important PTMs is glycosylation; this is distinct from glycans. An example of how a glycosylation reaction occurs and its consequences upon protein characteristics and reproducibility of recombinant proteins is given in Figure 1.12.

Glycosylation is the most frequent PTM. The terms *glycan* and *polysaccharide* are defined by the International Union of Pure and Applied Chemistry as synonyms meaning “compounds consisting of a large number of monosaccharides linked glycosidically.” However, in practice, the term *glycan* may also be used to refer to the carbohydrate portion of a glycol conjugate, such as a glycoprotein, glycolipid, or proteoglycan, even if the carbohydrate is only an oligosaccharide. Glycans usually solely consist of O-glycosidic linkages of monosaccharides. For example, cellulose is a glycan (or, to be more precise, a glucan) composed of β-1,4-linked D-glucose, and chitin is a glycan composed of β-1,4-linked *N*-acetyl-D-glucosamine.

Glycans can be homo- or heteropolymers of monosaccharide residues and can be linear or branched. The introduced chemical modifications

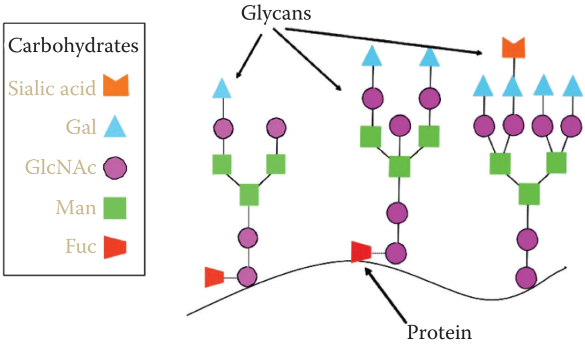

Figure 1.12 Schematic drawing of carbohydrate residues (or glycanic structures) present on some protein sequences (Gal = galactose, Man = mannose, Fuc = fucose, GlcNAc = N-acetyl glucosamine).