Can we seriously search for prebiotic compounds in the interstellar medium?

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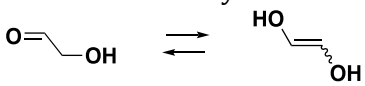
The purpose of this communication is to summarize what is known on the "prebiotic compounds in the Interstellar Medium (ISM)" and to treat some examples.
The first question is "Which compounds are prebiotic?" Only very simple molecules (water, formaldehyde, hydrogen cyanide, formamide, etc.) are unambiguously prebiotic compounds. After that, the unknown pathway(s) selected on the Early Earth and leading to the building blocks of life determine(s) which compounds acted as prebiotic compounds.
Do the prebiotic compounds leading to life on the primitive Earth have an exogenous origin? Here, too, the slider is difficult to fix. Compounds considered as prebiotic on early Earth and present in the ISM [1] may form on Earth and not come from meteorites. This is obvious to those who are kinetically unstable. But, for example, in the sequence (aldehydes -> imines -> α-aminonitriles -> amino acids), at which step does the exogenous material come? Presumably, sophisticated organic chemistry arose on Early Earth from exogenous matter. The small amounts of organics on the surface of Mars highlight the key role played by water on Earth. In all cases, the Primitive Earth has been a fascinating laboratory of organic chemistry.
We studied imines and carbohydrate compounds that are generally considered as prebiotic compounds, precursors to amino acids and sugars, respectively.
Six imines have been detected in the ISM and imines constitute the third family of heterocompounds in abundance observed in this medium after nitriles and aldehydes. All of them have the corresponding nitrile and aldehyde detected in the ISM [2]. Four of them have no corresponding amino acids in the constituents of the life on the Earth. Many other imines, yet undetected in the ISM, are necessary to form the numerous amino acids of life. The recording or publications of the millimetric spectra of several imines is currently in progress as for 1-propanimine ($CH_3CH_2CH{=}NH$) [3] or 2-iminopropanitrile ($NCC(=NH)CH_3$) [4].
Furthermore, ethenediol ($HOCH{=}CHOH$), the tautomer of glycolaldehyde ($HOCH_2CHO$), has been detected in the ISM [5]. It is probably a key compound in the formation of sugars from formaldehyde and glycolaldehyde or for the *in situ* synthesis of ribose in DNA.



NH-Aldimines or 1,2-Ethenediol are however too unstable to support the journey between the ISM and the Primitive Earth. The likelihood that such compounds would have formed in the ISM, transformed into compounds capable of withstanding travel and time, and then transformed on Earth into the starting compounds is unrealistic for many of them.
In the ISM and on the Early Earth, different chemistries may have led to the same compounds which exhibit thermodynamic and/or kinetic stability properties in their environment. If the contribution on Earth of chemical products by the meteorites is not in question, the nature and the synthesis of the compounds present in the meteorites and their chemical evolution on the Earth are still today more than obscure. So the delivery of "prebiotic" interstellar molecules to early Earth is doubtful to many of them, to say the least.

References

[1] https://cdms.astro.uni-koeln.de/classic/molecules:ism:nccnh-plus
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[5] V. M. Rivilla et al., ApJL, **2022**, 929:L11.