Asymmetric Amplification in Peptide-Catalyzed Formation of Tetrose Sugars from Nearly Racemic Amino Acids

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ABSTRACT Peptides formed from oligomerization of mixtures of amino acids under prebiotically plausible synthetic conditions are screened to identify catalysts for the formation of tetrose (C_4) sugars from glycolaldehyde in buffered aqueous solution. Initial studies of libraries constructed using mixtures of enantiopure amino acids identified a number of peptides capable of inducing enantioenrichment in C_4 sugars. Further studies demonstrated that enantioenriched erythrose could be synthesized in a one-pot sequential process starting from nearly racemic amino acids. Several selection levels are at play, combining physical phase behavior via eutectic partitioning with stochastic amplification in peptide formation and asymmetric catalysis of this simplified formose reaction.

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