The role of plants in future space endeavors.

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NIAC
NASA Institute for Advanced Concepts

John Z. Kiss

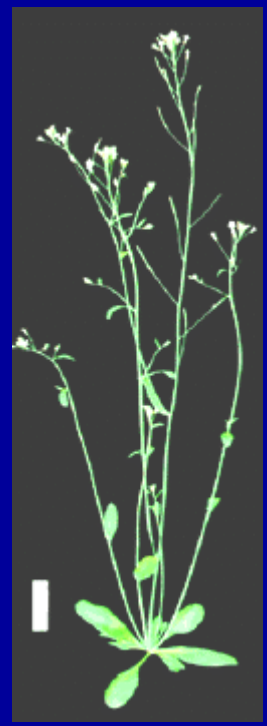
- Plant gravitational & space biology.
- Gravitropism and phototropism in plants.
- ESA Biorack on STS-81 & STS-84; ISS project in development.

- Dr. Chris Brown, N.C. State University
- Dr. Roger Hangarter, Indiana University
- Dr. Karl Hasenstein, University of Louisiana
- Dr. Mary Musgrave, University of Massachusetts

- **Basic (fundamental) biology research**
- **Advanced life support**
- **Biomonitors**

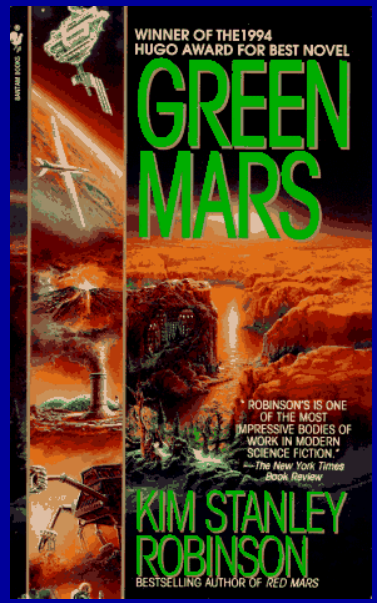
Basic Biological Research

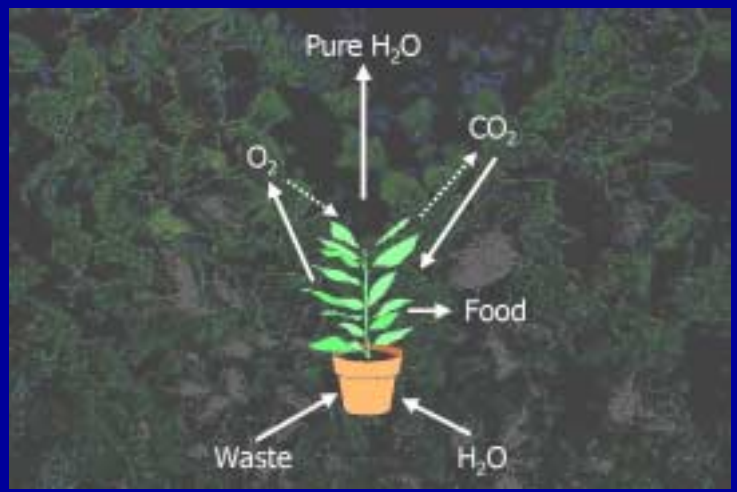
- The role of gravity in evolution.
- Role of the genome and other cell structures in sensing and responding to gravity.
- Interactions between gravity & environmental factors in plant growth and development.



Advanced Life Support

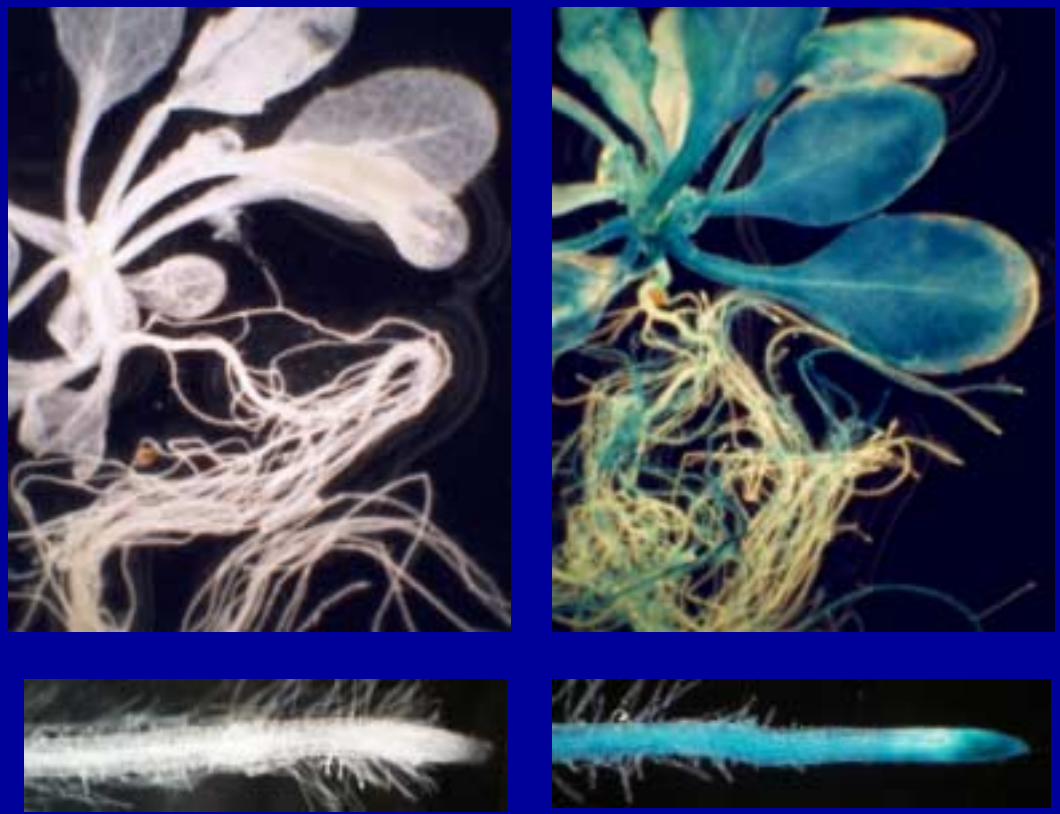
- Concept: human life support system, supplying food, water, and oxygen, open with respect to energy but closed with respect to mass, can operate indefinitely in space without resupply from Earth.
- Needed for long-term spaceflight missions and colonization of other planets.
- Plants: food, oxygen, psychological benefits.





Plants as Biomonitors

No stress **Stress**



Robert Ferl
Univ. of Florida

- Reporter gene: beta-glucuronidase (GUS)
- Green fluorescent protein (GFP); non-destructive

Plants as Biomonitors

- **Programmable, genetically-engineered plants can initiate production of food, drugs, plastics etc.**

- **Plants can be engineered for stresses of long-term spaceflight (water-deficients, high ethylene etc.) or unique stresses to other planets (Mars).**

- **Plants can be engineered to provide a signal if there are problems with the environment for the crew.**