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Obtaining the ion channel high resolution structures by electron cryo-microscopy

Membrane proteins that perform the physiological functions of transporting cations, anions and metabolic substrates across biological membranes are challenging to study. For example, they are inherently averse to aqueous phases usually used in the isolation of proteins, they are often of low abundance in the producing organism or tissue, and they are very difficult to persuade into the two- or three-dimensional crystalline arrays required for determination of their structures by X-ray or electron crystallography.

With single particle electron cryo-microscopy, these problems can be overcome and high-resolution structures of membrane proteins and other labile protein complexes can be obtained with very little protein and without the need for crystals. Here I highlight recent advances in electron microscopy, detectors and software, which have allowed determination of medium to high-resolution structures of membrane proteins and complexes that have been difficult to study by other structural biological techniques.

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