

# DO-IT-YOURSELF science in the Covid-19 times

## Personal perspective and motivation:

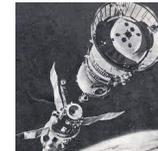
Excellent teachers changed my life. Vláďa Čápek showed me in the Charles University, Praha the power and beauty of physics and Ivan Šetlík in the Institute of Microbiology in Třeboň gave me the freedom to improvise in biology using tools of physics. The most valuable lesson from Ivan was not to surrender even in unfavorable conditions. He himself made it together with his colleagues Štěpán Kubín, Dan Bartoš, Jiří Doucha, Vilém Zachleder and others against all odds, with minimal resources, and in an incredibly short time. They introduced the later US-patented thin layer algal biotechnology, send the first algal cultures to the space station Mir and much more. Another important element in this were excellent handworkers, such as Mr. Zemánek and his colleagues in the Institute's workshop who taught me the elemental handworker skills.



**United States Patent** [19]  
**Doucha et al.**

[11] **Patent Number:** 5,981,271  
[45] **Date of Patent:** \*Nov. 9, 1999

[54] **PROCESS OF OUTDOOR THIN-LAYER CULTIVATION OF MICROALGAE AND BLUE-GREEN ALGAE AND BIOREACTOR FOR PERFORMING THE PROCESS** 5,541,056 7/1996 Huntley et al. .... 435/292.1  
FOREIGN PATENT DOCUMENTS  
279579 5/1995 Czech Rep. .  
278213 6/1993 Czechoslovakia .  
[75] Inventors: **Jiri Doucha**, Trebon; **Karel Livansky**, 2596412 10/1987 France ..... 435/292.1  
Ceska republika, both of Czech Rep. 5-284958 11/1993 Japan ..... 435/292.1  
2118572 11/1983 United Kingdom ..... 435/292.1  
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Life Sciences and Space Research

Proceedings of the Open Meeting of the Working Group on Space Biology of the Twenty-Second Plenary Meeting of COSPAR, Bangalore, India, 29 May-9 June 1979

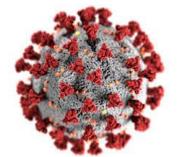


1980, Pages 199-204

BIOLOGICAL STUDIES OF *CHLORELLA PYRENOIDOSA* (STRAIN LARG-1) CULTURES GROWN UNDER SPACE FLIGHT CONDITIONS

V.A. Kordyum \*, E.Ya. Shepelev \*\*\*, G.I. Meleshko \*\*\*, I. Setlik \*\*\*\*\*, E.L. Kordyum \*\*, K.M. Sytnik \*\*, A.L. Mashinsky \*, A.F. Popova \*\*, N.P. Dubinin \*\*\*\*\*, E.N. Vaulina \*\*\*\*\*, L.V. Polivoda \*

WORKING HYPOTHESIS: One can do excellent science in a Do-It-Yourself way even in our Covid-19 times.



# TOPIC: Sky is the limit: Planetary boundary approached by DIY

The thin layer technology developed in the 60's in Třeboň by Ivan Šetlík et al. reached monthly average areal productivity of up to 30 g(dw)/m<sup>2</sup>.day with Chlorella/Scenedesmus suspensions.

Would the similar, but much cheaper Algae Turf Scrubber be producing the same or more?  
Can one test it at home (Covid) aiming at a construction shorter than one day & spending less than 500 €?

H e l i y o n



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## Expanded algal cultivation can reverse key planetary boundary transgressions

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**STEP 1: Saturday morning action started by identifying even and sun-exposed place in the garden. Sun was still largely behind the surrounding roofs.**



## STEP 2: Let's first enjoy the morning...



## STEP 3: No rush.



**STEP 4: After the good cup of cappuccino and müsli (included in the project costs), let's see what we brought yesterday from an unnamed Baumarkt in Budweis.**



**STEP 5: In Czech this is “koza”, auf Deutsch “Arbeitsbock”. This one was not height-adjustable but inexpensive from <http://www.wolfcraft.com/>**



## STEP 6: ... and the second one.



**STEP 7: This I found in my garage from my previous projects.  
2 x 0.5 meter, 10 mm polycarbonate roofing sheet. Everywhere available.**



**STEP 8: If sloped to one side, small adjustments can be done by self-adhesive patches used, e.g., for chairs.**



## STEP 9: Looks good now.



## STEP 10: Let's cover the floway by substratum. Here, white none-woven fabric from beltzmann.cz, 2 x 1.5 meters. Layer 1.



## STEP 11: Layer 1 fastened by two woodcraft clamps.



## STEP 12: Layer 2, again fastened by clamps.



## STEP 13: Layer 3.



**STEP 14: The top of the none-woven fabric will be covered by 2 x 1 meter of sturdy fabric reinforcement 4 x 4 mm mesh.**



## STEP 15: Both substratum layers laid, covered, and clamped.



## STEP 15: Side view.



## STEP 16: Pond pump. Later it will turn out that this would better be stronger.



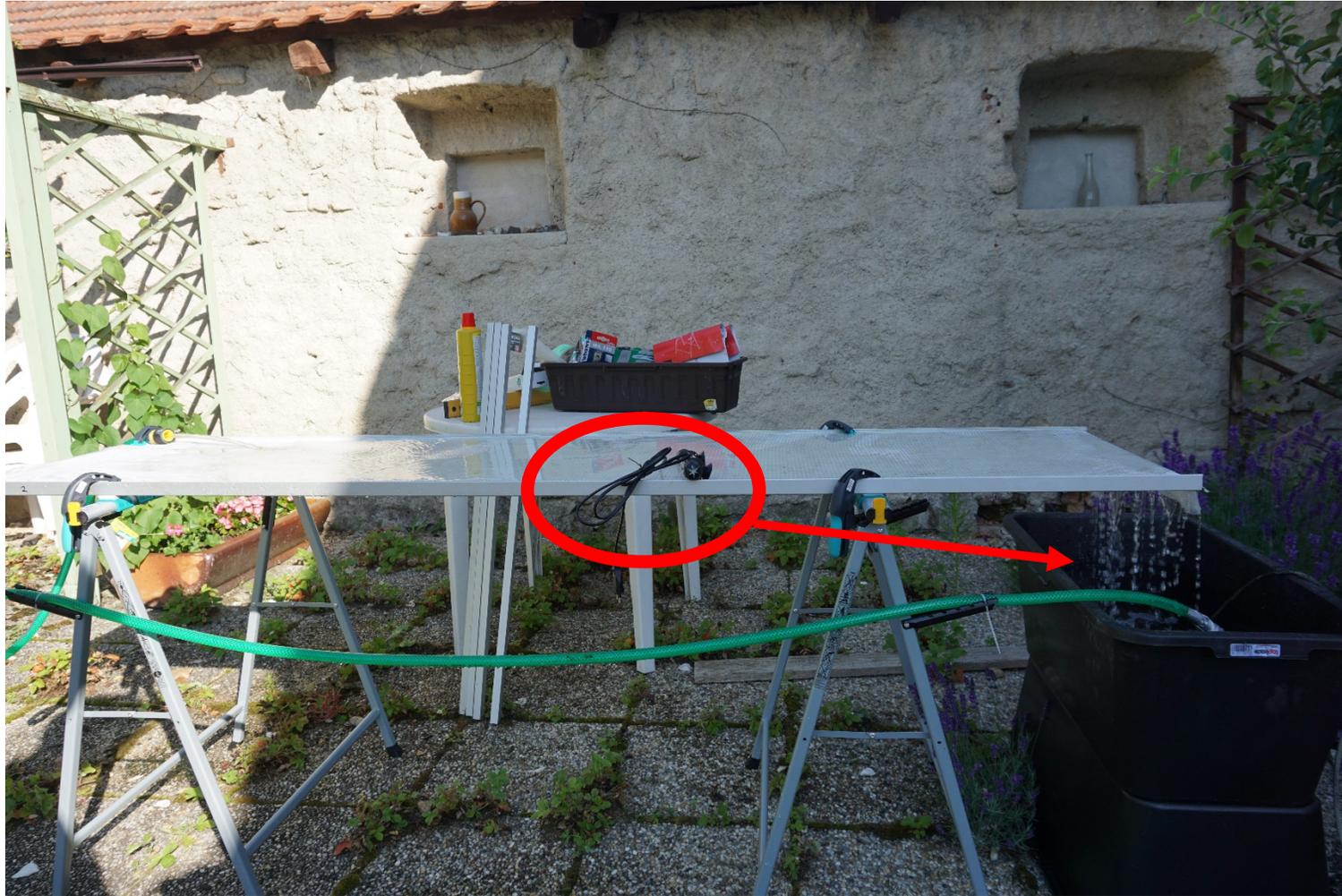
## STEP 17: The pond pump travelling to its place in the retention tank.



## STEP 18: Pond pump in the retention tank and hose attached.



## STEP 19: Heating element with a thermostat for temperature experiments.



## STEP 20: Pump with a timer for chemostat experiments.



**STEP 21: At this point a swinging bucket or other water pulsing device comes that is supposed to generate oscillating, turbulent water flow over the flowway. This may bring the benthic filaments of algae in motion, break the boundary layer around the cells and facilitate mass transfer of CO<sub>2</sub>, of O<sub>2</sub>, and of nutrients.**

**I choose to start by building 49 cm wide, 32 cm long and 16 high cage from 2 x 2 cm aluminium profiles using black plastic connectors that are available on the same baumarkt shelf.**

**For the first tests, I hanged on the cage upside down a gardening water sprinkler Kärcher RS 130-3 and connected it to the hose of the pond pump.**

**Other devices, such as swinging bucket or siphone can be tested later.**

**STEP 21: Aluminium scaffold cage with an inverted water sprinkler. This took another trip to a hardware store and as much 2 hours to build.**



**STEP 21: Toggle this and the previous slide to see the sprinkler rotation.**



# DIY Algae Turf Scrubber

Version 1.0: Covid-19 home office in Třeboň, July 2020

Water sprinkler

Floway

40 L thermostated retention tank and pond pump

Bucket with nutrients / bicarbonate for chemostat experiments



2 valve T-connector for rapid flushing/cleaning

**Suggestions for improving the ATS DIY design or cloning it and comparing it in different climatic conditions are most welcomed at [I.nedbal\(at\)fz-juelich.de](mailto:I.nedbal(at)fz-juelich.de). Thank you!**

**BTW: A DIY strawberry fertilization experiment already started at the foot of the scrubber:**

