When left-handed and right-handed crystals cannot coexist.

Implications in the life origin and the pharmaceutical industry

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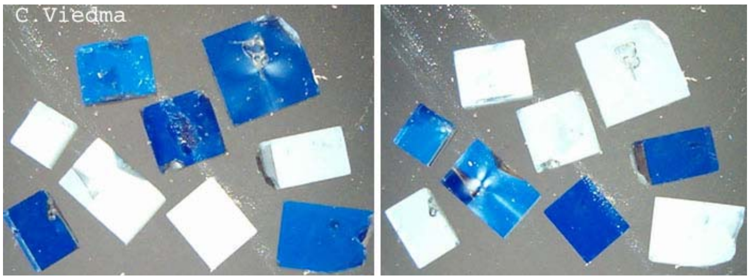
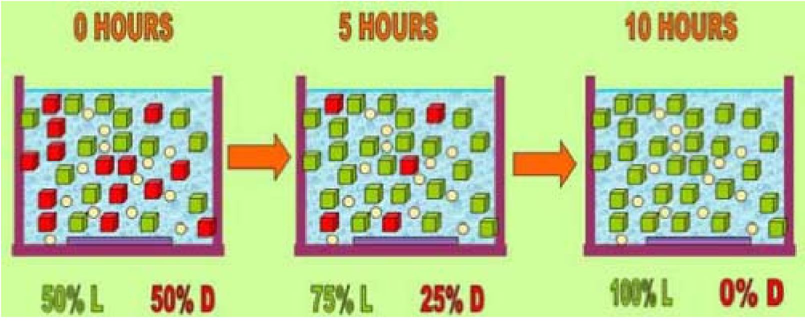


Chiral symmetry breaking occurs when a physical or chemical process sponta-neously generates a large excess of one of the two enantiomers – left-handed (L) or right-handed (D) – with no preference as to which of the two enantiomers is produced. From the viewpoint of energy, these two enantiomers can exist with an equal probability, and inorganic processes that involve chiral products commonly yield a racemic mixture of both. The fact that biologically relevant molecules exist only as one of the two enantiomers is a fascinating example of complete symmetry breaking in chirality and has long intrigued the science community. The origin of this selective chirality has remained a fundamental enigma with regard to the origin of life since the time of Pasteur, some 140 years ago.



However, we recently discovered a new way to achieve not only resolution, but also total deracemization in a reliable way: two populations of (R) and (S) crystals were converted into a single chirality. This new technique of deracemisation is a very promising route and practically interesting as proven for the production of single chirality of Clopidogrel (U.S. sales in 2007: 7300 million as Plavix) and Prasugrel, and the mechanism provides a possible route to explain the homochirality of nature.

Cristóbal Viedma is professor of crystallography and mineralogy in the Universidad Complutense de Madrid. His research interests include crystals growth in nature and in industry, spontaneous generation and propagation of chiral asymmetry in crystallization and in nature (implications in the origin of biochirality), mineral vs organic self-organization (implication in prebiotic chemistry), catalytic and order effect between organic molecules and minerals: biomineralization, minerabiogenesis and biomimetic morphologies, and geological aspects of planets and bodies of solar system.

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