

## **Molecular Architecture and Function of A-type ATPases**

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F-, V-, and A-type ATPases are central to biological energy conversion. Photosynthetic and respiratory systems of all living organisms convert energy derived from light or from nutrients into transmembrane electrochemical proton gradients. F-type ATP synthases use the energy stored in these gradients to synthesise the universal biological energy carrier ATP from ADP and inorganic phosphate. The transmembrane Fo sector of the enzyme contains a rotary motor that is fuelled by the proton gradient. The rotary torque induced by the passage of protons through Fo is transmitted via a central stalk to the catalytic subunits in the soluble F1 domain, where the rotation induces conformational changes that enable the synthesis and subsequent release of ATP. Eukaryotic vacuolar (V-type) ATPases operate in reverse: They utilise energy derived from ATP hydrolysis to build up transmembrane ion gradients. V-type ATPases play an important role in pH homeostasis and enable transport processes across membranes. While most eubacterial ATPases are of the F-type, some eubacteria and all known archaea have ATPases of the A-type, which are close homologues of V-type ATPases, but are mostly used for ATP synthesis. A-type ATPases are simpler in design than their eukaryotic counterparts, but are more versatile in that they can operate in reverse in dependence of the cellular environment. We are using a combination of electron microscopy and X-ray structure analysis to build a pseudo-atomic model of a eubacterial A-type ATPase and are using phage display derived antibody fragments against individual subunits to determine their location within the complex and to facilitate crystallisation. This will allow a better understanding of the complex structure and regulatory mechanisms of A-ATPases in particular and of proton translocating ATPases in general.

