BIOLOGICAL NITROGEN FIXATION (BNF)

- Biological nitrogen fixation (BNF) is the term used for a process in which nitrogen gas (N_2) from the atmosphere is converted into ammonia (NH_3) or related nitrogenous compounds in soil with the help of soil microorganisms.
- Nitrogen fixation is carried out naturally in soil by microorganisms termed diazotrophs that include bacteria such as *Azotobacter, Clostridium, Rhizobium* .
- Atmospheric molecular dinitrogen is a relatively non-reactive molecule that is metabolically useless to all but a few microorganisms.
- Biological nitrogen fixation converts N_2 into ammonia, which is metabolized by most organisms.

REACTION OF BIOLOGICAL NITROGEN FIXATION (BNF)

- N_2 + 8H2+ 16ATP ------> 2 NH_3 + 2H_2+ 16ADP + 16 P_i

  The equation above indicates that one molecule of nitrogen gas (N_2) combines with eight hydrogen ions (also known as protons) (8H+) to form two molecules of ammonia (2NH_3) and two molecules of hydrogen gas (2H_2). This reaction is conducted by an enzyme known as nitrogenase. The 16 molecules of ATP (ATP = Adenosine Triphosphate, an energy storing compound) represent the energy required for the BNF reaction to take place. As ammonia (NH_3) is formed it is converted to an amino acid such as glutamine. The Nitrogen in amino acids can be used by the plant to synthesize proteins for its growth and development.

FUNCTIONS AND STRUCTURAL FEATURES OF NITROGENASE

- All biological nitrogen fixation is effected by enzymes called nitrgenases.These enzymes contain iron, often with a second metal, usually molybdenum.
- Nitrogenase consists of two metalloproteins: Fe protein and MoFe protein (named after their metal clusters).
- The Fe protein contains a ferredoxin (4Fe-4S), which is known to play a role in electron transfer in many proteins.
- The MoFe protein is most likely the active center where N2 binds and is reduced.

CATALYTIC CYCLE OF NITROGENASE