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Recognition of aromatic compounds by bacterial ABC transporters and catabolic operon transcription regulator

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Abstract

Aromatic compounds resulting from the breakdown of lignin and other plant-derived phenylpropanoids and flavonoids are abundant in soil. The bacterial catabolism of these compounds plays an important role in the recycling of such carbon sources in the ecosystem. Bacterial ABC transporters participate in import of aromatic compounds into the cell. A set of solute-binding proteins (SBPs) of ABC transporters from several species of soil bacteria have been identified and characterized that could support the uptake. A number of crystal structures of SBPs in complex with aromatic compounds have been determined. The structures revealed a ligand-binding pocket and provide details of molecular recognition. SBPs that can accommodate larger ligands have increased cavity volumes. SBPs with larger cavities can bind smaller ligands by attracting a water molecule. The imported aromatic compounds are then degraded. In *Acinetobacter* the *hca* catabolic operon is regulated by HcaR repressor. The enzymes encoded by *hca* operon allow bacteria to utilize hydroxycinnamates as the sole source of carbon. The crystal structures of HcaR in apo form and in complex with several aromatic ligands have been determined. The protein is a new member of the MarR/SlyA family of transcription factors. HcaR shows a very different binding site for aromatic compounds as compared with SBPs but is still capable of accommodating multiple compounds. Ligand binding reduces HcaR affinity for DNA and as a result the transcription of catabolic operon is up-regulated. HcaR seems to be unique because it is capable of binding substrates, intermediates and products of *hca* operon enzymes.

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Biography

Andrzej Joachimiak has completed his Ph. D. from the University of A. Mickiewicz, Poznan, Poland, and postdoctoral studies from the University of Chicago, Chicago. He is Argonne Distinguished Fellow, Director of the Structural Biology Center and the Midwest Center for Structural Genomics at Biosciences Division, Argonne National Laboratory, and Professor at the University of Chicago. He has published more than 260 peer-reviewed manuscripts in reputed journals and book chapters in the area of molecular and structural biology. He serves as an editorial board member of several journals. Fields of interest include structural biology using synchrotron radiation, enzymes specificity, protein-ligand interactions, protein-nucleic acid interactions and molecular chaperones.