

Microorganisms can obtain energy in many ways; much of this energy is used in biosynthesis or anabolism. During biosynthesis m.o begins with simple precursors, such as inorganic molecules or monomers ,and construct more complex until new organelles and cells arise .

Synthesis of Sugars and Polysaccharides

Many M.O can carry out photosynthesis (in which CO₂ is incorporate or fix), these autotrophs can convert this inorganic molecule to organic carbon, most common pathway is Calvin-Benson cycle: three different stages can be differentiated :

- **Carboxylation phase:** addition CO₂ to riboues 1, 5- biphosphate, forming two molecules of 3-phosphoglycerate.
- **Reduction phase:** reduction of 3-phosphoglycerate to glyceraldehydes 3-phosphate.
- **Rgeneration phase:** trioses are used to reform ribulose 1, 5-biphosphate ,and some hexose sugars like ; glucose and fructose.

The formation of glucose from CO₂ may be summarized by the following equation:

Sugars formed in the Calvin cycle can then be used to synthesize other essential molecules. The synthesis of glucose from non carbohydrate precursors is called **gluconeogenesis**. Beside carbon and oxygen, M.O also requires large quantities of phosphorus, sulfur and nitrogen for biosynthesis.

Synthesis of Amino Acids

Amino acid synthesis requires construction of the proper carbon skeletons, amino acid skeletons are derived from acetyl-CoA and intermediates of the TCA cycle, glycolysis and Calvin cycle. Most biosynthetic pathways are more complex and common intermediates often are used in the synthesis of families of related amino acids. The ribosome is the site of protein synthesis, synthesis is accurate and rapid .The final step in gene expression is protein synthesis or translation; the mRNA nucleotide sequence is translated into the a.a sequence of polypeptide chain. Protein synthesis may be divided into 3 stages;

Initiation, Elongation, Termination, this process is discussed in molecular biology .

The Synthesis of Purines , Pyrimidines and Nucleotides

Purine and pyrimidine biosynthesis is critical for all cells because these molecules are used in the synthesis of ATP , several cofactors ,ribonucleic acid (RNA), deoxyribonucleic acid (DNA), and other important cell components. Purines and pyrimidines are cyclic nitrogenous bases with several double bonds, purines consist of two joined rings, whereas pyrimidines have only one. Purines (adenine and guanine) the pyrimidine (uracil, cytosine and thymine) are commonly found in microorganisms. A nucleoside : is a purine or pyrimidines base joined with a pentose sugar, either ribose or deoxyribose. A nucleotide is a nucleoside with one or more phosphate groups attached to the sugar.

