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Probing transport of antibiotics and nucleic acids through phospholipid bilayer membranes by use of synthetic amphiphiles

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Abstract

The individual cell is defined in part by the boundary membrane that keeps its contents within and restricts the entry of external material. The earliest cells must have been bounded by membranes that were leaky so that some nutrients could enter, waste materials could exit, and other chemical requirements could be facilitated. Of course, there is no fossil record of membranes but we know that modern bilayers are breached by protein channels that selectively transport cations, anions, and various chemical species into and out of cells. These proteins closely regulate the cell's interior and are vital to survival. During the past two decades, synthetic, membrane-penetrating amphiphiles have been developed that exhibit some of the properties of the far more complex protein channels. Crown ether-derived "hydraphile" synthetic cation-conducting channels are an example of a synthetic amphiphile that selectively transports Na^+ into cells. Based on the success of developing the family of hydraphile compounds, we have extended the structural types to an array of amphiphiles. These include amphiphilic peptides and pyrogallol[4]arenes. Some of the experiments that have led to our understanding of how these amphiphiles function will be discussed, along with novel applications as co-transporters of antibiotics. In addition, some very simple anion complexing agents will be shown to function as capable transformation and transfection agents for DNA plasmids.

Biography

Dr. George Gokel earned the B.S. in chemistry at Tulane University and the Ph.D. at the University of Southern California working with Ivar Ugi. He did post-doctoral work with Donald Cram at UCLA. He has held positions at Pennsylvania State University, the University of Maryland, the University of Miami, and the Washington University School of Medicine in St. Louis. He is currently Distinguished Professor of Science and Director of the Center for Nanoscience at the University of Missouri-St. Louis. He has coauthored more than 400 papers, 15 books, and is named as an inventor on 15 issued patents.

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