Sulfur Assimilation

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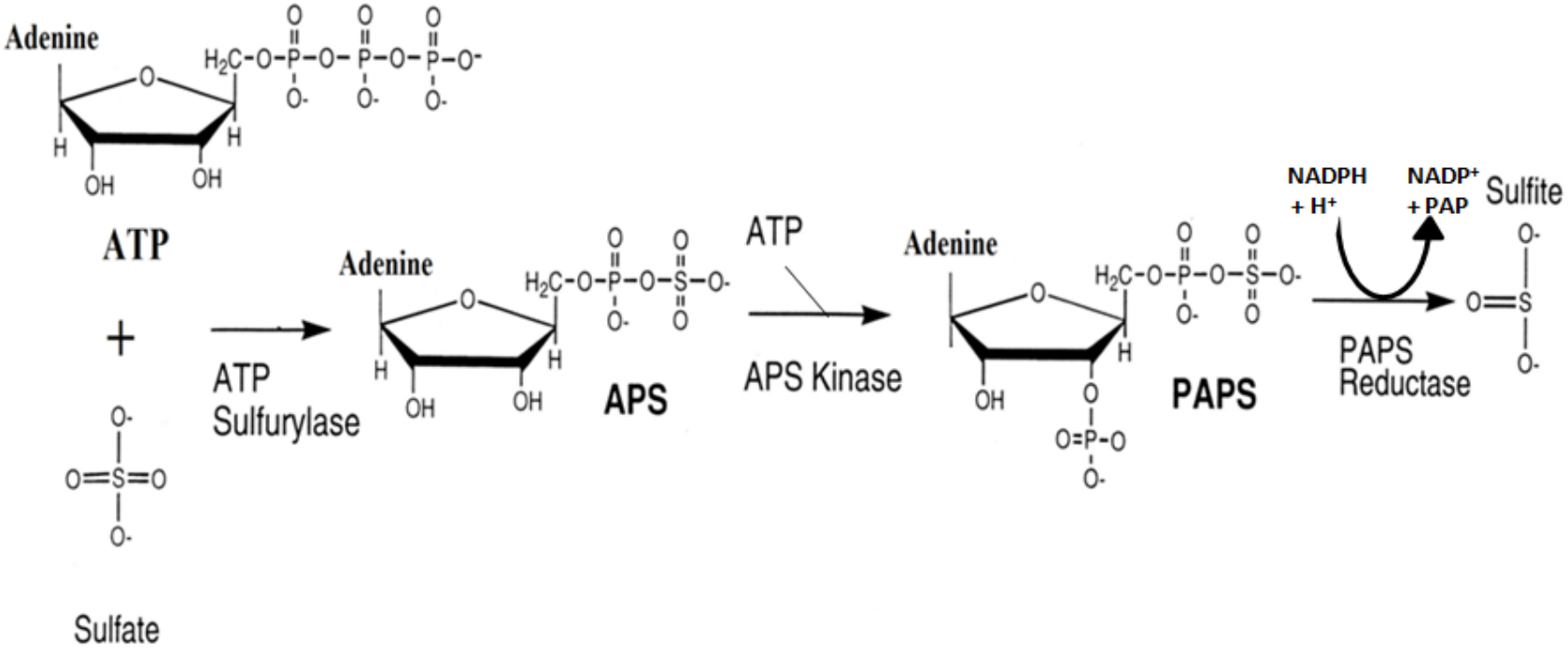
Sulfur Assimilation

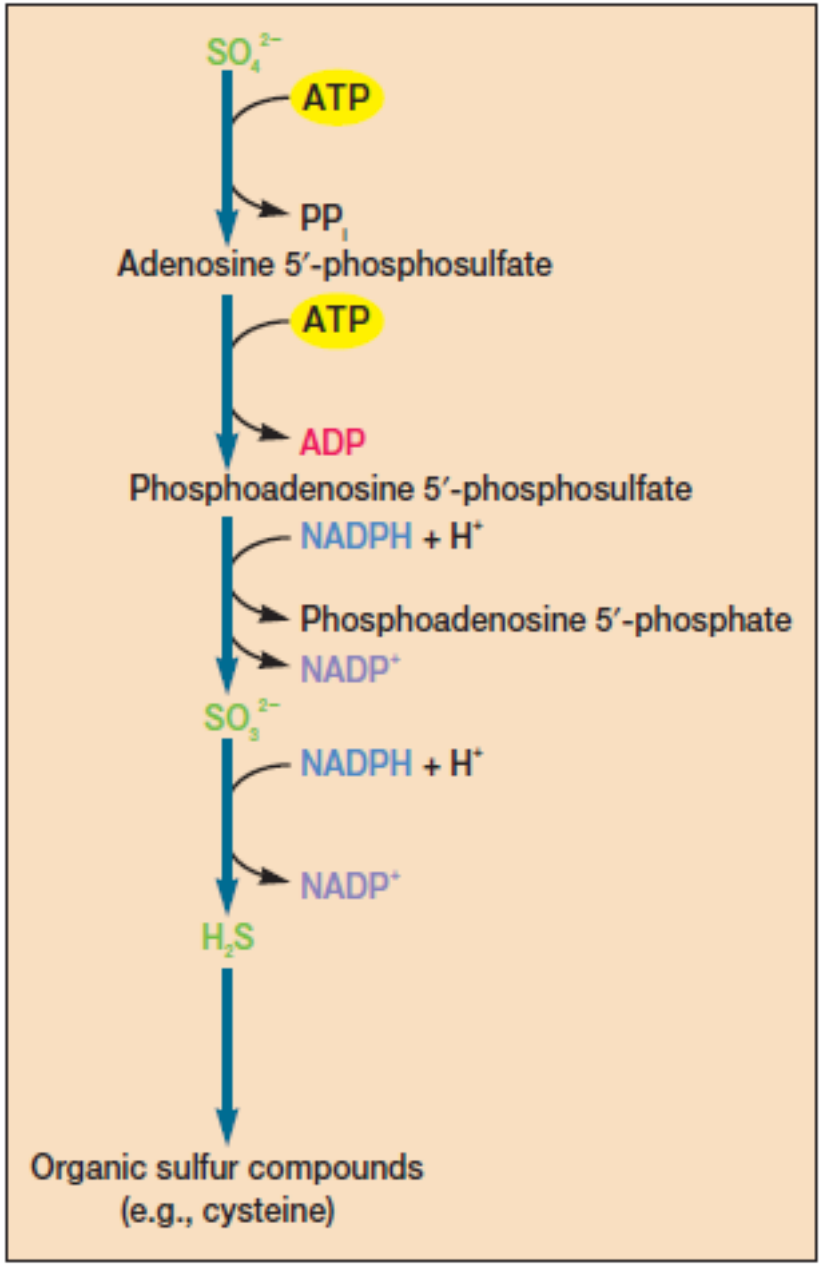
- Sulfur is needed for the synthesis of amino acids (cysteine and methionine) and several coenzymes (e.g., coenzyme A and biotin) and may be obtained from two sources.
- Many microorganisms use cysteine and methionine, obtained from either external sources or intracellular amino acid reserves.
- In addition, sulfate can provide sulfur for biosynthesis.
- The sulfur atom in sulfate is more oxidized than it is in cysteine and other organic molecules; thus sulfate must be reduced before it can be assimilated.
- This process is known as **assimilatory sulfate reduction to distinguish** it from the **dissimilatory sulfate reduction that takes place** when sulfate acts as an electron acceptor during anaerobic respiration.

Assimilatory sulfate reduction

- Assimilatory sulfate reduction involves sulfate activation through the formation of phosphoadenosine 5′-phosphosulfate, followed by reduction of the sulfate.
- The process is a complex one in which sulfate is first reduced to sulfite ($SO3^{2-}$), then to hydrogen sulfide.

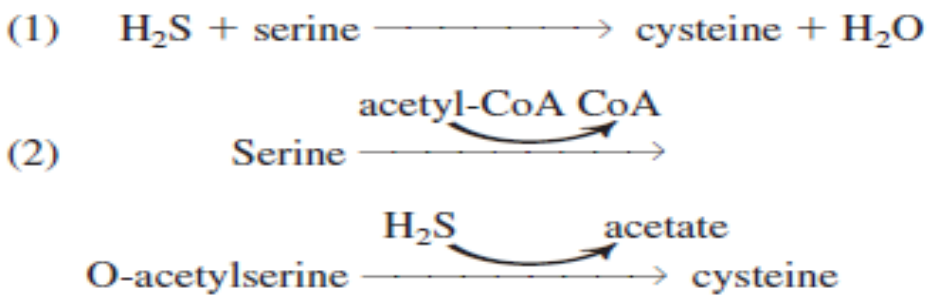


Assimilatory Sulfate Reduction Pathway



Sulfur Assimilation

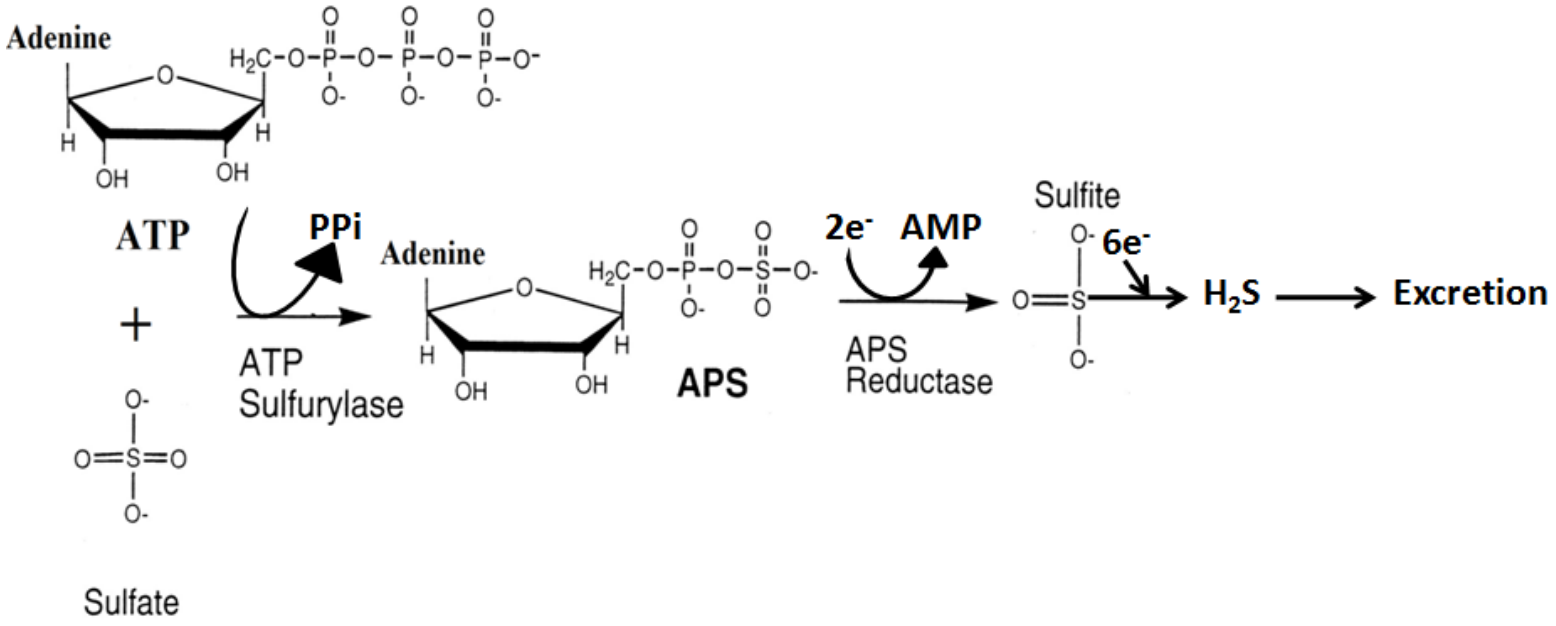
- Cysteine can be synthesized from hydrogen sulfide in two ways:
  - Fungi appear to combine hydrogen sulfide with serine to form cysteine (process 1),
  - whereas many bacteria join hydrogen sulfide with O-acetylserine instead (process 2).



- Once formed, cysteine can be used in the synthesis of other sulfur containing organic compounds.

Dissimilative sulfate reduction

- Dissimilatory pathway: restricted to sulfate reducing bacteria, utilize sulfate as an electron acceptor for energy generating process.
- Sulphate ion is stable and cannot be used without first being activated by means of ATP to adinosine phosphosulfate (APS).
- In dissimilative sulfate reduction , the sulfate moiety of APS is directly reduced to sulfite with the release of AMP.



Biochemistry of sulphate reduction