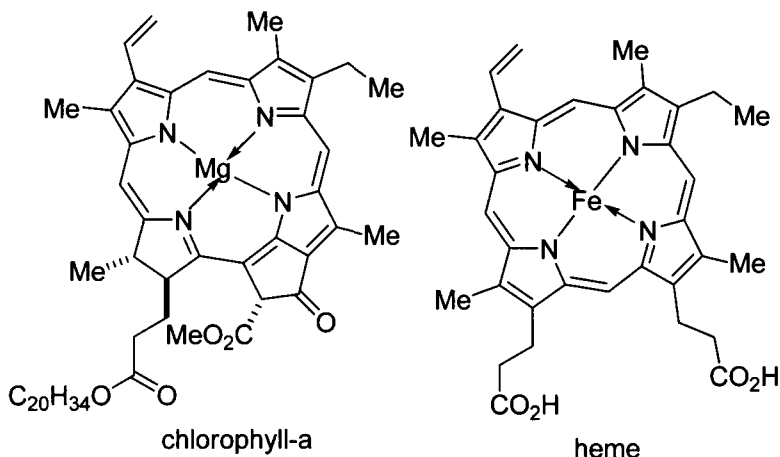


Pyrrole, also an aromatic heterocycle with 6 π -electrons, is probably the most unique of all among the aromatic heterocycles. Different from furan and thiophene, the nitrogen atom on the pyrrole ring only has one lone pair of electrons, which both contributed to the 6 π -electrons to achieve the aromaticity. As a consequence, although pyrrole is also an electron-excessive aromatic heterocycle, just like furan and thiophene, pyrrole has many of its own characteristics. For instance, it is probably the most reactive as a nucleophile among all aromatic heterocycles (see Chapter 2). In addition, pyrrole's conjugation effect outweighs the nitrogen's inductive effect in the contributing dipole moment, with the partial positive charge resting at the nitrogen atom.

1.3 Importance of Heterocycles in Life

The importance of heterocycles in life was recognized as the nascent stage of organic chemistry two centuries ago with isolation of alkaloids such as morphine from poppy seeds, quinine from cinchona barks, and camptothecin from the Chinese joy tree. Today, heterocycles are found in numerous fields of biochemical and physiological such as photosynthesis, amino acids, DNA bases, vitamins, endogenous neurotransmitters, and so on.



To begin with, chlorophyll is porphyrin (a tetramer of pyrrole) surrounding a magnesium atom. It is the molecule that absorbs sunlight and