Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **96** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) How did first life emerge on terrestrial planets?

Wednesday 9 June 2021 15:45 (5 minutes)

How did the first genetic code and the first forms of cellular appear in the early life, about 3.5 billion years ago, of terrestrial and Earth-like exoplanets? This question has become especially timely with the discovery of an ever-increasing number of rocky exoplanets where liquid water is present and the successful landing of Perseverance, the latest of NASA's Mars rovers to search for signes of molecular life on the red planet.

We investigated how specific conditions on terrestrial planets, such as water, temperatures, radiation, atmospheres, and the presence of certain minerals and organic molecules, can potentially drive polymerization of RNA-like polymers. Experiments were conducted using the Planet Simulator, a custom-built simulation chamber.

Our current results show that the formation of the first genetic assemblies would have occurred in shallow wells that undergo hot-cold and wet-dry cycles. Nucleic acids may have evolved in contact with salt, such as ammonium chloride, and in particular phospholipids and simple membranes, for the formation of protocells when the concentration of those elements would have been optimal. We found that long RNA polymers form spontaneously in the presence of membranes in these warm little ponds and that these polymers are spontaneously incorporated into liposomes. We observe RNA-chains of hundreds of nucleotides whose length depends on the exact temperature and humidity cycles due to daily and seasonal change. Together these results may present a pathway to the formation of first prebiotic life.

Authors: DUJARDIN, Alix (McMaster University); BIDER, Renée-Claude (McMaster University); CROMPVOETS, Breanna (McMaster University); HIMBERT, Sebastian (McMaster University); RHEINSTÄDTER, Hannah V. (McMaster University); Dr PUDRITZ, Ralph (McMaster University); Dr RHEINSTADTER, Maikel (McMaster University)

Presenter: DUJARDIN, Alix (McMaster University)

Session Classification: W3-4 Molecular and Cellular Biophysics (DPMB) / Biophysique moléculaire et biophysique cellulaire (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)