SELF-ASSEMBLED SYNTHETIC ION CHANNELS

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ABSTRACT

Ion transport across membranes is essential for cell function and is involved in many physiological processes such as neuronal signaling, muscle contraction, cardiovascular function and immune response. Ion channel proteins selectively facilitate and regulate the transport of cations (K^+, Na^+, Ca^{2+}, etc) or anions (Cl^-, HCO_3^-, etc) through a variety of mechanisms. Dysfunction of ion channel proteins has been associated with many severe human diseases, e.g., cystic fibrosis, asthma, hypertension, epilepsy, and myocardial infarction. Therefore, small molecules that mediate and regulate ion transport across cell membranes have important applications in biomedical research and treatment of human diseases associated with ion transport deficiency.

In this talk, I will report our recent discovery of small molecules that self-assemble into synthetic ion channels to transport small anions or cations across biological membranes. Their ion transport properties have been extensively characterized by combining tools of chemistry, biology and electrophysiology. These synthetic ion channels can function efficiently, independent of natural ion channels, in living cells, tissues and animals. They are easy to synthesize and their pharmacological properties can be readily modified for therapeutic applications. Explorations on their potential biomedical applications will also be presented.