A transmembrane domain is a hydrophobic segment of a protein that spans the cell membrane. Transmembrane domains are found in many membrane proteins, including receptors, channels, transporters, and enzymes.

The structure of a transmembrane domain typically consists of one or more alpha helices or beta sheets that traverse the cell membrane. The hydrophobic amino acid residues in the transmembrane domain interact with the hydrophobic lipid bilayer of the membrane, anchoring the protein to the membrane.

Transmembrane domains play a critical role in the function of membrane proteins, as they allow these proteins to interact with both the extracellular and intracellular environments. For example, transmembrane domains in receptors allow them to bind to ligands on the extracellular side of the membrane and transmit signals to the intracellular side of the membrane. Similarly, transmembrane domains in transporters allow them to move molecules across the membrane.

Mutations or structural changes in transmembrane domains can disrupt the function of membrane proteins and lead to disease. For example, mutations in the transmembrane domain of the cystic fibrosis transmembrane conductance regulator (CFTR) protein lead to the development of cystic fibrosis, a genetic disorder that affects the lungs, pancreas, and other organs.

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