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Author: Emad Tajkhorshid

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Molecular insight into drug exporters within the cellular membrane

Emad Tajkhorshid

NIH Center for Macromolecular Modeling and Bioinformatics, Department of Biochemistry, and Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL 61801, U.S.A.
Email: emad@life.illinois.edu

Transport of material across the cellular membrane is one of the most fundamental processes in biology. All living cells rely on continuous traffic of molecular species of diverse size and chemistry, ranging from monoatomic charged ions to very large macromolecules such as proteins, across biological membranes, not only between the cell and its environment but also between different cellular compartments within the cell, e.g., mitochondria. As the hydrophobic lipid bilayers composing biological membranes poses a substantial barrier against free movement of most material relevant to cellular metabolism, specialized membrane proteins have been evolved to provide pathways for transport of different molecular species from one side of the membrane to the other side. Furthermore, and probably more importantly, often biological cells need to establish (electro)chemical gradients for their transport substrates between the two sides of the membrane, a process that obviously cannot rely on passive, independent diffusion of one substrate. Active membrane transporters are molecular machines evolved to couple various sources of energy in the cell to movement of their substrate in a specific direction under physiological conditions. Given the central role of membrane transport to key physiological processes, such as absorption and secretion of wide spectrum of molecules in the gastrointestinal tract and in kidneys, neurotransmitter uptake from the synaptic cleft, establishment and modulation of membrane potential in excitable cells,