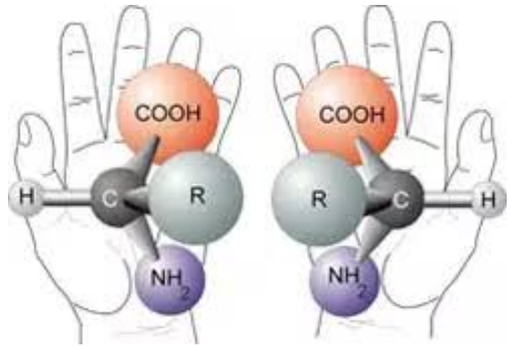
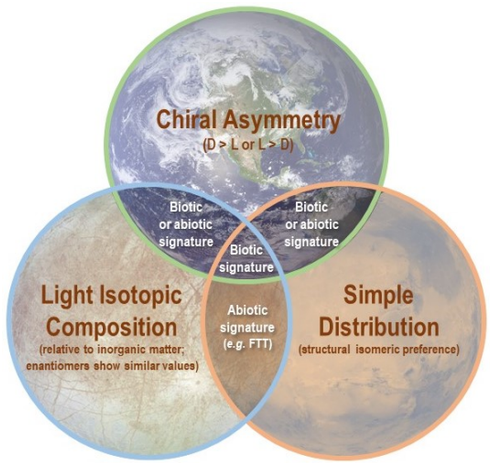
# New Criteria for using Chirality for Life Detection

Chiral molecules, including some amino acids and sugars, come in two different forms, one the mirror image of the other, similar to our hands. Scientists refer to these different molecules as “left-handed” or ”right-handed.” Life on Earth only uses left-handed amino acids, for reason that are still a mystery. Can we distinguish between biological and non-biological chemistry in our solar system by using chiral asymmetry (differences in the proportion of “handedness” of molecules)?



Chiral molecules exist as mirror-image forms

Homochirality (uniformity in handedness) is believed to be a unique property of life and an excellent chemical biosignature. However, excesses in chirality (> 60%) can also have non-biological origin (meteorites, for example, can have large excesses of one handedness over another), which complicates the use of chirality as a unique biosignature. Based on all available data, we propose that the detection of chiral asymmetry (left > right or right>left), combined with small differences in isotopes (*e.g.,* $^{13}C$ depletion; life favors lighter isotopes) and a simple molecular distribution, would provide a compelling biotic signature.




The detection of chiral molecule asymmetry (in amino acids or sugars) by itself may be insufficient to establish a definitive biological origin. Future *in situ* life detection instruments should include both chirality and compound-specific isotope measurement capability. The search for evidence of extraterrestrial life in our solar system is very challenging and will require multiple lines of evidence guided by our understanding of both life on Earth and abiotic chemistry.


*D. P. Glavin, A. S. Burton, J. E. Elsila, J. C. Aponte, and J. P. Dworkin (2019) “The Search for Chiral Asymmetry as a Potential Biosignature in our Solar System”* Chemical Reviews *120, 4660−4689, doi: 10.1021/acs.chemrev.9b00474.*