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Review of Enzymes in the Cysteine Biosynthesis Pathway

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ABSTRACT: In plants and microbes – *De novo* biosynthesis of L-cysteine involves an enzyme - Serine acetyl transferase (SAT) also known as CysE that catalyzes the production of *O*-acetyl-L-serine (OAS) from acetyl-CoA and L-serine. OAS is then converted to L-cysteine in the presence of sulfide by the enzyme *O*-acetylserine sulfhydrylase (OASS) also denoted as CysK. The end-product (L-cysteine) is maintained by complex kinetics and strictly regulated by two known mechanisms. In the first, SAT is inhibited by Cysteine through a feedback mechanism. The second mechanism involves association of SAT and OASS to form a cysteine synthase complex. OASS is a member of cysteine synthase superfamily and in bacteria two isozymes, OASS-A and OASS-B are known to be produced under aerobic and anaerobic conditions, respectively. The two isozymes are almost structurally superimposable but where OASS-A forms a tight complex with SAT, OASS-B does not interact with SAT. In addition, a novel thermostable OASS that catalyzes the sulfhydrylation of O-phospho-L-serine to form L-cysteine has been discovered and named O-phosphoserine sulfhydrylase (OPSS). This pathway is largely absent in humans and enzymes in this pathway are novel drug targets. Reviewing of recent insights into biochemical and structural aspect of Cysteine biosynthesis pathway in microbes may aid in designing of innovative drugs in human pathogens such as *M. tuberculosis, H. influenza, E. coli, Vibrio cholerae, Pseudomonas auriginosa, Streptococcus pneumoniae, Klebsiella pneumonia, Shigella flexineri, S. aureus, B. subtilis, etc.* with interesting implications.

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