

## Electron Carriers (NAD and FAD)

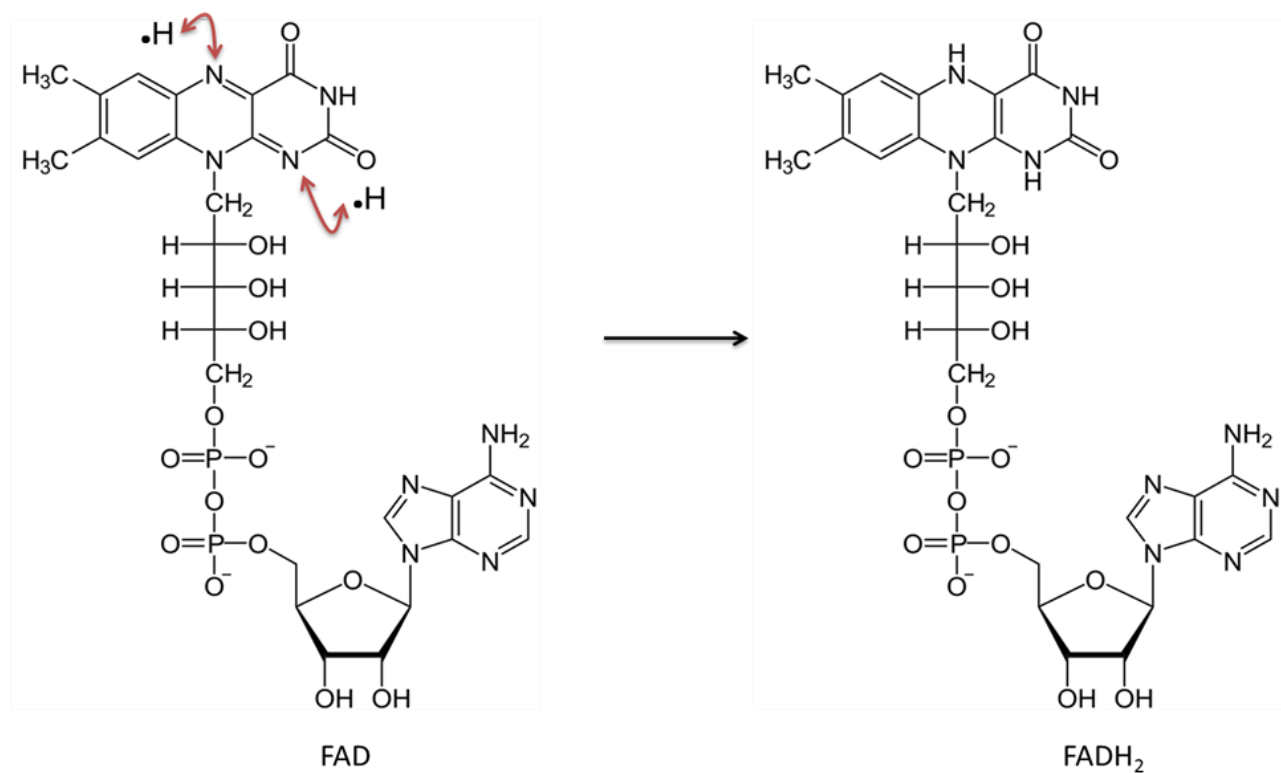
**Nicotinamide Adenine Dinucleotide** (NAD) and **Flavin Adenine Dinucleotide** (FAD) are coenzymes involved in reversible oxidation and reduction reactions. It is often stated that these compounds are electron carriers because they accept electrons (become reduced) during catabolic steps in the breakdown of organic molecules such as carbohydrates and lipids. Then, these reduced coenzymes can donate these electrons to some other biochemical reaction normally involved in a process that is anabolic (like the synthesis of ATP).

### NAD<sup>+</sup> / NADH

**Nicotinamide Adenine Dinucleotide** in its oxidized state is called **NAD<sup>+</sup>**, after being reduced (or accepting electrons), it is referred to as **NADH**. The vitamin Niacin (also called B3) is used to derive this compound. Niacin provides the organic ring structure that will directly participate in the transfer of a hydrogen atom and 2 electrons. NAD<sup>+</sup> is often found in conjunction with a "*dehydrogenase*" enzyme. A dehydrogenase reaction removes two hydrogen atoms; one as a hydride (H<sup>-</sup>) (*a hydride is a hydrogen atom with 2 electrons*) and one as a hydrogen cation (H<sup>+</sup>) (*and of course, a hydrogen cation has no electrons*). The hydride bonds with NAD<sup>+</sup> and creates a reduced compound of Nicotinamide Adenine Dinucleotide (NADH). The second hydrogen atom (H<sup>+</sup>) is released into solution.

As you examine the reactions for metabolism, look for reactions that yield NADH. NADH will be important as it will deliver the hydrogens and electrons that it picks up to biochemical processes that can use the electrons and hydrogens to make ATP.





**FAD Conversion to FADH<sub>2</sub>.** Image created by JS at BYU Idaho F2013.

**Flavin adenine dinucleotide in the oxidized form (FAD) accepts two hydrogen atoms (each with one electron) and becomes FADH<sub>2</sub>.**

As you examine the reactions for metabolism, look for a reaction that yields FADH<sub>2</sub>. Similar to NADH, FADH<sub>2</sub> will be important as it will deliver hydrogens and electrons to biochemical processes that can use the electrons and hydrogens to make ATP.



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