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ASTROBIOLOGY

The Role of Carbohydrates at the Origin of Homochirality in Biosystems

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Abstract Pasteur has demonstrated that the chiral components in a racemic mixture can separate in homochiral crystals. But with a strong chiral discrimination the chiral components in a concentrated mixture can also phase separate into homochiral fluid domains, and the isomerization kinetics can then perform a symmetry breaking into one thermodynamical stable homochiral system. Glyceraldehyde has a sufficient chiral discrimination to perform such a symmetry breaking. The requirement of a high concentration of the chiral reactant(s) in an aqueous solution in order to perform and *maintain* homochirality; the appearance of phosphorylation of almost all carbohydrates in the central machinery of life; the basic ideas that the biochemistry and the glycolysis and gluconeogenesis contain the trace of the biochemical evolution, all point in the direction of that homochirality was obtained just after- or at a phosphorylation of the very first products of the formose reaction, at high concentrations of the reactants in phosphate rich compartments in submarine hydrothermal vents. A racemic solution of D,L-glyceraldehyde-3-phosphate could be the template for obtaining homochiral D-glyceraldehyde-3-phosphate(aq) as well as L-amino acids.

Keywords Homochirality · Origin of life

Origin of Life and the Environment at Earth 4 Billion Year Ago

All carbohydrates and derivatives of carbohydrates in biosystems are D-configurations and all amino acids and derivatives of are L-configurations. This

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