**19.2 ATP Synthesis**

* ATP synthesisis explainedby chemiosmotic model (**Fig. 19-19)**.





* Electron flow is accompanied by proton transfer across the membrane, producing both a chemical gradient and an electrical gradient.
* The proton-motive force drives the synthesis of ATP as protons flow back into the matrix through a proton pore associated with **ATP synthase**.
* ATP synthase has two functional domains, F0 and F1.
* If
* 10 protons are pumped out per NADH
* 6 protons are pumped out per FADH2
* 4 protons must flow in to produce 1 ATP
* 2.5 molecules of ATP are generated by using 1 NADH in oxidative phosphorylation.
* 1.5 molecules of ATP are generated by using 1 FADH2 in oxidative phosphorylation.

**Shuttle Systems Indirectly Convey Cytosolic NADH into Mitochondria for Oxidation**

* Complex I can accept electrons only from NADH in the matrix.
* The inner membrane is not permeable to NADH.
* How can the NADH generated by glycolysis in the cytosol be reoxidized to NAD+ by O2 via the respiratory chain?
* Special shuttle systems carry cytosolic NADH into mitochondria by indirect route.
* One of them is **malate-aspartate shuttle (Fig. 19-31)**. Complex I can accept electrons from NADH.





* The other is **glycerol 3-phosphate shuttle** (**Fig. 19-32)**. Ubiquinone can accept electrons from FADH2.



* Complete oxidation of a molecule of glucose to CO2 yields 30 or 32 ATP (**Table 19-5)**.



**THE END**