Glycosylation is an enzymatic process of adding sugar residues to proteins or lipids. This reaction takes place inside Golgi apparatus or the endoplasmic reticulum and is catalysed by glycosyltransferases. Substrates in this process are activated forms of monosaccharides called nucleotide sugars. Their synthesis takes place in cytoplasm or nucleus. They are transferred to the site of glycosylation by a so-called nucleotide sugar transporters, which belongs to The solute carrier family 35.

A fucose is one of the sugars that are used in the glycosylation process. Sugar structures, in which one of components is fucose, are involved in many biological processes. Fucosylated oligosaccharides take part in e.g. cell adhesion, tissue development, angiogenesis, a movement of leukocytes to sites of infection or a formation of malignancies. Its activated form, GDP-fucose, is produced in the cytoplasm by two, considered to work independently, synthetic pathways, so-called "*de novo*" and "*salvage*". Mutations in genes encoding enzymes involved in the synthesis of GDP-fucose lead to serious diseases. Studies on these conditions have shown that a decreased function of one pathway may not be complemented by action of the another. Therefore, one of the goals of this project is to answer a question whether, the operation of these two synthetic pathways is unrelated to each other. Our preliminary research suggests that this is not true. Into Golgi apparatus, the activated fucose is transported by a SLC35C1 protein. Mutations in gene encoding the GDP-fucose transporter leads to a Leukocyte adhesion deficiency type 2, a disease that is often fatal to patients. Our research on the molecular mechanism of an applied therapy, supplementation with exogenous fucose, shed new light on a method of transporting activated fucose to Golgi apparatus, the site of glycosylation. We suggested that the SLC35C1 protein could transport GDP-fucose produced by only one of the synthesis pathways. However, these are only suggestions that require further research to confirm them. This project aims to conduct a series of experiments to verify this claim. Fucosyltransferases catalyse the transfer of GDP-fucose to the appropriate acceptor. Malfunctions in their functioning contribute to cancer formation. It has recently been proposed that GDP-fucose can be attached to selected oligosaccharides depending on the source of its origin. Therefore, one of the goals of this project is to investigate whether fucosyltransferases use GDP-fucose produced by a specific synthetic pathway in their glycosylation process.

In this project, we plan to characterize the entire metabolism of fucose in mammalian cells. Starting from the synthesis of its active form, through transport to the site of glycosylation, and ending with its attachment to macromolecules. For this purpose, we will use the newest techniques of molecular biology and biochemistry. We will examine whether the pathways of GDP-fucose synthesis are independent of each other or whether they regulate their action. We will check whether the SLC35C1 protein actually selectively transports the mentioned nucleotide-sugar and whether fucosyltransferases are capable of recognizing and using GDP-fucose produced by only one of the synthesis pathways.

In-depth understanding of the mechanisms responsible for the metabolism of fucose in mammalian cells and their relationships may contribute to understanding pathologies related to the fucosylation process and creating more effective therapies in the future. Moreover, answering the hypotheses/questions posed in this project may contribute to broadening the knowledge about glycosylation and looking at it in a non-canonical way.