The Asymmetry of Life

Cornelia Meinert[a], Uwe J. Meierhenrich[a], Laurent Nahon[b], Nykola C. Jones[c], Søren V. Hoffmann[c] & Louis le Sergeant d'Hendecourt[d,e]

[a] *Institute de Chimie de Nice, CNRS UMR 7272, Université Côte d'Azur, 06108 Nice, France e-mail: cornelia.meinert@univ-cotedazur.fr;*
[b] *Synchrotron SOLEIL, 91192 Gif-sur-Yvette, France;* [c] *Aarhus University, 8000 Aarhus, Denmark;* [d] *Université d'Aix-Marseille, 13397 Marseille, France &* [e] *Université Paris-Saclay, 91190 Saint-Aubin, France*

What is responsible for the emergence of life's homochiral biopolymers – DNA/RNA and proteins – where all the constituent monomers exhibit the same *handedness*? Based on *in-situ* observations and laboratory studies, we propose that this handedness occurs when chiral biomolecules are synthesized asymmetrically through interaction with circularly polarized light (cpl) in interstellar space.[1] Previous experimental results on the asymmetric photolysis of amino acids,[2] as well as the absolute asymmetric synthesis from achiral interstellar ice precursor molecules,[3] revealed polarization- and energy-controlled induced enantiomeric enrichments.
The recent detection of sugar molecules in interstellar analogue ices[4] (**Fig. 1**) suggests that the molecular building blocks of the genetic material are abundant in interstellar environments and potentially present in comets and small bodies, such as asteroids and interstellar dust particles. I will therefore highlight a few significant results on our on-going cometary ice simulation experiments, the chiroptical properties of targeted sugar molecules in the UV using circularly polarized synchrotron light and present future strategies towards furthering understanding the origin of asymmetric prebiotic molecules.

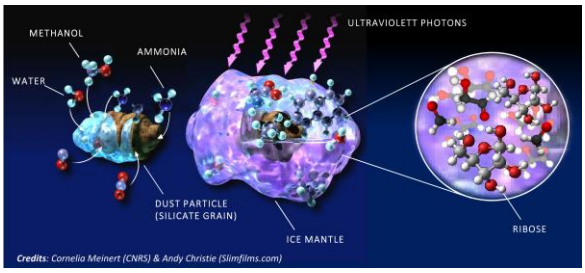

Figure 1 Ribose forms in the icy mantles of interstellar dust grains from simple precursor molecules (water, methanol, and ammonia) under high energy radiation.

ACKNOWLEDGMENTS

Support by the European Research Council under the EU's HORIZON 2020 research & innovation programme [grant agreement 804144] is gratefully acknowledged.

REFERENCES

[1] C. Meinert, *et al*., *Phys. Life Rev*. **8**, 307 (2011).
[2] C. Meinert, et al., *Angew. Chem. Int. Ed.* **53**, 210 (2014).
[3] P. de Marcellus, et al., *Astrophys. J. Lett*. **727**, L27 (2011); P. Modica, *et al*., *ApJ* **788**, 79 (2014).
[4] C. Meinert, et al., *Science* **352**, 208 (2016)