Free energy released from chemiosmosis can be coupled in cotransport

These membrane potentials as they are termed can exist across any membranes with the ability to pump ions against their gradients. One proton related use of these gradients is in secondary active transport. Unlike primary active transport, secondary active transport does not directly require the energy released from the hydrolysis or ATP to power transportation across the membrane. Instead the energy for this process is the free energy, as mentioned above, released when the ion moves down its electrochemical gradient. This is then coupled with the movement of another solute against its gradient and across the membrane. The movement of this solute maybe in the same direction as the passive movement of the ion (symporter) and in the opposite direction (antiporter), but either way the mechanism is still very similar. (130 words)

The mechanism of secondary active cotransport of protons is seen in Escherichia Coli cells taking up lactose and other sugars. The bacteria form a H+ gradient across the membrane using ATP from the oxidation of various fuels to power the pumping of protons. The cotransporter protein involved is called lactose permease, it has a structure as such that between the two main regions of the protein there is an opening into which lactose can fit. This binding pocket faces the outside of the cell. Protons diffuse from the extracellular fluid down their electrochemical gradients into the permease binding site where they bind to a carboxyl group. The proton is followed by lactose which also binds causing an conformational change releasing the lactose to the other side of the membrane along with the proton. As both the ion and the cotransported substance are moving in the same direction the lactose permease enzyme can be described as a symporter. (157 words)