

The role of synthetic biology in NASA's missions

Lynn J. Rothschild, NASA Ames Research Center, Lynn.J.Rothschild@nasa.gov

Human exploration off planet is severely limited by the cost of launching materials into space and re-supply. Thus materials brought from earth must be light, stable and reliable at destination. Using traditional approaches a lunar or Mars base would require either transporting a hefty store of metals or heavy manufacturing equipment and construction materials for *in situ* extraction; both would severely limit any other mission objectives. Long-term human space presence requires periodic replenishment, adding a massive cost overhead. Even robotic missions often sacrifice science goals for heavy radiation and thermal protection.

Biology has the potential to solve these problems because it can replicate and repair itself, and do a wide variety of chemical reactions including making food, fuel and materials. Synthetic biology can greatly enhance and expand life's evolved repertoire, and will be required for the production of bioproducts off planet as the only alternative is re-supply.. Using natural and synthetically altered organisms as the feedstock for additive manufacturing could one day make possible the dream of producing bespoke tools, food, smart fabrics and even replacement organs on demand.

The “what” and “how” of this game-changing technology will be covered along with a smorgasbord of proof-of-concept studies – from Biomining to “Hell Cell” and BioWires to printed advanced biocomposites, de-extinction and BioWires - that have emerged from our lab in the last few years and a taste of what is to come.