

Guanine synthesis from interstellar organic molecules as an example of prebiological chemistry

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Abstract. The idea that some nitrogen bases, such as adenine and guanine, are easily formed and can be found in interstellar space should not be rejected. In fact, they have been found in the soluble fraction of some ancient meteors. It is possible that the “seed” of life had its origin in space, and thanks to Earth conditions, a synergistic interaction occurred and allowed life to spring forth on our planet.

Keywords. Guanine, synthesis, prebiological, chemistry, DNA

1. Introduction

Guanine is one of the five main nucleobases found in the nucleic acids DNA and RNA, the others being adenine, cytosine, thymine, and uracil. With the formula $C_5H_5N_5O$, guanine is a derivative of purine, consisting of a fused pyrimidine-imidazole ring system with conjugated double bonds.

Two experiments conducted by Levy *et al.* showed that heating 10 M NH_4CN at 80 °C for 24 hours gave a yield of 0.0007%, while using 0.1 M NH_4CN frozen at -20 °C for 25 hours gave a 0.0035% yield. These results indicate guanine could arise in frozen regions of the primitive Earth.

2. Theoretical proposal

Is it possible to make guanine from organic molecules from interstellar space?

The live organisms require a molecular response RNA or DNA, it is vital to understand whether predecessors exist in interstellar space.

This synthesis is proposed as a reaction of hydrogen cyanide molecules with formaldehyde, going through mediators; malonitrile, acid malonic, nitro malonic acid, 2-amino malonic acid, and 3-oxoserinamide. The last, due to cyclization, forms 2-oxo 4,5 dihydro-1H-imidazole-4 carboxylic acid. This, because of a hydroxyl functional exchange for chloride and reaction with guanine, forms 1,2,3,9 tetrahydro 6H purinone which produces guanine through reduction. As a result, the importance of prebiotic chemistry to generate life is proven.

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