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STAR-MAPPING WITH SLIME MOLD PHYSARUM POLYCEPHALUM

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Introduction: Human curiosity and exploration towards outer space has led to many fantastic inventions and given way to alternative scenarios about the origins of life. In the Space Science in the Arts course together with ESTEC with support from ILEWG. I got interested about unicellular slime mold *Physarum polycephalum.*

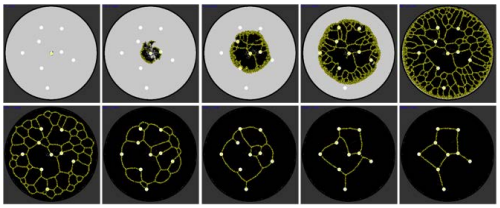
There has been and still is a lot of research on *Physarum polycephalum*. This brainless eucaryotic microbe has its smartness and external memory strategies. *Physarum* can navigate through a maze made of agar using the shortest route possible when two pieces of food are placed at two separate exits of the maze. It can build efficient networks - *Physarum* created network similar to the existing Tokyo train system. It is being used to control a robot, in USB-sensor and in sound synthesis. Right now there is a lot of research about using Physarum in bio-computing.

Beginning of the project: I obtained a sclerotium of Physarum polycephalum from Nenad Popov, who worked with slime molds for his master thesis and visualized its inner chemical reactions in real time. Contacted Jutta Krause (ESTEC) and Rob Zwijnenberg (Arts and Genomics Centre). I put a a sclerotium on moisturized paper towel on a petri dish and some oat flakes near the plasmodium and it started to grow a network. I was curious what small systems (slime mold) could tell about ungraspable systems (space) and if *Physarum polycephalum* might create its own map of star constellations and show some hidden knowledge about the universe.

I introduced the stars of Cassiopeia to the slime mold to find new connections, skyways *Physarum* would build between them. It used its language of effectiveness to interpret unintelligible space. I saw it as a way of communicating with *Physarum polycephalum*.

Results: The images (1; 2) below show the growth patterns of *Physarum polycephalum* and last one (3) shows the results of a research of Jeff Jones.

1. *Physarum polycephalum* translating Cassiopeia



2. Wave-like network growth in nutrient-rich substrate

Development and perspective: What happens if Physarum polycephalum would live in microgravity conditions (in space station)? Would it adapt to the new environment and grow three-dimensional networks? It's particularly interesting because of the fact that there is not many experiments with fungi in space (in that case scientists are usually keen about the results (before and after effects of the microgravity), not the process). I would like to find out, what happens in between the process, what the morphology could tell us. It seems essential to possibly understand something about life, how life landed on Earth. Another direction could be sending the *Physarum polycephalum* to populate an unknown planet, sending it to a space odyssey.

Next steps could be:
- experimenting with *Physarum polycephalum* growing on 3D-structures (on endless forms, bowl/sphere/little globe)

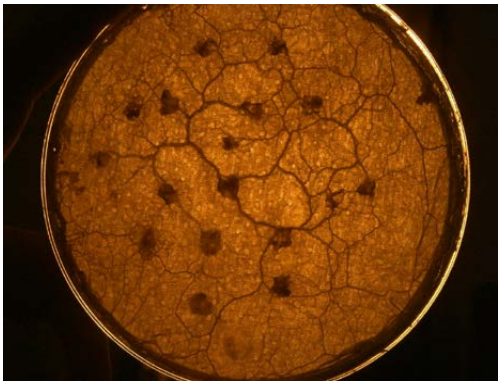
- finding out if centrifuge (testing it in Large Diameter Centrifuge in ESTEC) infrared, sound would affect the growth patterns.

The outcome of the project could be:
- an installation:

a) projecting star maps/constellations/cluster galaxies on top of the actual growth patterns of *Physarum polycephalum*
b) mapping (possibly real-time) and comparing (using video-projection and graphic lines to draw the journey) *Physarum*'s effective system of finding food and my own chaotic movements while making decisions in an unknown city.
- a performance:
slowing time down to *Physarum polycephalum*'s pace and creating a space to breathe, to show what's happening with my breath and blood-vessel-system (or nervous system, *Physarum* is similar to nerve cell) and creating a dialogue with the *Physarum*'s growth. Creating an understanding about our cells and how we are alive.
- a static art-piece:
different ways to understand and speak and listen to *Physarum polycephalum*, stop-motion of it growing in three-dimensional objects, choreographing it, using microscopic images)

- sending *Physarum polycephalum* to space, making experiments in Large Diameter Centrifuge in ESTEC. Already had a contact with Jutta Krause, astrobiologist in ESTEC to probably make my experiment in "Spin Your Thesis" programme.

Summary: I would continue my research and trying to have contacts with different scientists and artists who have worked with *Physarum polycephalum*.
In the end of January I'm participating in Bio-LOGIC workshop "Living Structures and Swarm Bodies" where we are growing *Physarum* on designed structures using hacked 3D printer for organic material.



3. *Physarum polycephalum*'s growth pattern

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[2] Jeff Jones (2010) *Complex Adaptive Behaviour is Mediated by Environmental Interactions in Particle Approximations of Physarum polycephalum*.

[3] E. R. Miranda, A. Adamatzky, J. Jones (2011) *Sounds Synthesis with Slime Mould of Physarum Polycephalum, Journal of Bionic Engineering, p. 107-113*

[4] Emily Singer (2013) *In Natural Networks, Strength in Loops, Quanta Magazine*

[5] Laura Sanders (2010) *Slime Mold ; Grows Network ; Just Like Tokyo ; Rail System*