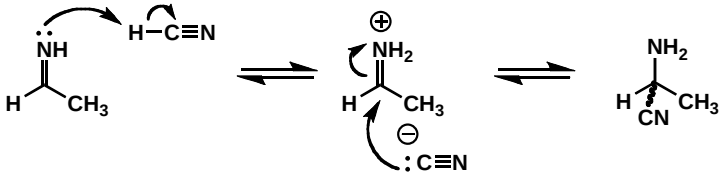
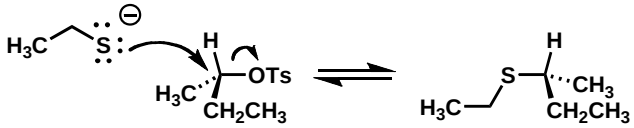
31-1. (a) An early step in the Strecker reaction generates a racemic mixture of chiral enantiomers. Many other answers are possible.



(b) An SN2 reaction with of an achiral nucleophile with an enantiopure electrophile satisfies the conditions of the question. Many other answers are possible.



(c) The chiral pool consists of single enantiomers of molecules that are not easily inverted or racemized by abiotic molecules. Abiotic molecules are either achiral or racemic.

31-2.

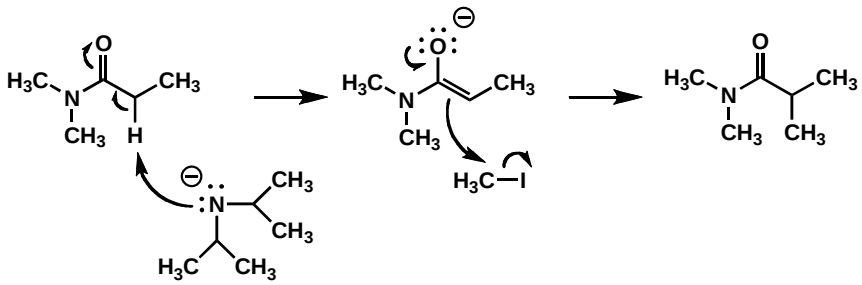
(a) An enantiodifferentiating crystallization of a racemic mixture of some chiral molecule still may have occurred, but one must then propose that the rest of Feldspar's chiral pool was generated from the crystal that was enantiomorphous to the one that seeded Earth's chirality.

(b) The enantiomorphous biopolymers would still be broken down in our gut into their constituent monomers, but since our enzymes would not recognize these non-natural enantiomeric biomonomers, none of them would be metabolized. The results would be…..unpleasant.

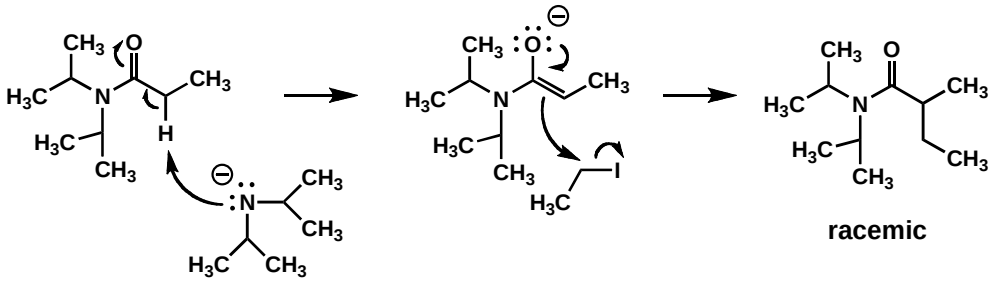
(c) The only component of a protein sequencing experiment that is sensitive to chirality is trypsin digestion. So, you would need to synthesize the enantiomer of trypsin to break the enantiomeric proteins into smaller fragments. You would then do the same with CNBr cleavage. Then PITC-mediated Edman degradation of each set of fragments and alignment of the resulting sequences using the shotgun strategy would lead to elucidation of the primary structure of the protein.

31-3.

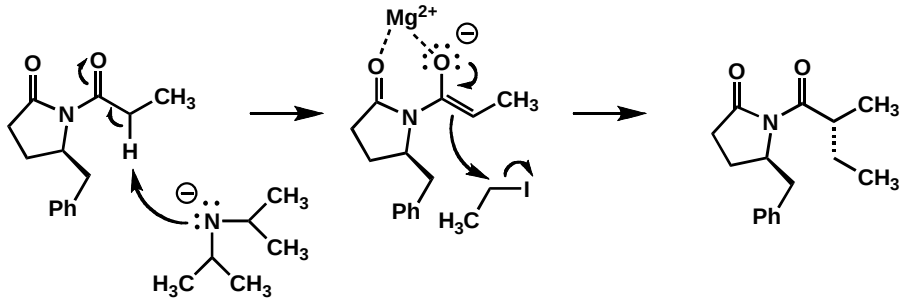
(a) Since an E enolate would suffer from sever allylic strain, only the Z enolate will form. The direction of attack of the enolate on the electrophile is irrelevant, since the product is achiral.



(b) Since an E enolate would suffer from sever allylic strain, only the Z enolate will form. The electrophile can approach from either the Re or Si of the planar enolate, leading to a racemic mixture of products.

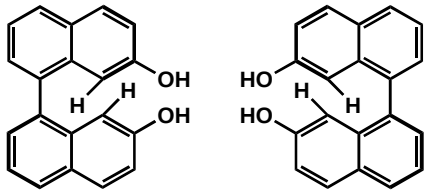


(c) Since an E enolate would suffer from sever allylic strain, only the Z enolate will form. Due to steric repulsion on the top face, the electrophile can only approach from the bottom face of the planar enolate, leading to a single product enantiomer.

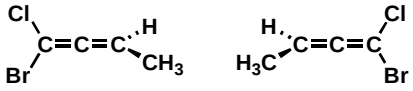


31-4

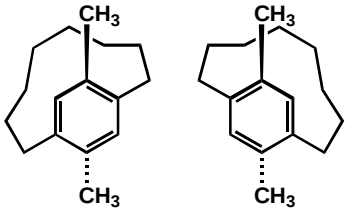
(a) If binol were planar, the two indicated hydrogens would occupy the same space, which is impossible, So, binol rotates its pi systems out-of-place, allowing for axial chirality and two non-equilibrating enantiomers. Note: the C-H bonds do not bend; they are shown at an odd angle here for illustration only.



(b) Due to the orthogonality of its substituents necessitated by the sp hybridization of the central carbon, many allenes show axial chirality and can have an enenatiomer.



(c) Because the methyl substituents must be threaded through the cyclophane ring, they can exist as a mixture of non-equilibrating atropisomers, and thus show planar chirality.



31-5. Either chiral column chromatography or classical resolution may work in this case. Classical resolution is the simplest option, given that amino acids easily form carboxylate salts. However, if the diastereomeric salts formed from treating the racemic mixture with an enantiopure amine from the chiral pool do not have sufficiently different physical properties, column chromatography through an enantiopure stationary phase is a good option. To check which enantiomer matches your sample, measure the optical rotation of each resolved sample in a polarimeter. The enantiomer that rotates light in the same direction as your initial sample has the same absolute stereochemistry as your original sample.

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