

## Insights into the mechanism of amino acid formation in the interstellar medium by laboratory experiments and computations

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Amino acids play a fundamental role in Earth-like life, with a hypothesis suggesting their origins lie in interstellar space, potentially reaching Earth via asteroid and meteorite impacts. Understanding the formation mechanisms of amino acids through laboratory experiments and detecting them in interstellar environments are vital for supporting this hypothesis and unraveling the origins of life. In this presentation, I will first summarize previous laboratory studies on amino acid formation from small molecules abundant in the interstellar medium. Then, I will discuss our own investigations into amino alcohol and amino acid formations and their reactions in astrophysical analogue ices and solid *para*-H<sub>2</sub>, primarily conducted using the VIZSLA setup at ELTE Eötvös University, in collaboration with others. I will detail our efforts to synthesize serine (NH<sub>2</sub>CH(CH<sub>2</sub>OH)COOH) from  $\alpha$ -glycyl (NH<sub>2</sub>C·HCOOH) and hydroxymethyl (·CH<sub>2</sub>OH). However, computational results indicate that this pathway for serine formation is not favored, prompting exploration of alternative routes for the formation of serine and larger amino acids in low-temperature ices. Finally, I will propose further experiments aimed at shedding light on the mechanism of interstellar amino acid formations and either supporting or disproving the molecular panspermia hypothesis.