



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The uptake of nutrients, including carbohydrates, metal ions, amino acids and peptides, are required for many biological processes. Bacterial cell scavenges these essential nutrients from microenvironments for their survival. It utilizes a myriad of mechanisms to acquire these essential nutrients from the extracellular environment. One of the mechanisms involves the use of several transport proteins, such as ATP-binding cassette (ABC) transporters to import and export the substrates. ABC transporters, conserved across all organisms, are powered by the energy from ATP to move substrates across cellular membranes. Topologically, the ABC transport system possesses a functional and structural unit known as substrate (or solute)-binding protein (SBP) for nutrient acquisition inside the cell. SBPs bind to the specific ligand with high affinity and mediate their transport into the cytoplasm via the cognate inner membrane component known as a transmembrane domain (TMD). Because of the low sequence identity of SBPs, understanding the structural basis of substrate recognition by them has remained very challenging. Though several SBPs bound to carbohydrates have been characterized, little is known about the selection criteria for carbohydrate diversity. Thus, this study elucidated the structural, functional and mechanistic details of SBPs of ABC transporter. The finding of this study revealed that the thermophilic gram-negative bacterium *Thermus thermophilus* HB8 possesses two SBPs (ORF ids: TTHA0356 and TTHB082) of ABC transporters, which selectively transports α - and β -glycosides, respectively. In-depth characterization of TTHA0356 protein suggested that it maintains the stereoselectivity for linkages and does not allow the passage of β -glycosides. Similarly, the protein TTHB082 maintained the specificity only for β -glycosides and occluded the transport of α -glycosides. In contrast, the characterization of third SBP (ORF id: TTHA0379) revealed that the protein TTHA0379 is a dinucleotide-binding protein rather than sugar-binding protein. Altogether, this study provides a basic understanding of the selective nature of ABC transporter over the versatility of carbohydrates.