

Programmable Plants: Development of an In Planta System for the Remote Monitoring and Control of Plant Function for Life Support

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We propose to validate the viability and define the major feasibility issues of producing programmable plants. This project will align NASA's goal of solar system exploration with the emerging fields of genomics and nanoscience. We will explore the revolutionary concept of bringing these two disciplines together for the development of plants with remote monitoring and control devices in planta and we will develop an architecture for the design and use of robotic plants that can be programmed to express or repress inducible genes or modules of genes from remote signals. These programmable plants, designed with receptors/receivers that would be activated by remotely generated signals, would provide the air, water, food, fiber, pharmaceuticals, chemical feedstock, and material needed to sustain the human element beyond Earth and ensure the success of the mission. The plants would thus be programmed from earth or from a satellite to initiate a bioregenerative life support system for an incoming or resident crew, to initiate production of pharmaceuticals or nutraceuticals, to generate biomass, or to produce fiber or plastics for construction. Development and integration of a fully biologically based life support system that is genetically engineered and remotely controlled to act in response to the changing needs of the crew/team would be of enormous significance in the quest to establish a human presence beyond Earth.

The marriage and application of functional genomics and nanotechnology would bring NASA's goal of establishing a human presence on Mars closer to reality. However, a massive amount of advanced concept planning, system development and research in both areas remains to be done. A clear architecture is needed to bring this effort to fruition. The goal of this proposal is to develop such an architecture.

Considering the potential benefit to mankind on Earth and beyond, it is an effort destined to be undertaken.

