Macromolecular machines at energized membranes

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In biology, energy is often stored as an electrochemical transmembrane proton gradient. These gradients are established by the electron transport chain during cellular respiration, or proton pumps such as V-ATPases. The proton motive force from these gradients is used to generate ATP or drive secondary transport. We have used cryoEM to study the structure and dynamics of membrane protein complexes involved in these bioenergetic processes. The studies reveal the mechanism of proton translocation in V-ATPases, ATP synthases, and electron transport chain supercomplexes. The discovery of new subunits in V-ATPases links them to multiple processes in mammalian cells. Structures of the electron transport chain supercomplexes and ATP synthase from mycobacteria open new routes for developing antibiotics to treat mycobacterial infections such as the Mycobacterium tuberculosis infection that cause the disease TB.