CHIRALITY FROM NON-CHIRALITY? H. G. Hansma, Department of Physics, University of California, Santa Barbara CA 93106. hhansma@physics.ucsb.edu.

Maybe chirality can arise without preexisting chirality, just as life seems to have arisen without preexisting life. Maybe chirality arose in crowded spaces between two crystal surfaces. [1] In the figures below, crowding in two dimensions favors the formation of homochiral polymers.

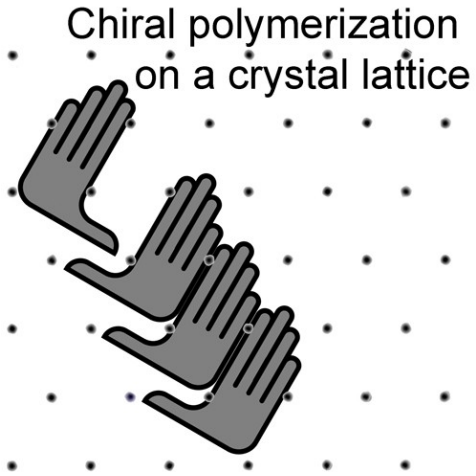

Figure 1. Chiral figures on a hexagonal grid. Mica's hexagonal grid has a periodicity of 0.5 nm.

Muscovite mica provides many crowded spaces between pairs of mica sheets. Mica is a non-swelling clay mineral with anionic nanometer-thick Si-Al-O planar crystalline sheets held together by metal cations. Muscovite mica is preferred for the origins of life [2-4], because its sheets are held together by potassium ions, which are found in high concentrations in all living cells. The spaces between pairs of mica sheets may be an ideal site for solid-state synthesis of organic molecules and polymers.

Mechanical energy is proposed as an endless energy source for the origins of life between mica sheets. The mechanical energy would come from the movement of mica sheets, open-and-shut, powered by fluid flows and/or temperature changes. This mechanical energy is large enough for the formation of covalent bonds.

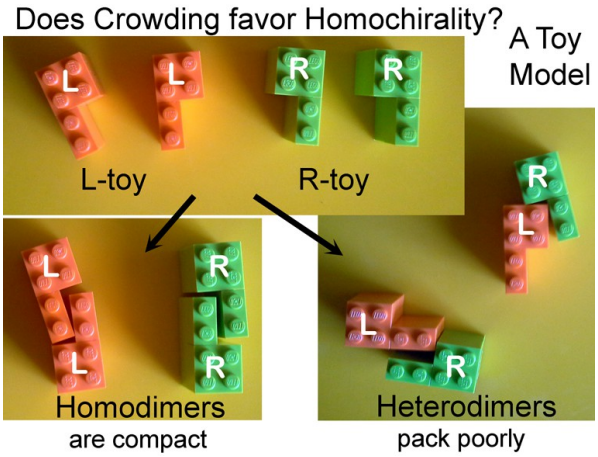

Figure 2. Lego models of homodimers and heterodimers.

References:

[1] Hansma, H.G.,Orig Life Evol Biosph, 2015. DOI 10.1007/s11084-014-9382-5. [2] Hansma, H.G., Journal of Theoretical Biology, 2010. 266(1): p. 175-188. [3] Hansma, H.G., J. Biol. Struct. Dynamics, 2013. 31(8): p. 888-895. [4] Hansma, H.G., in *Probing Mechanics at Nanoscale Dimensions*, N. Tamura, et al., Editors. 2009, Materials Research Society: Warrendale, PA. p. II03-15.