

**Oxidative Stress Response of Biological Organisms
Exposed to Lunar Dust Simulants**

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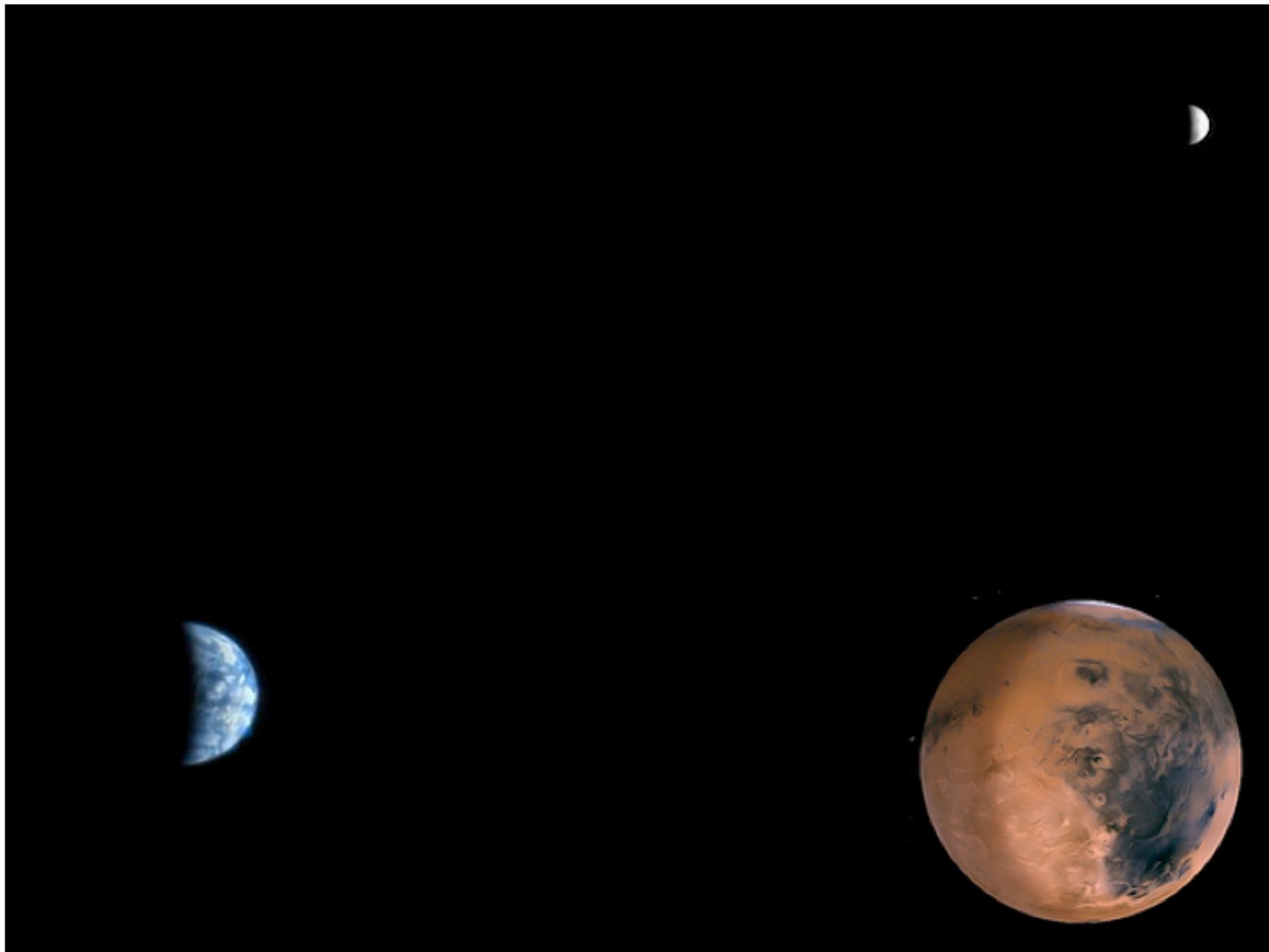
Helen Nichol

Bogdan Popescu

Ingrid Pickering

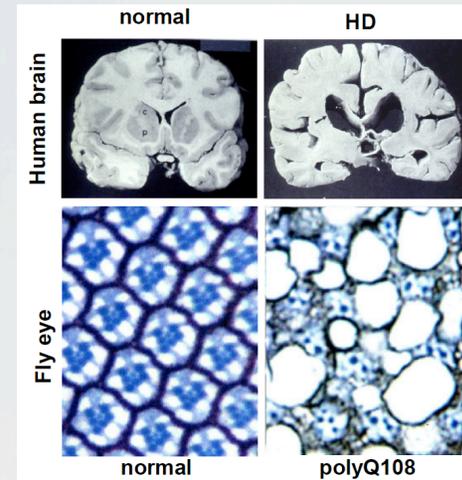
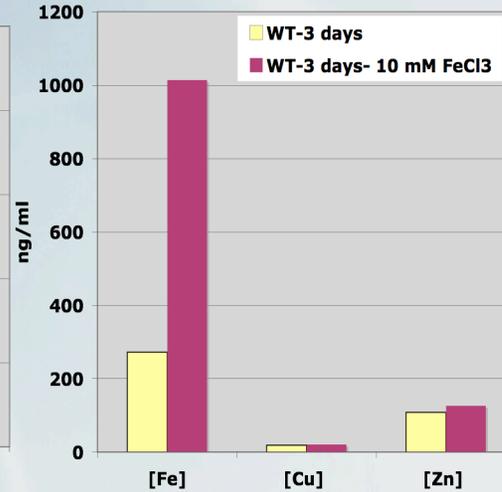
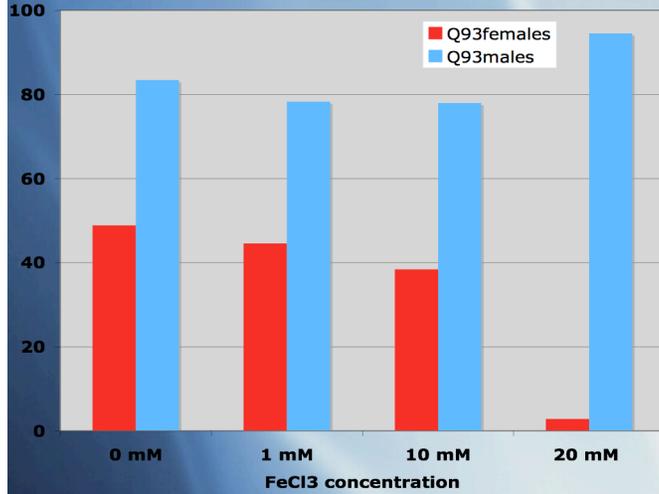
Graham George



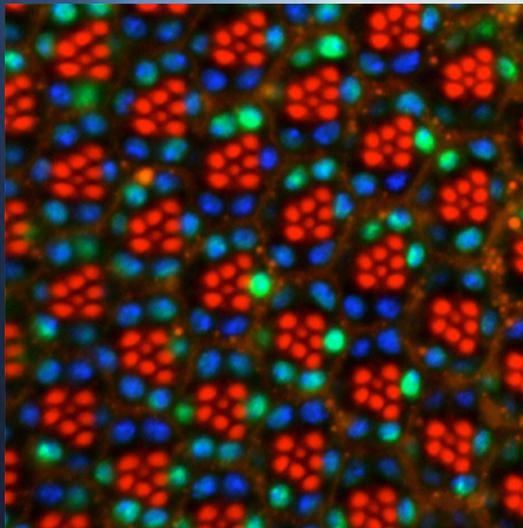
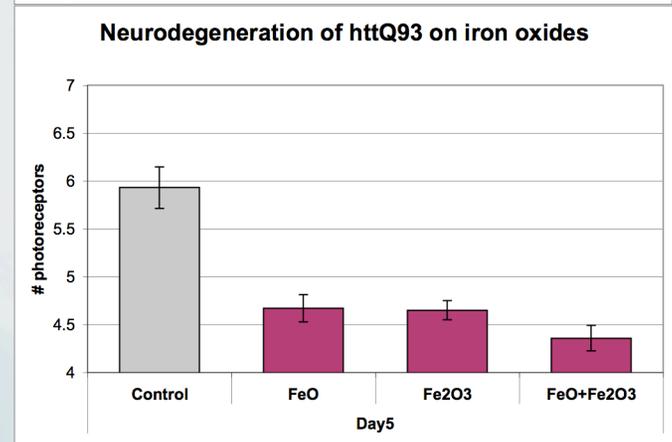
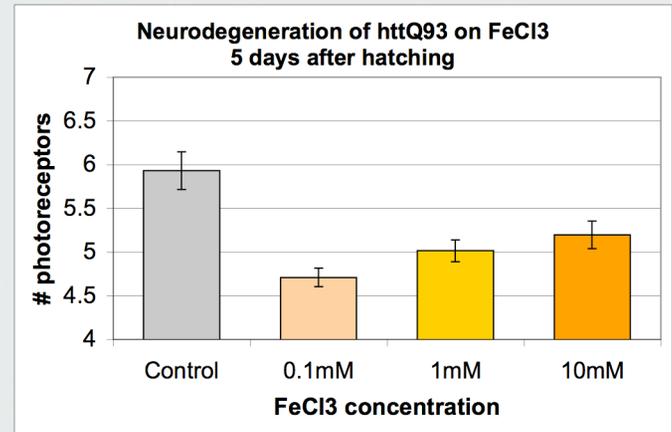


Is the iron in lunar dust a problem?

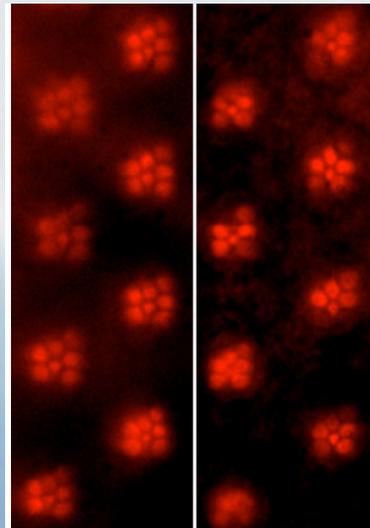
htt (CAG)_n
 HTT(Glu)_n



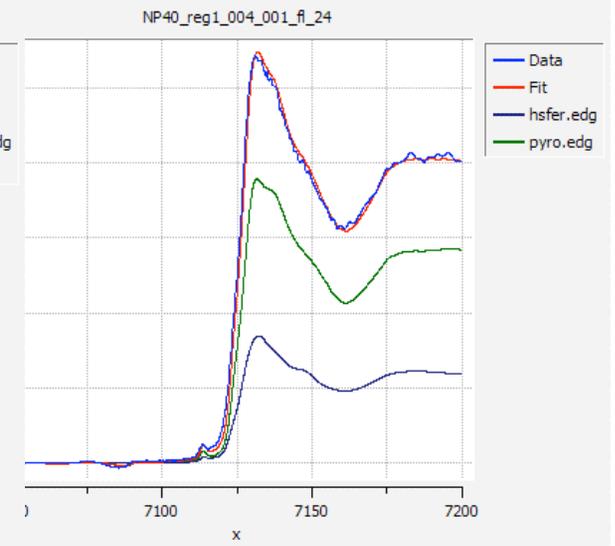
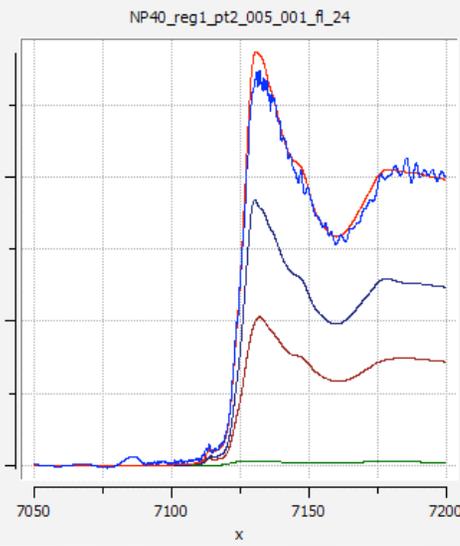
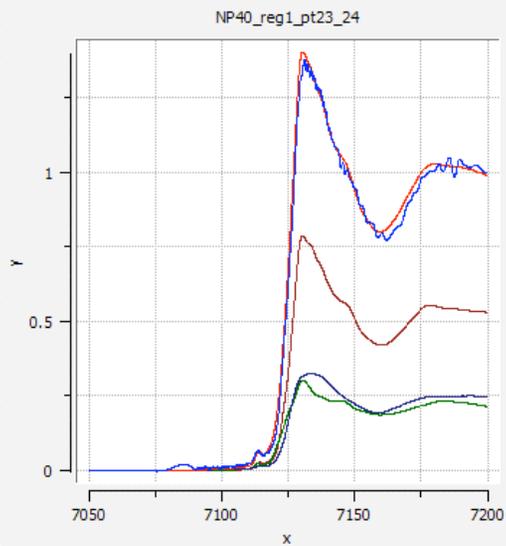
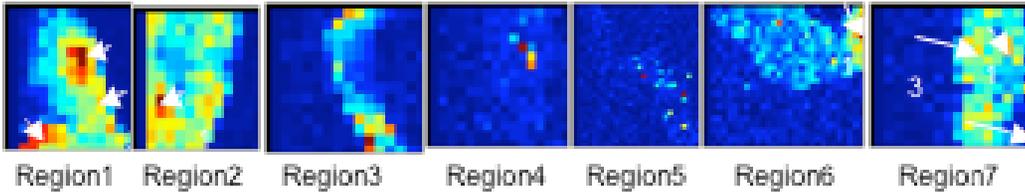
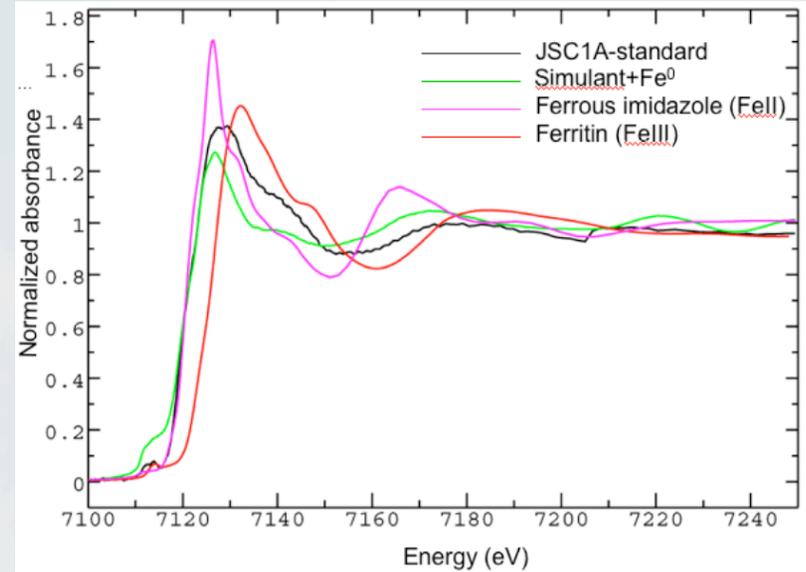
J.L. Marsh et al, HMG 2003



picture courtesy of Natalia Slepko

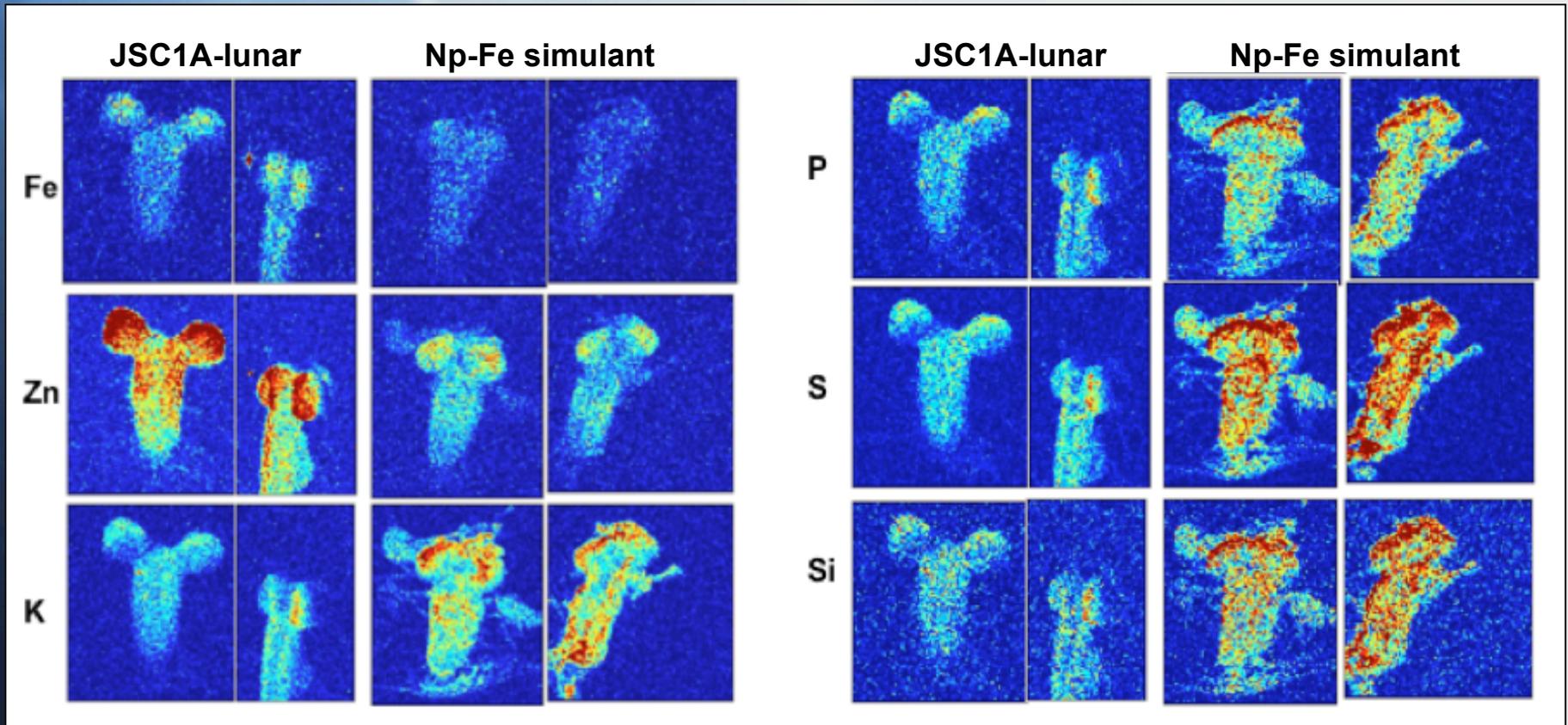


Is the iron in lunar dust bioavailable? (accessible to cells)



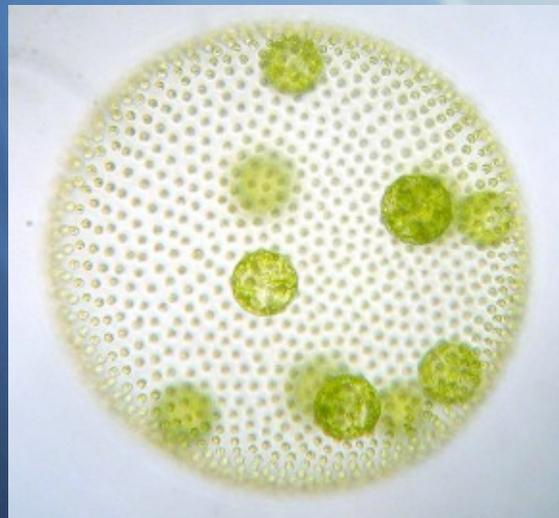
Where does it end up?

Metals accumulate differentially in the brain

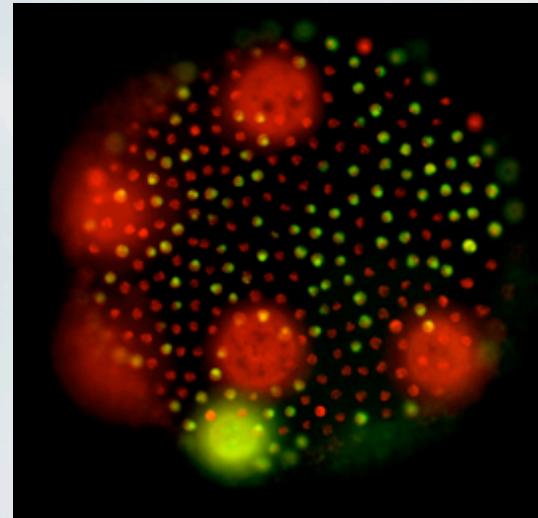


What is the significance of metal accumulation?

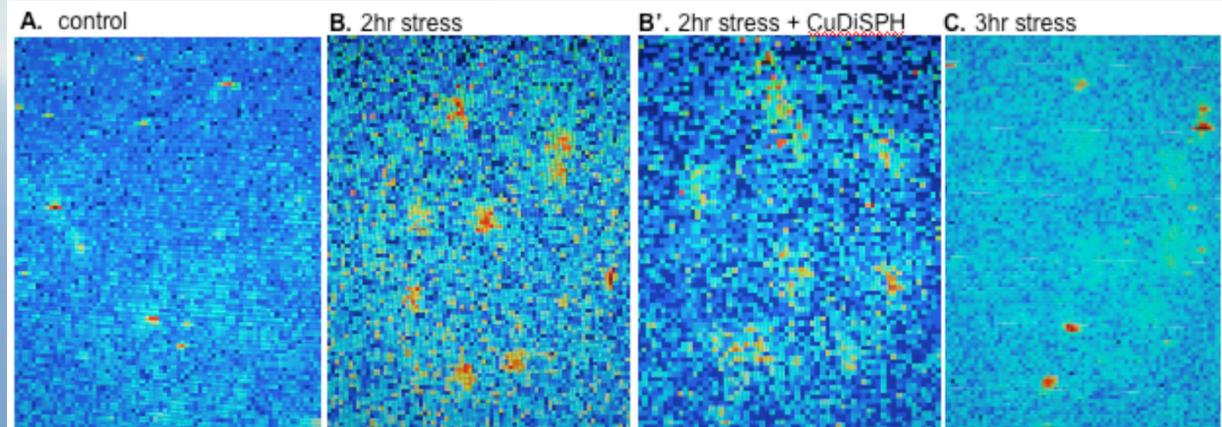
The oxidative stress response ...



stress
→
ROS accumulation

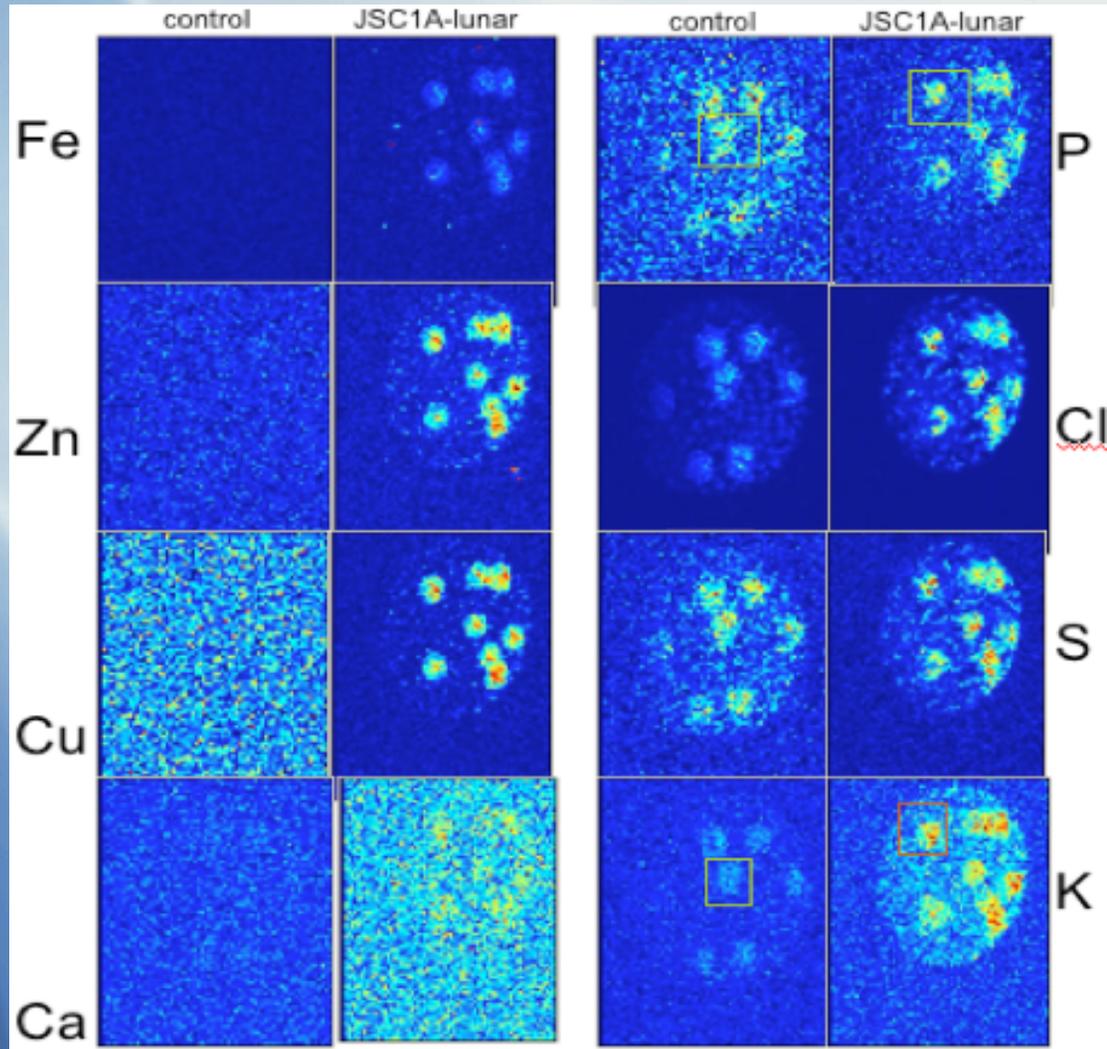


↕
Fe accumulation

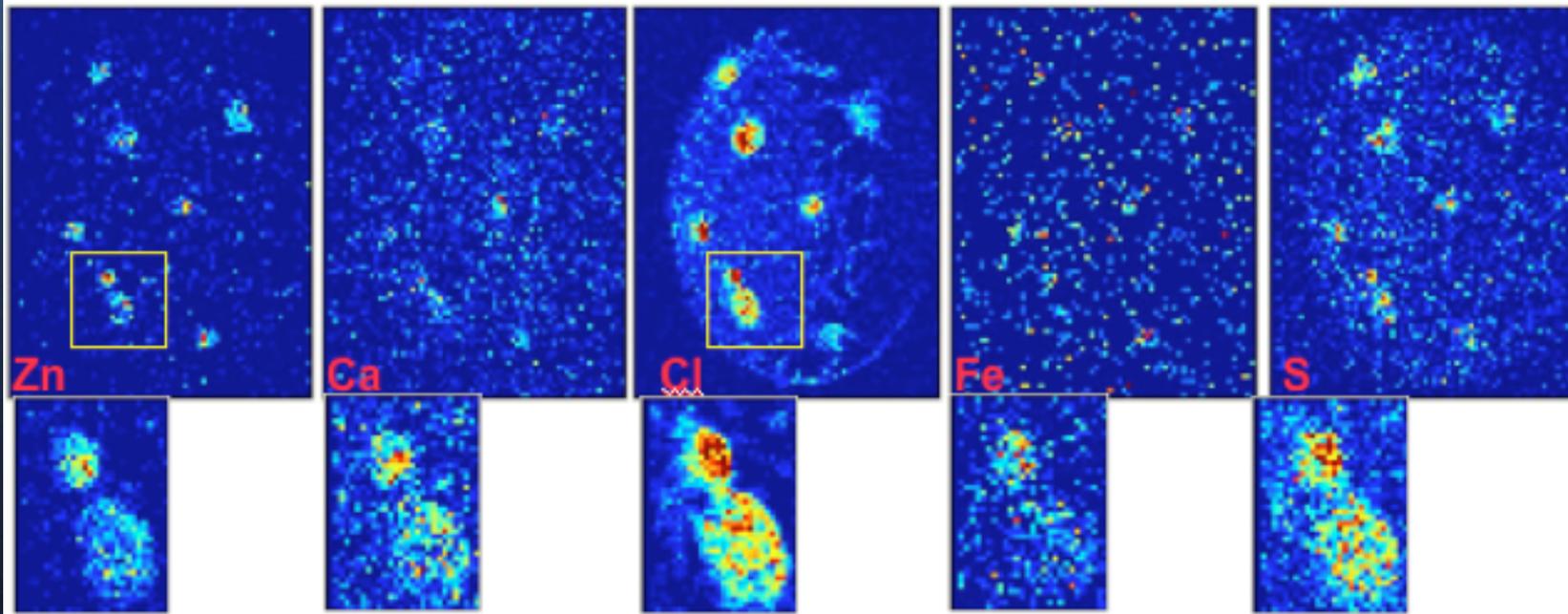
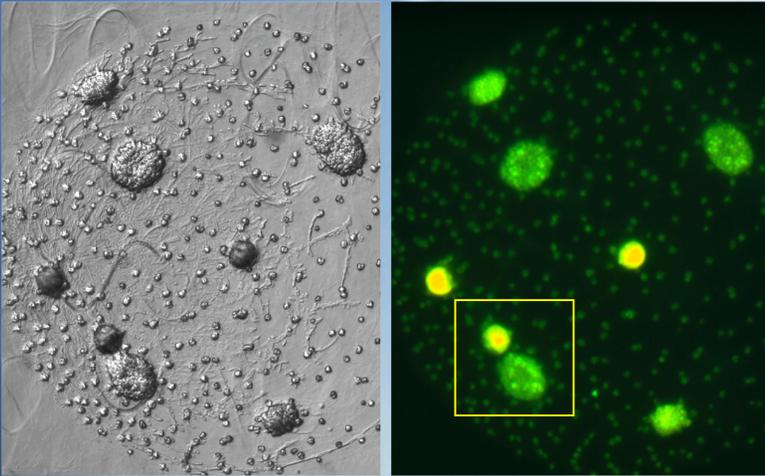


... and the accumulation of iron in the alga Volvox carteri

Intracellular elemental changes in colonies exposed to lunar dust simulants



Relative elemental changes in spores vs gonidia

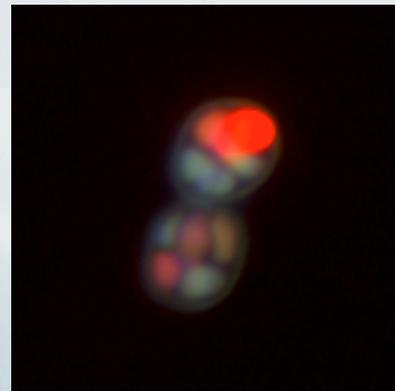
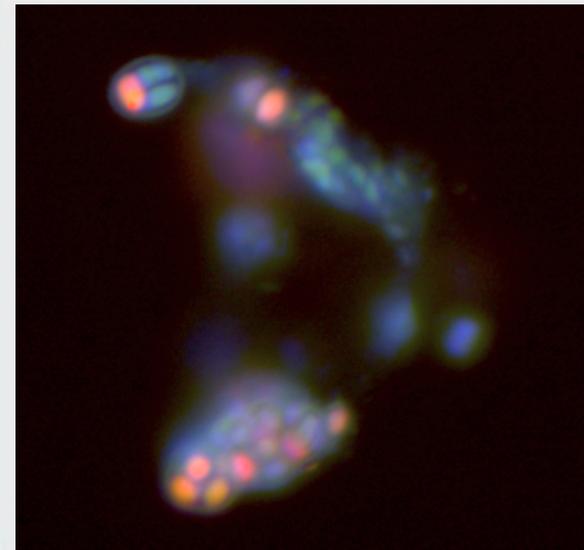
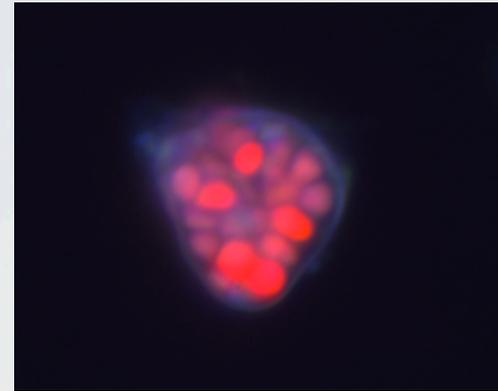
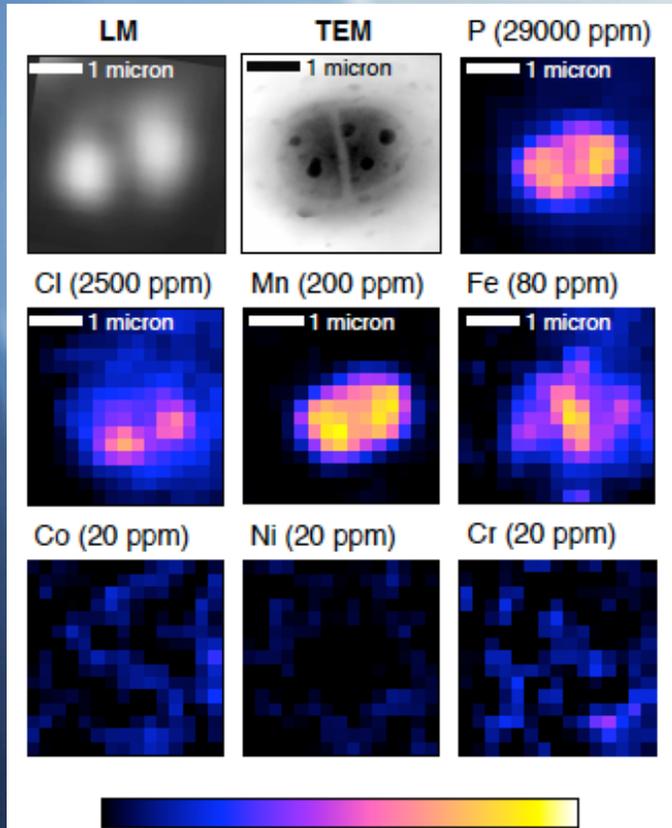


2µm res.

0.5µm res.

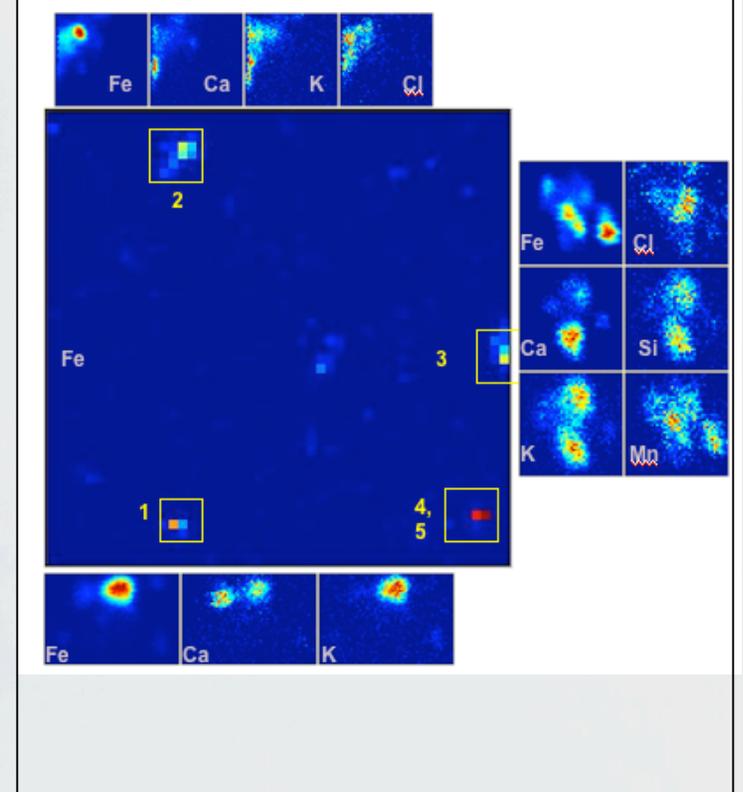
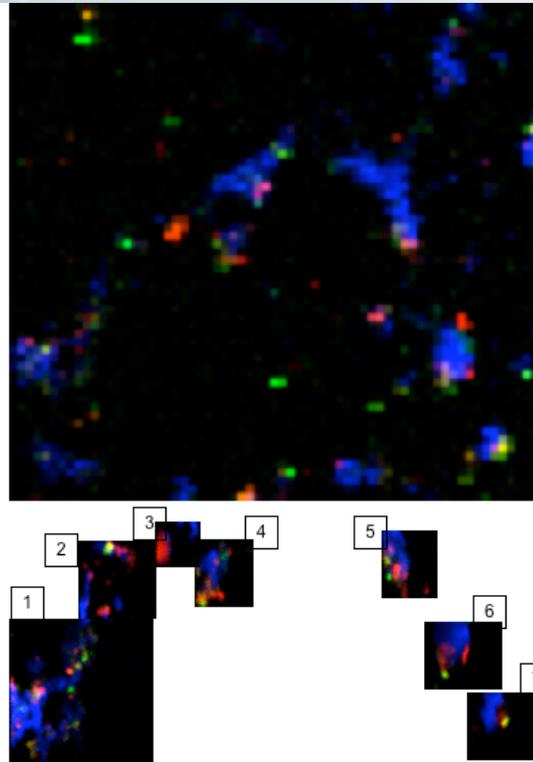
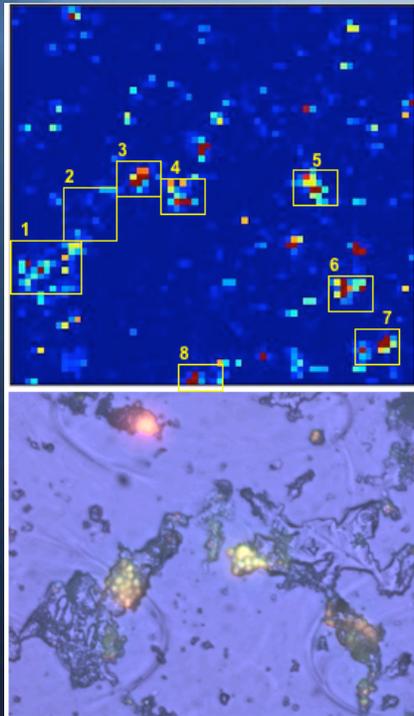
- Spores are - desiccation resistant**
- temperature resistant**
- UV resistant**

Metals for radiation and desiccation resistance



M.Daly et al, Protein Oxidation Implicated as the Primary Determinant of Bacterial Radioresistance, PLoS Biology 2007

Elemental fingerprinting of the halophilic bacterial population in Atacama salts



Dry

70% RH

Current working hypotheses:

- ***exposure to lunar (and Mars) simulants induces oxidative stress and the intracellular accumulation of metals***
- ***modulating the cellular redox balance is a strategy of response and adaptation to the environment (radiation, desiccation, planetary surfaces) = stress***
- ***the response is common to all cells, while survival depends on:***
 - ***genetic background***
 - ***physiology of the organism***
 - ***structure of the community (neighboring cells)***
 - ***adaptations***
- ***can really use the Moon as a stepping stone***

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