Glycoprotein

Proteins that contain oligosaccharide chains (glycans) covalently attached to polypeptide side-chains.

The carbohydrate is attached to the protein in a cotranslational or posttranslational modification.

This process is known as glycosylation. Secreted extracellular proteins are often glycosylated. In proteins that have segments extending extracellularly, the extracellular segments are also glycosylated. Glycoproteins are often important integral membrane proteins, where they play a role in cell–cell interactions. Glycoproteins are also formed in the cytosol, but their functions and the pathways producing these modifications in this compartment are less well understood.

Classification

Glycoproteins can be classified based on various criteria:

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1. Classification by Glycosylation Type This is the most common method of classification, based on how carbohydrates are attached to the protein:

A. N-linked Glycoproteins - Carbohydrates are attached to the nitrogen atom of asparagine residues in a consensus sequence (Asn-X-Ser/Thr, where X is any amino acid except proline). - Synthesized in the endoplasmic reticulum (ER) and further processed in the Golgi apparatus. - Example: Immunoglobulins, erythropoietin.

B. O-linked Glycoproteins - Carbohydrates are attached to the oxygen atom of serine or threonine residues. - Typically added in the Golgi apparatus after protein synthesis. - Example: Mucins, collagen.

C. C-linked Glycoproteins - A less common form where carbohydrates are attached to the carbon atom of tryptophan residues. - Example: Properdin.

D. Glypiated Glycoproteins - Glycosylphosphatidylinositol (GPI) anchors attach the glycoprotein to the cell membrane. - Example: Alkaline phosphatase.

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2. Classification by Carbohydrate Structure Based on the type of carbohydrate chains present:

A. High-Mannose Glycoproteins - Contain multiple mannose residues in their carbohydrate chains.

B. Complex Glycoproteins - Contain a mix of several different sugars (e.g., sialic acid, fucose, galactose) in a branched structure.

C. Hybrid Glycoproteins - Contain a mix of high-mannose and complex-type glycans.

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3. Classification by Function Glycoproteins are also classified based on their biological roles:

A. Structural Glycoproteins - Contribute to cellular structure. - Example: Collagen.

B. Enzymatic Glycoproteins - Glycoproteins that function as enzymes. - Example: Alkaline phosphatase, lysosomal enzymes.

C. Transport Glycoproteins - Facilitate the transport of molecules. - Example: Transferrin.

D. Receptor Glycoproteins - Involved in signal transduction and cellular recognition. - Example: Insulin receptor, EGF receptor.

E. Immune Glycoproteins - Play a role in the immune system. - Example: Immunoglobulins, MHC molecules.

F. Secreted Glycoproteins - Serve functions in extracellular environments. - Example: Mucins, hormones like erythropoietin.

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4. Classification by Cellular Location - **Membrane-bound Glycoproteins:** Located on cell surfaces (e.g., receptors, adhesion molecules). - **Secreted Glycoproteins:** Found in extracellular fluids (e.g., hormones, enzymes). - **Cytoplasmic/Nuclear Glycoproteins:** Present in intracellular compartments with glycosylation modifications like O-GlcNAcylation.

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5. Classification by Evolutionary Origin Some glycoproteins are classified based on evolutionary conservation or specific species.

- Example: Viral glycoproteins (spike glycoproteins in SARS-CoV-2).

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This framework helps in understanding the diversity and specialized roles of glycoproteins in biological systems. Let me know if you need deeper insights into any category!

Apolipoprotein E

Erythropoietin

Glycoprotein IIbIIIa