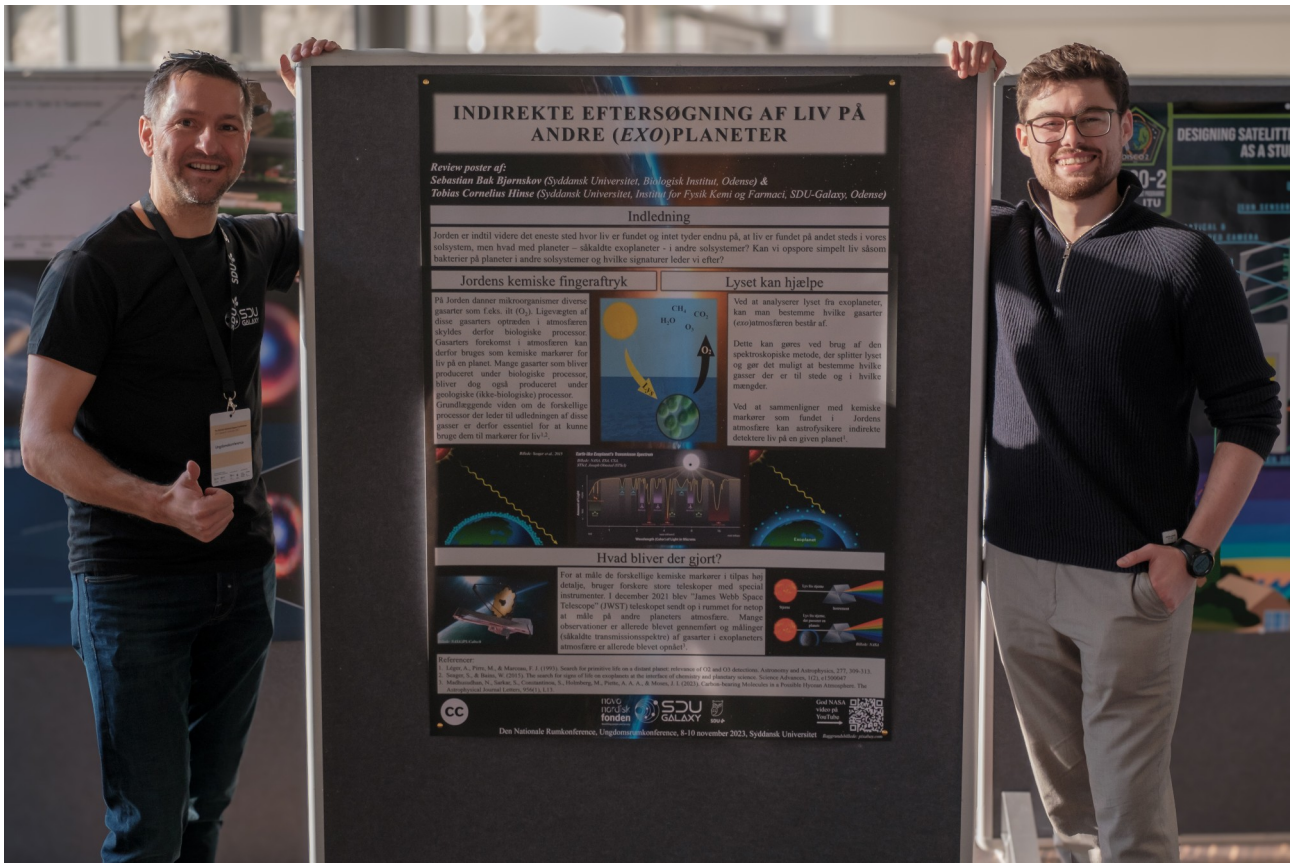
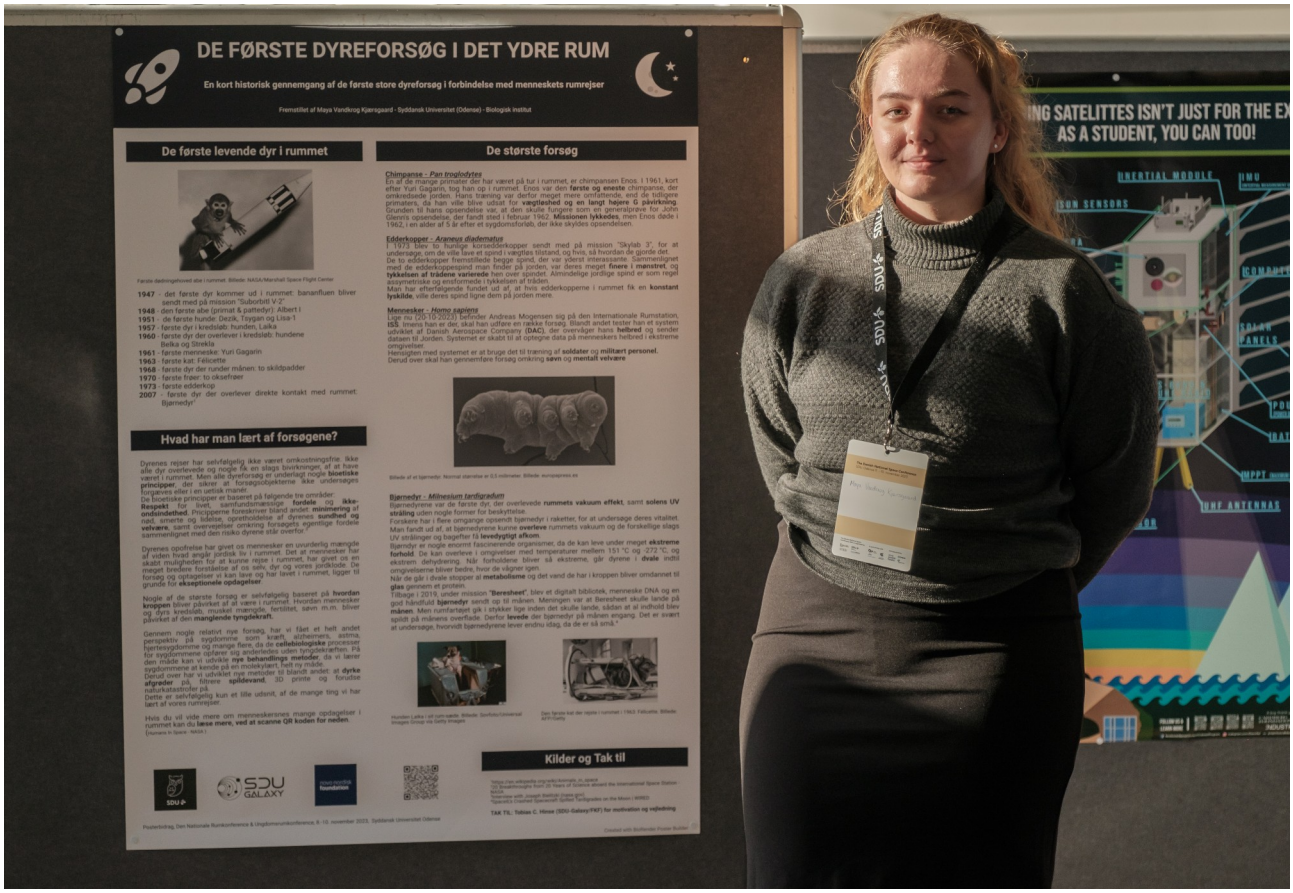
Astrobiologi Poster Projekt til nationale rumkonference 2023 på SDU

Art:	Citizen Science / STEAM communication
Sted:	SDU / Ungdomsrumkonferencen / Den nationale rumkonference
Skole:	SDU
Dato:	15. august 2023 - 10. november 2023
Tid:	n/a
Antal elever:	5
GDPR / pictures for public?	Yes. Permission obtained.
Lærerkontakt:	n/a
Formidler / supervisor:	Tobias C. Hinse (Syddansk Universitet, FKF / SDU-Galaxy).
Information:	I supervised a group of SDU biology students to create a review poster within the field of astrobiology. This resulted in 5/8 students participating in the danish national youth space conference and national space conference on various topics relating space science with biology. Posters are part of science communication and some of them are uploaded to zenodo.

Missing from the group pictures is Jaspur Ellingsgaard (Poster title: ”Iron reduction as a viable metabolic pathway in Enceladus’ ocean (Roche et al. 2023)”).


Metabolomic Analysis of Aspergillus Niger Fungi Isolated From the International Space Station
A review poster by Amenah Ayyoub, University of Southern Denmark, Department of Biochemistry and Molecular Biology, Odense
Introduction
Many microbes present in spacecraft pose a risk to the health of astronauts. The radiation and microgravity that characterize space travel increase the likelihood of contracting infections. It is crucial to research various kinds of bacteria, including fungus, on the International Space Station (ISS) due to the astronauts' health.
On the ISS fungus called Aspergillus niger (A. niger) was found. These fungi produce secondary metabolites (SMs) called naphtho-γ-pyrones with biological properties like antimicrobial and antioxidant activities. These fungi are also widely used in the biotech industry to produce enzymes.
Researchers have taken the strain called JSC-093350089 found on the ISS and compared it to a laboratory strain of the same fungi called ATCC 1015. They've discovered that the ISS strain produces higher levels of therapeutically relevant SMs like the oxidant Pyranonigrin A than the ATCC 1015 strain. To understand why this is, they looked at the genetic differences between these two strains and examined whether Pyranonigrin A could protect against UV radiation.
Method and Results
Discussion
DESIGNING SATE
AS A
SDU GALAXY
Amenah Ayyoub


INDIREKTE EFTERSØGNING AF LIV PÅ ANDRE (EXO)PLANETER
Review poster af:
Sebastian Bak Bjørnskov (Syddansk Universitet, Biologisk Institut, Odense) &
Tobias Cornelius Hinse (Syddansk Universitet, Institut for Fysik Kemi og Farmaci, SDU-Galaxy, Odense)
Indledning
Jordens kemiske fingeraftryk
Lyset kan hjælpe
Hvad bliver der gjort?
Referencer:
Den Nationale Rumkonference, Ungdomsrumkonference, 8-10 november 2023, Syddansk Universitet
DESIGNING SATELITT
AS A STU

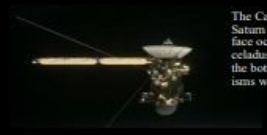

DE FØRSTE DYREFORSØG I DET YDRE RUM
En kort historisk gennemgang af de første store dyreforsøg i forbindelse med menneskets rumrejser
De første levende dyr i rummet
De største forsøg
Hvad har man lært af forsøgene?
Kilder og Tak til
NG SATELLITTES ISN'T JUST FOR THE EX
AS A STUDENT, YOU CAN TOO!


SDU GALAXY
GalaxyRover
SIEMENS
DE FØRSTE DYREFORSØG I DET YDRE RUM

"Iron reduction as a viable metabolic pathway in Enceladus' ocean" (Roche *et al.* 2023)

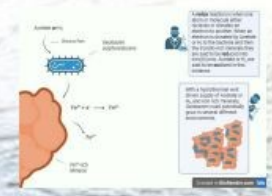
A review. Can we detect microbial-biological activity on Saturn's moon Enceladus?

By Jaspur Ellingsgaard, Biologisk Institut, SDU.



The Cassini mission (1997 - 2017) which explored Saturn and its moons discovered evidence of a subsurface ocean below the icesheet covering the moon Enceladus. It is believed that hydrothermal vents exist on the bottom which could provide potential microorganisms with nutrients and iron-rich minerals.

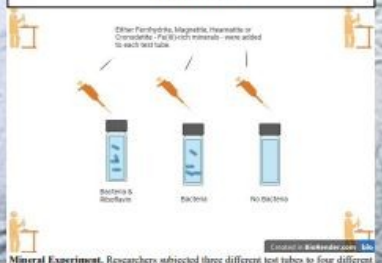
" [...] this work has added additional support for Enceladus as an astrobiological target in future missions, missions which could aim to detect iron in Enceladus' plumes [...] " (Roche *et al.*, 2023).



Hydrothermal vents are geysers located on the bottom of oceans which discharge vapor-heated water from inside the crust in to the ocean above - water which is rich in carbon and hydrogen (H_2), iron-rich minerals, and other essential nutrients for life. As a part of its metabolism, the bacteria, *Geobacter sulphureducens*, receives an electron (e-) from either Acetate (a carbon rich molecule) or hydrogen gas. With the help of metabolic processes inside the bacteria, the electron is ultimately delivered to an iron-rich mineral outside of the cell as *G. sulphureducens* cannot store iron inside of it. This provides the bacteria with energy.

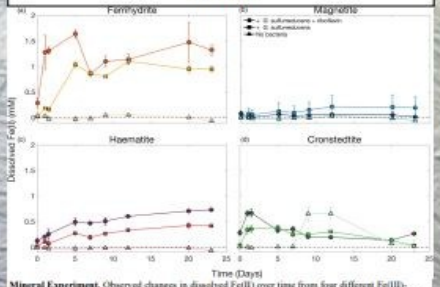
There are, generally speaking, two different oxidative states which iron exists as: Iron(III) and iron(II) and in chemistry these are denoted Fe^{3+} and Fe^{2+} respectively, where the numbers tell us about the charge the atom. When the negatively charged electron from the bacteria is donated to the positively charged Fe^{3+} its charge is reduced to Fe^{2+} - the iron has been reduced in a redox reaction.

Methods

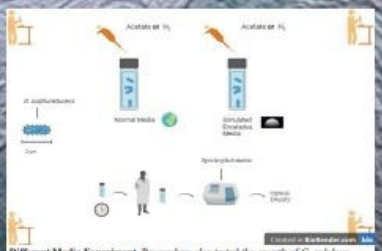


Mineral Experiment. Researchers subjected three different test tubes to four different Fe(III)-rich minerals. One test tube contained bacteria using riboflavin as an electron shuttle. The second test tube contained only bacteria, and the third contained no bacteria or iron reducing elements. The minerals were fernihydrite, magnetite, haematite and cronstedtite - all minerals thought to be present on Enceladus.

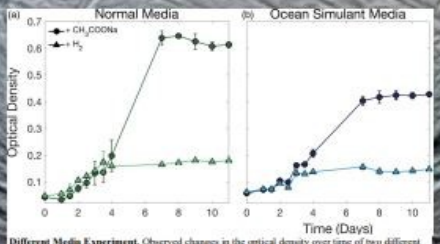
Results



Mineral Experiment. Observed changes in dissolved Fe(II) over time from four different Fe(III)-bearing minerals at neutral pH (pH 7), with the presence of iron-reducing bacteria and riboflavin as an electron shuttle. Figures (a-d) represent the minerals fernihydrite, magnetite, haematite and cronstedtite, Respectively. These minerals are thought to be present on Enceladus. Error bars indicate standard deviation from the mean. (Roche *et al.*, 2023)



Different Media Experiment. Researchers also tested the growth of *G. sulphureducens* by measuring the optical density of the sample in either an Earth-like environment media or an Enceladus-like environment media. Acetate or H_2 was added, time was allowed to pass, and the optical density was periodically measured by a spectrophotometer (Roche *et al.*, 2023).



Different Media Experiment. Observed changes in the optical density over time of two different solutions inoculated with bacteria: normal basal medium (a) and Enceladus ocean simulant (b) with either Acetate or hydrogen as electron donors. The bacteria preferred Acetate over hydrogen and showed growth in the Enceladus-like media, however the growth was lower compared to the Earth-like media. Error bars indicate the standard deviation from the mean (Roche *et al.*, 2023).

Take-Home Message - A vent driven supply of Acetate and H_2 could sustain iron reducing bacteria under Enceladus' subsurface ocean conditions. In spite of *Geobacter sulphureducens* being a poor candidate for this type research it nonetheless survived and grew under the simulated extraterrestrial environment of Enceladus. Future studies should focus on finding an alkaliphilic, and halophilic species better suited for the Enceladus environment.

A special thank you to NovoNordisk Fonden who funded this event. And to SDU and Prof. Tobias Cornelius Hasse for giving up-and-comers an opportunity to cut their teeth in publishing.

Roche, M., Fox-Powell, M., Hamp, R., & Byrne, J. (2023). Iron reduction as a viable metabolic pathway in Enceladus' ocean. *International Journal of Astrobiology*, 22(5), 539-558.

Background Image Credit: NASA/JPL-Caltech