Astrobiology at the Maker Faire

SynBio 2010

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National Aeronautics and Space Administration

RECEIVING ORGANIZATION
LOG NUMBER PROJECT ID NOTE

Ames Research Center
SERVICE REQUEST

REQUESTER E-MAIL	REQUESTER NAME	TELEPHONE	LOCATION	REQUESTING CODE	SERIAL NUMBER
Christopher.P.McKay@nasa.gov	Christopher P Mckay,chris Mckay	(650) 604-6864	N245/212	SST	721
POINT OF CONTACT E-MAIL	**POINT OF CONTACT**	**TELEPHONE**			
Christopher.P.McKay@nasa.gov	Christopher P Mckay,chris Mckay	(650) 604-6864			
SUBMIT TO	**REQUEST DATE**	**COMPLETE BY**	**JOB RATE**		
logistics@mail.nasa.gov	3/30/2009		Routine Job - Regular Rate		

COST CENTER	WBS ELEMENT	FUND	EXPIRATION DATE (R FUNDS)	FUNDED PROGRAM	AMOUNT OR %	ASSOC. PR NO.
21881	509496.02.08.01.73	SCEX22609D		21		
21881						
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WORK REQUIRED

ITEM	DESCRIPTION	QTY	UNIT COST	EXTENSION
			$787.85	

1. Reconstruct Martian life from the fragments preserved in ancient ice.
2. Create 5 types of super-microbes that can survive on Mars.

his requirement authorizes expenditures not to exceed: TOTAL:

APPROVALS

(•) This procurement does not include EIT items.
( ) This procurement does include EIT items and form ARC/F59 is attached.

1 - RESPONSIBLE RESOURCE (Required)	SIGNATURE & DATE	LOCAL (If required)	SIGNATURE & DATE
	3/30/09	2 - TECHNICAL MANAGER (Required)	3/30/09

ESTIMATED COST:	LABOR	COMPUTER ACCOUNTING	OTHER	
MATLS/ALG & SUPPLIS	HOURS ____ AT ____	UNITS ____ AT ____		ESTIMATE TOTAL

Astrobiology is the study of the origin, evolution, distribution, and **future** of life in the universe.

Doc: *"Your future is whatever you make it."*

Proposed Goal for Astrobiology & Society

- **Enhance the richness & diversity of life in the universe.**

Implied activities:

1. Search for, and support, a second genesis of life on other worlds
2. Expand life from Earth

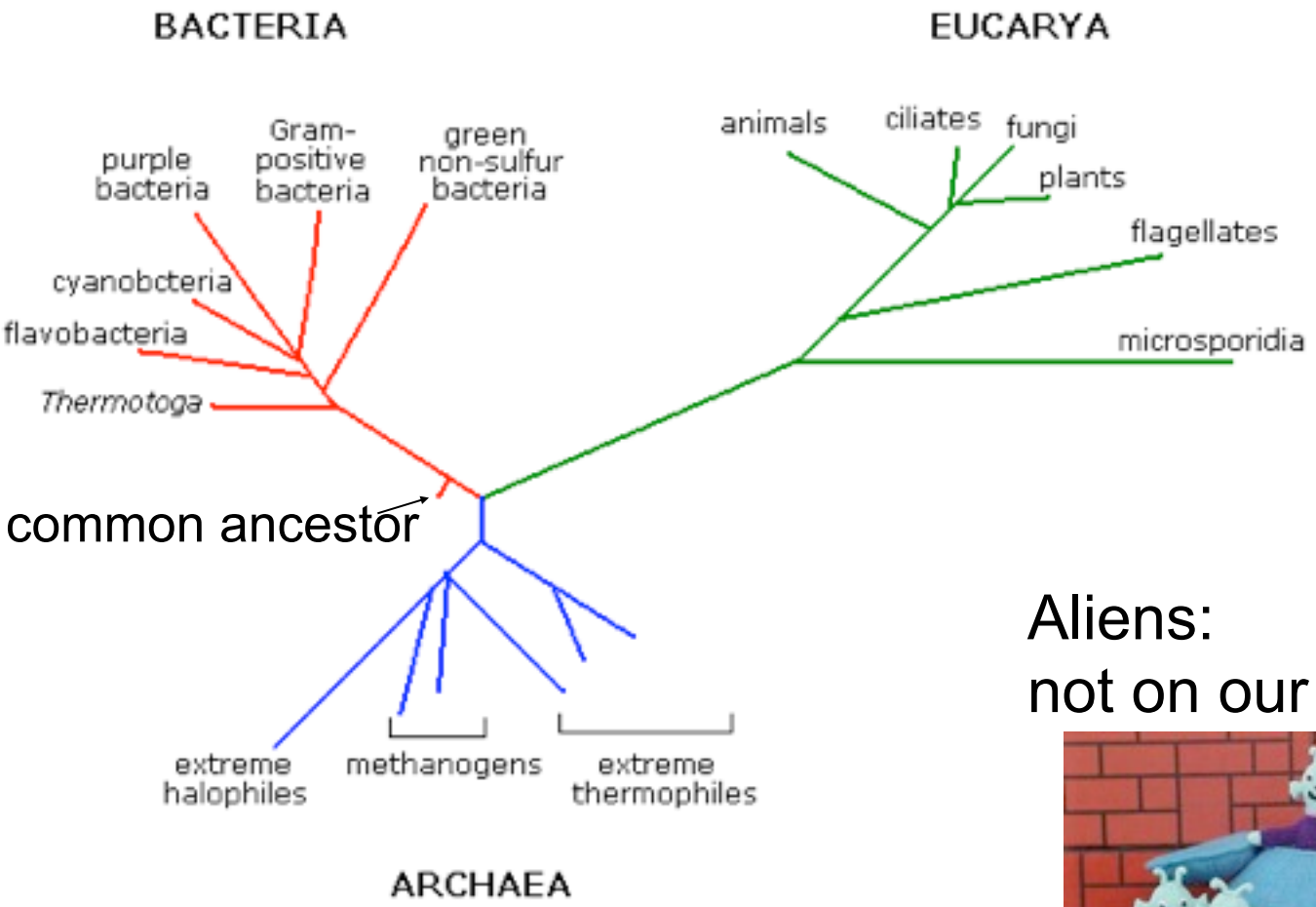
Near term implications

1. Search for a second genesis
   -biologically reversible exploration
2. Determine if life from Earth can grow on Mars
3. Determine if Mars can be restored to habitability

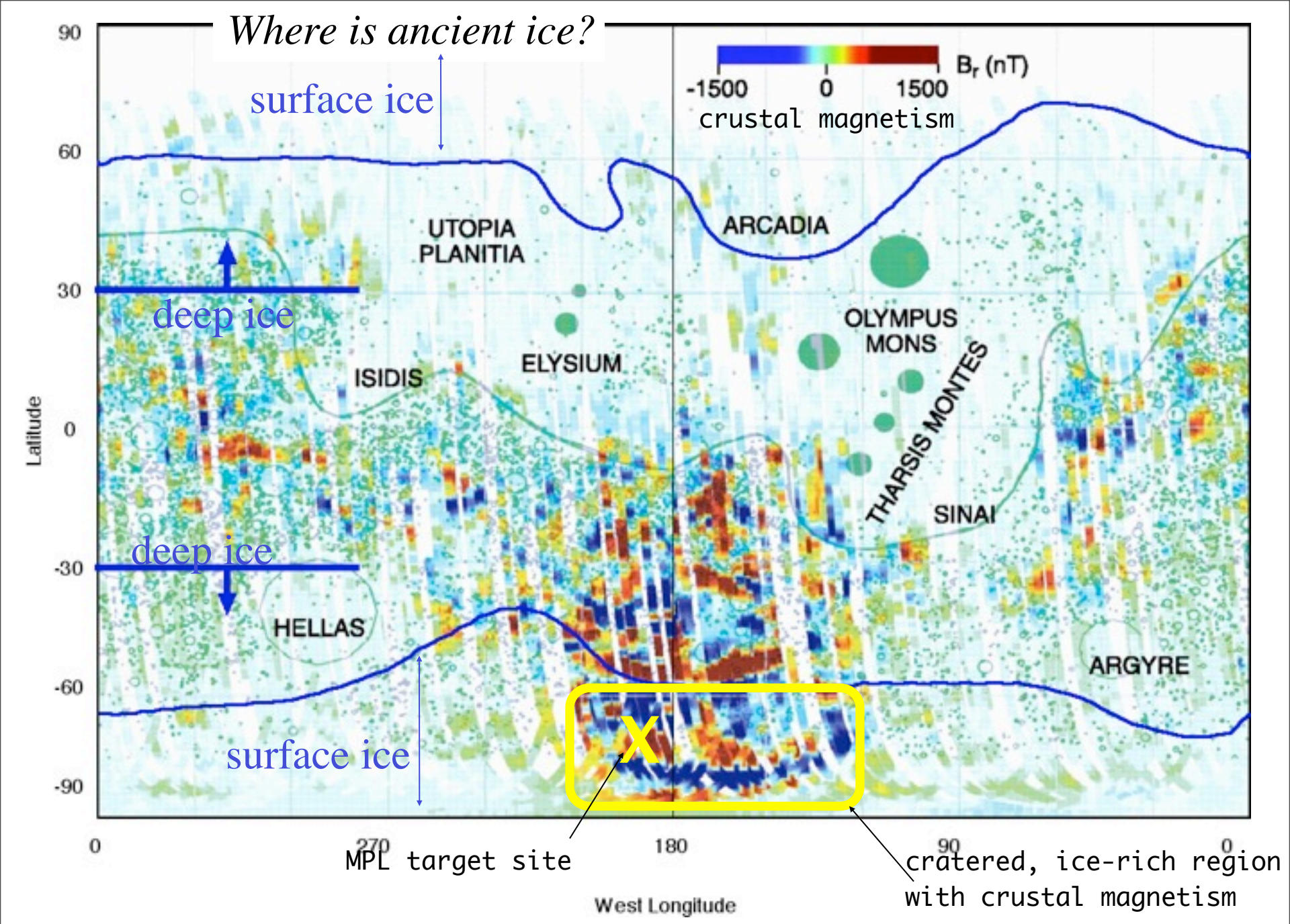
Three Possibilities for Past Life on Mars

- There was no life on Mars. *No worries*.
- It was related to Earth life, common origin. *Very little worries*.
- It was a second genesis unrelated to Earth. *Could be worries.*

The Earth tree of life



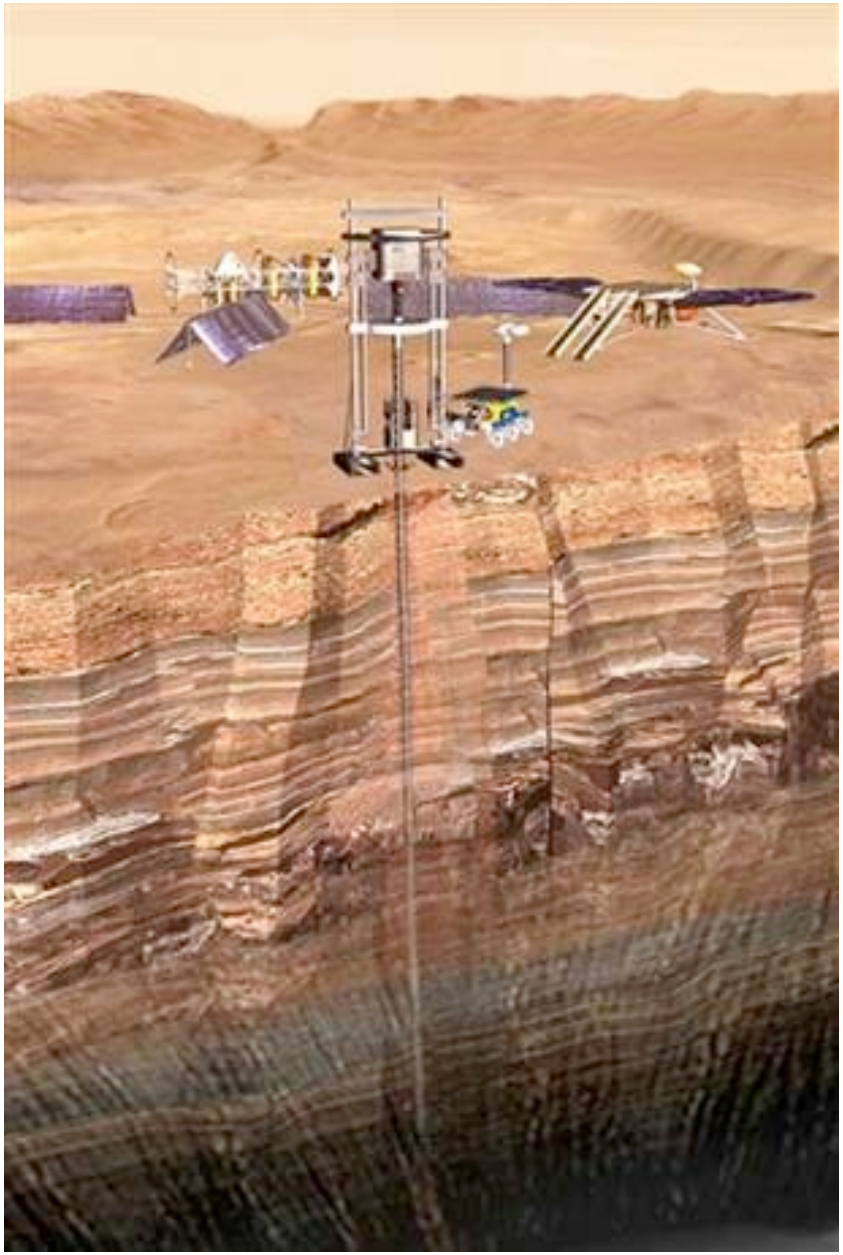
Aliens:
not on our tree of life



From:Smith & McKay, PSS 2005; data from Acuna et al, 1999; Barlow, 1997, Squyres and Carr, 1986

Limits on long term dormancy

- kT: Thermal decay: $\sim e^{-\Delta E/kT}$
  racemization of amino acids
  degradation of organic material
  not important on Mars, -70°C
- eV: Radiation from crustal U,Th, K ~0.2rad/yr
  lethal dose for *Deinococcus radiodurans* in 100 Myr
  on Mars hundreds of lethal dose over 3.5 Gyr
- Its dead, Jim



Optimistic Scenario

1. Life arose on Mars early in it's history separate from Earth.
2. Remnants of this life will be found in ancient ice.
3. It will be dead due to radiation.
4. We will decide to reconstruct it.

Why preserve a second genesis?

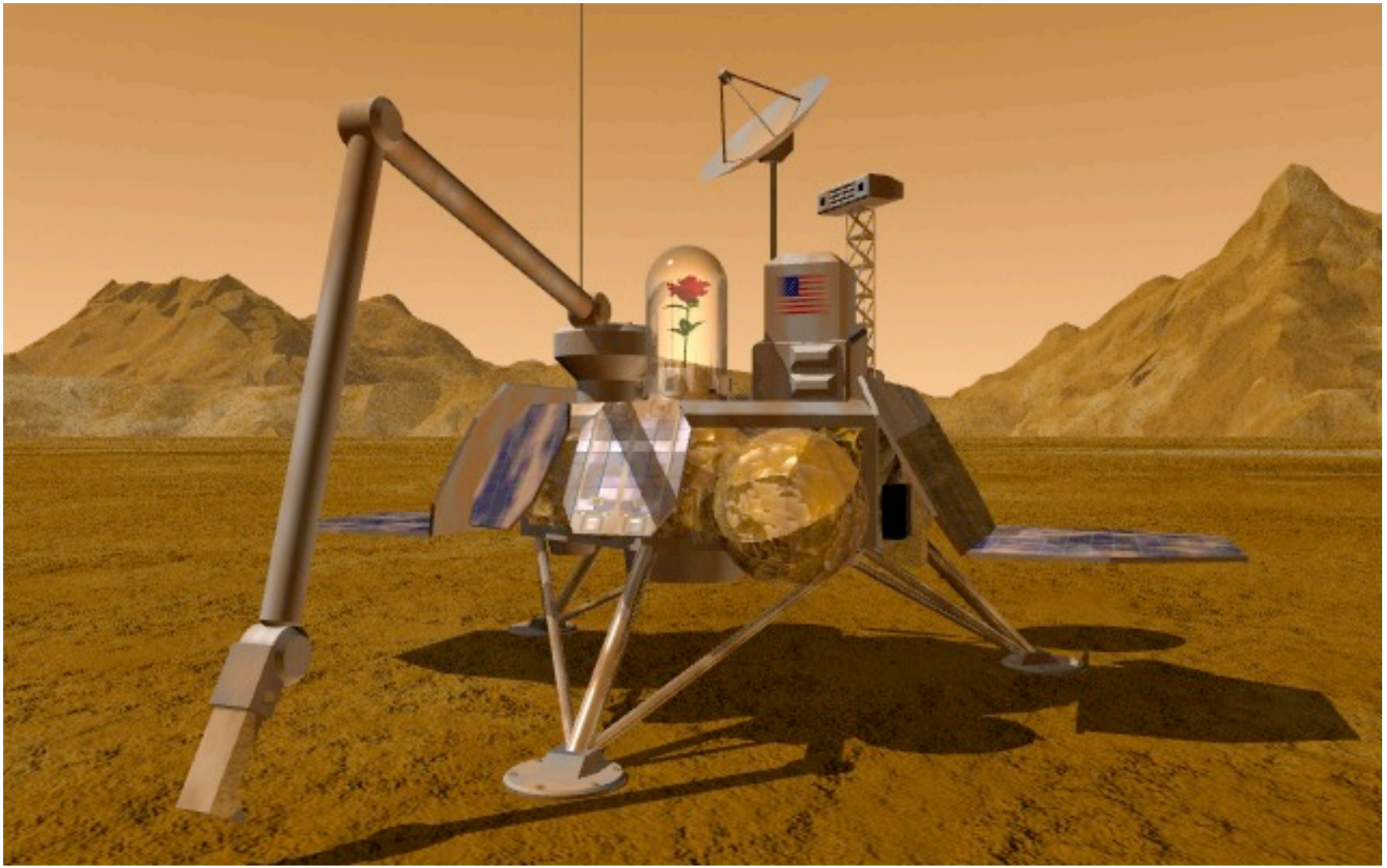
- Fundamental ethical principles related to the value of life and the value of diversity in life.
- Utilitarian benefit that comes from direct study of a second genesis.
- Restoring life and a biosphere to a dead world is a worthy goal for a space-faring people.

Immediate Recommendation: Biologically Reversible Exploration

The robotic and human exploration of Mars should be done in a way that is biologically reversible. We must be able to undo ('ctrl Z') our contamination of Mars if we discover a second genesis of life.

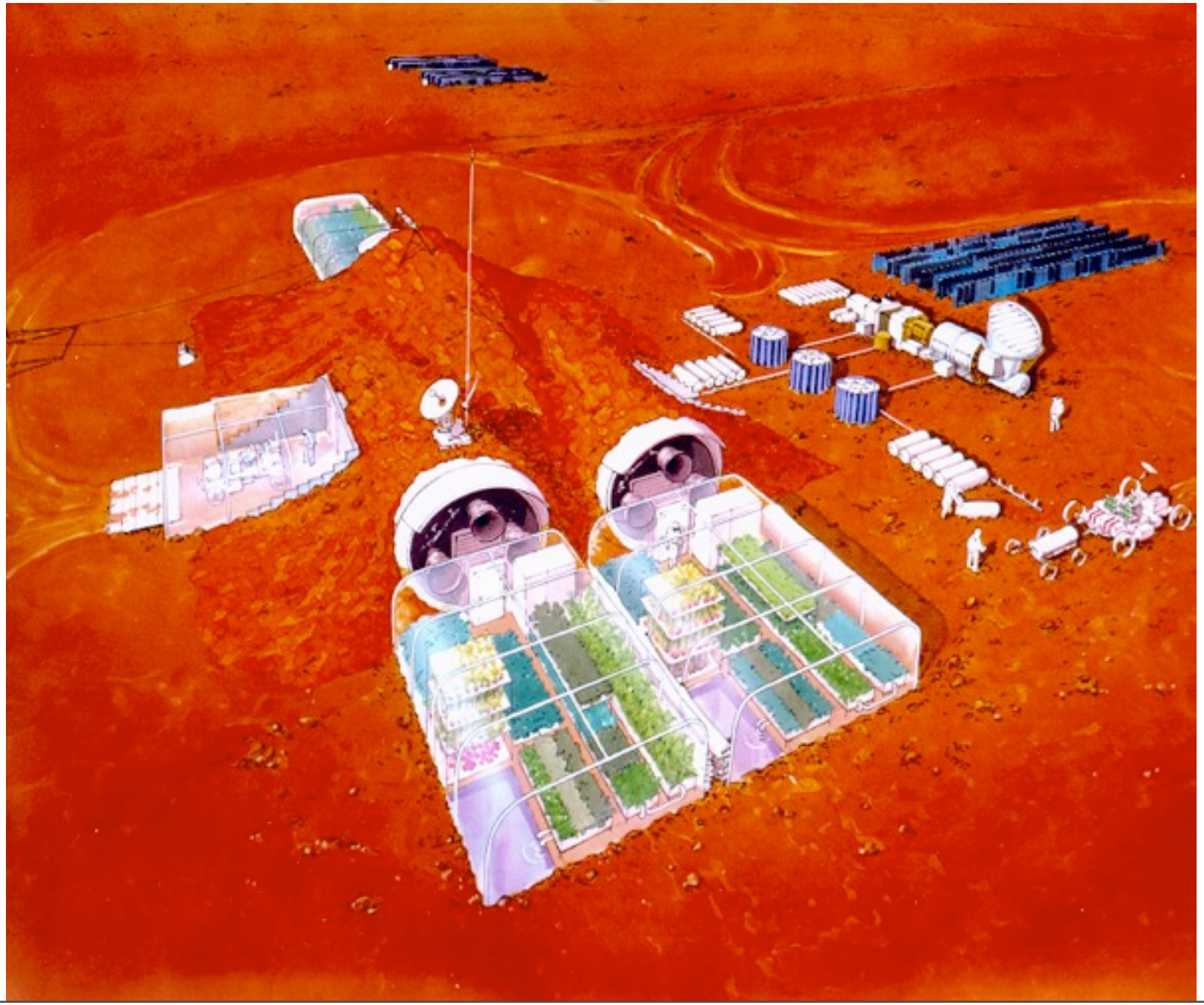
Near-term missions

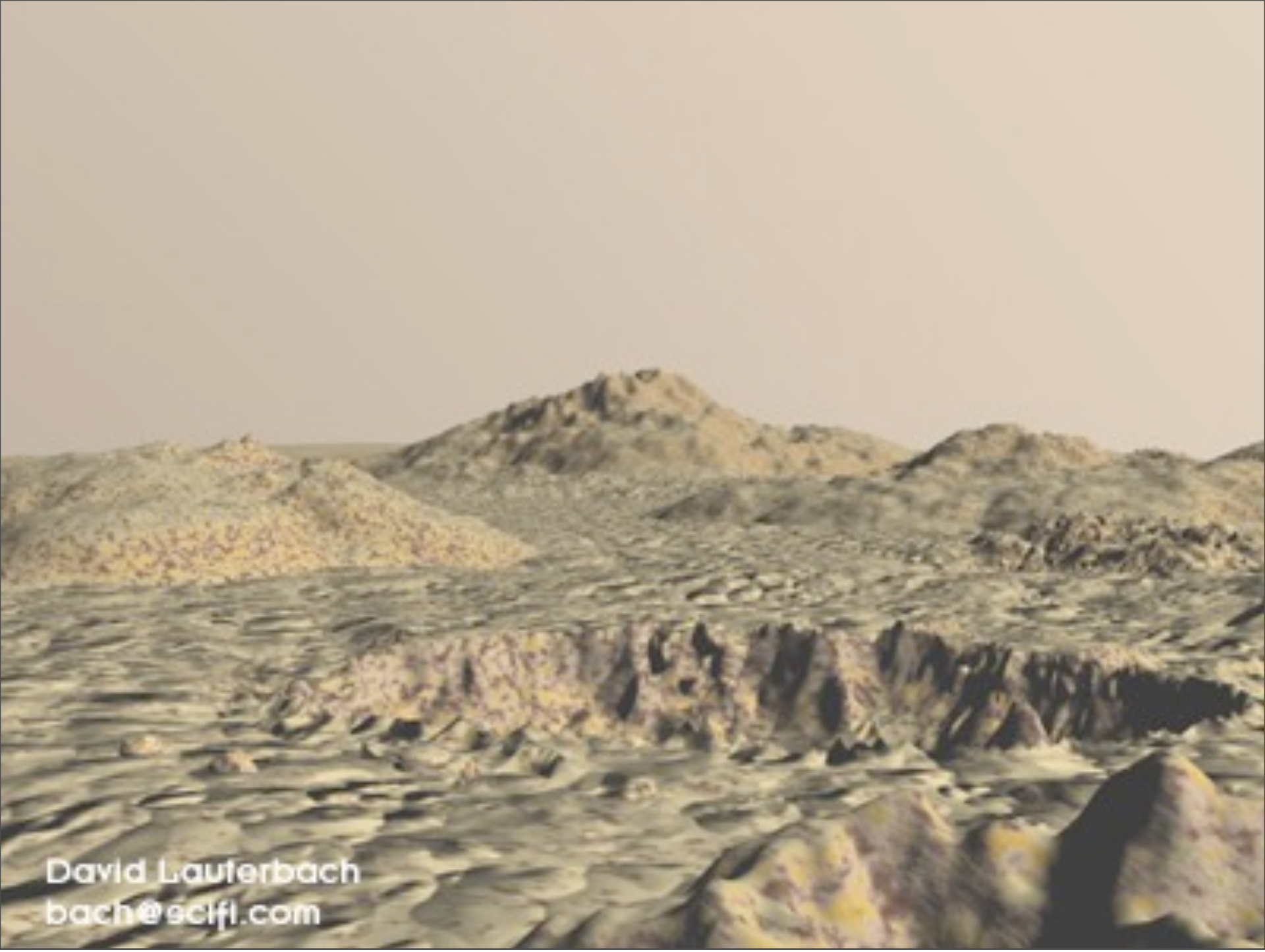
Using the martian soil and atmosphere for a plant growth module



"There has never been a flower on Mars" she said "but we will learn to grow them." From *A Rose for Ecclesiastes*, by Roger Zelazny.

Human exploration of Mars: 2025+

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$+\Delta E$ =

Before

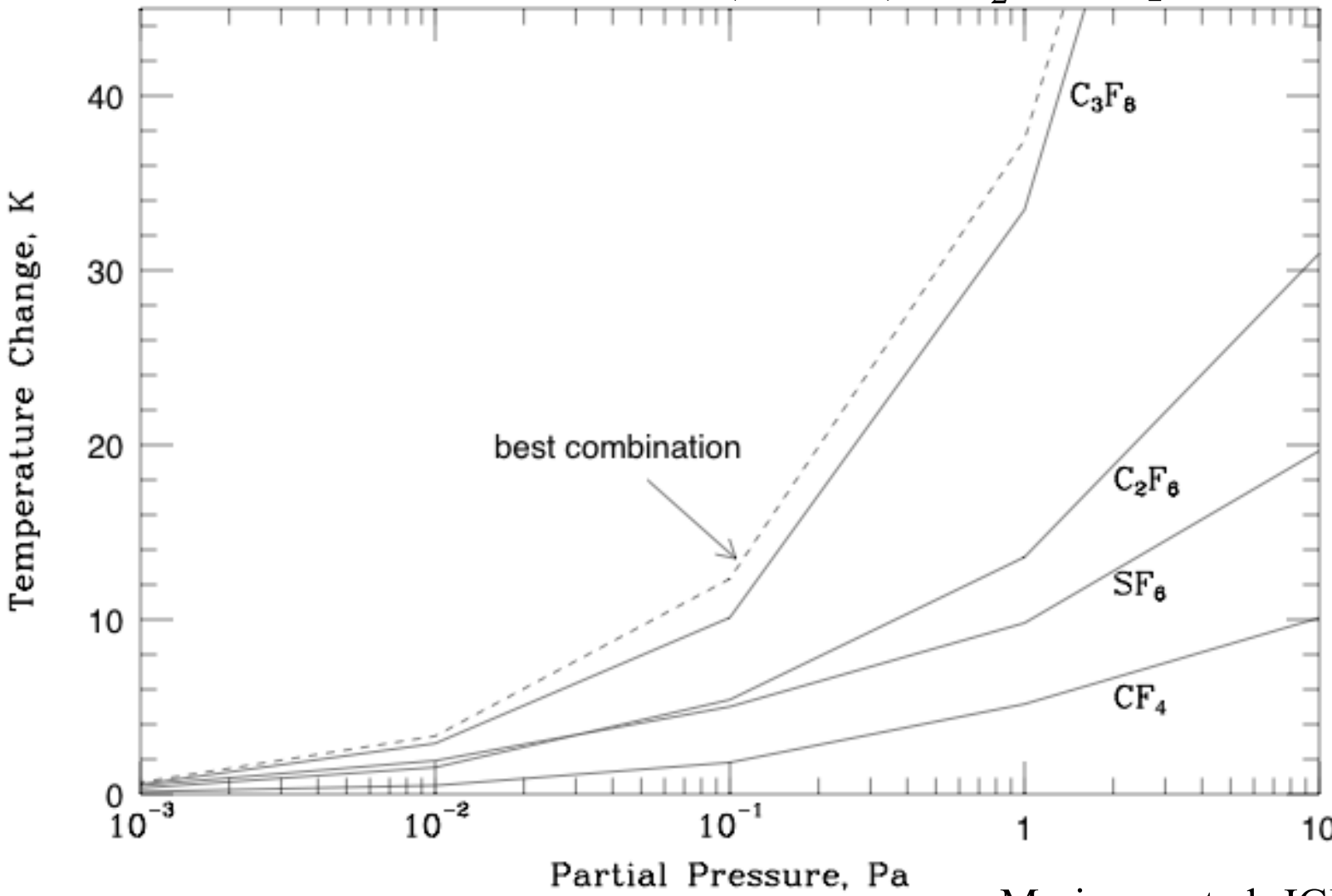
After

100 years to warm ✓

100,000 years for O_2 ✗

Results

ΔT for Mars with 600 Pa (6 mbar) CO_2 atmosphere



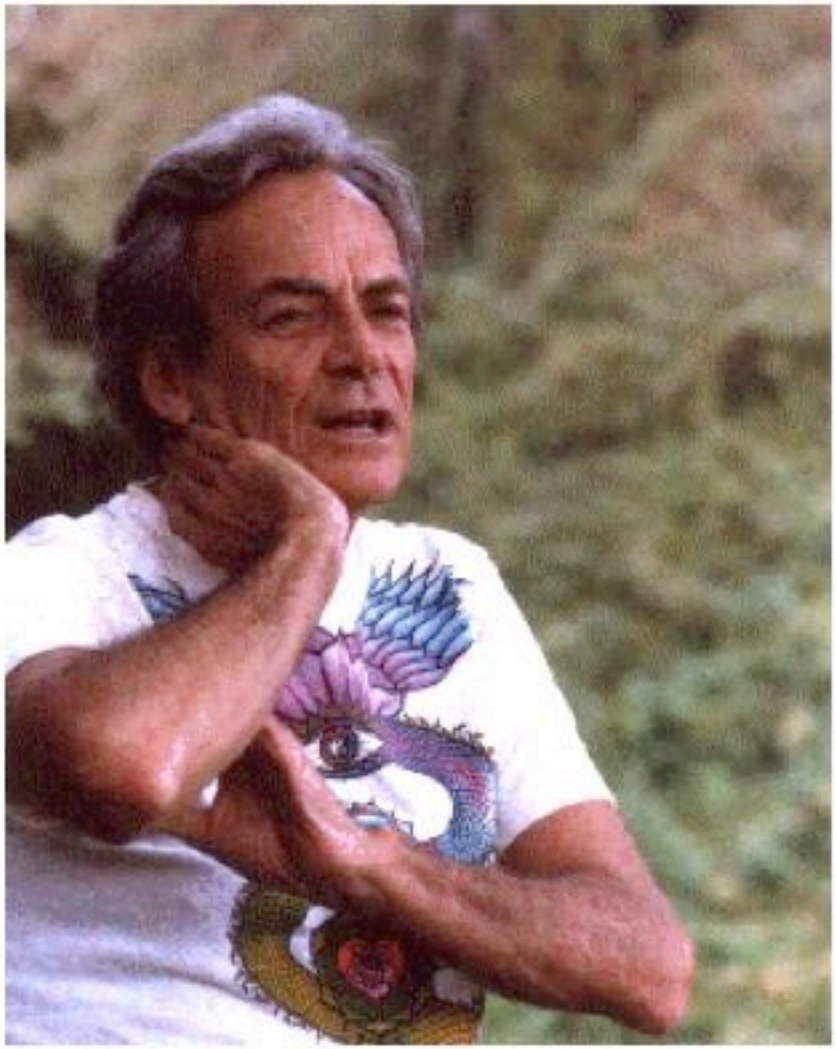
Marinova et al. JGR 2005

Martian superbugs

Resistance to UV, oxidant, low water, cold, & perchlorate

1. SuperWeathering microbes
2. Super organic producers
3. Wood making (O_2 releasing)

What I cannot create I do not understand.



Richard P. Feynman
written on his office blackboard
as he left it for the last time
in January 1988

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