

Řasy a sinice v polárních ekosystémech

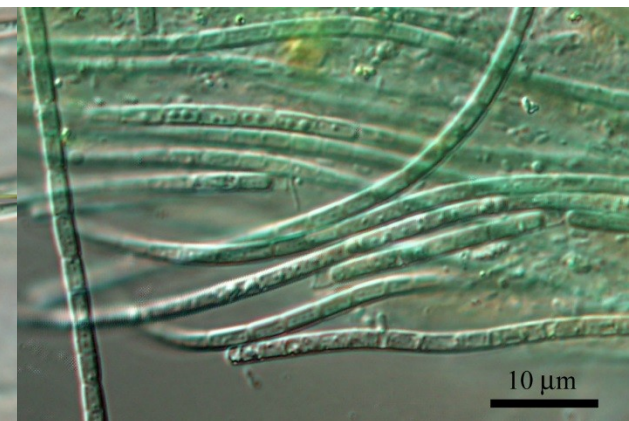
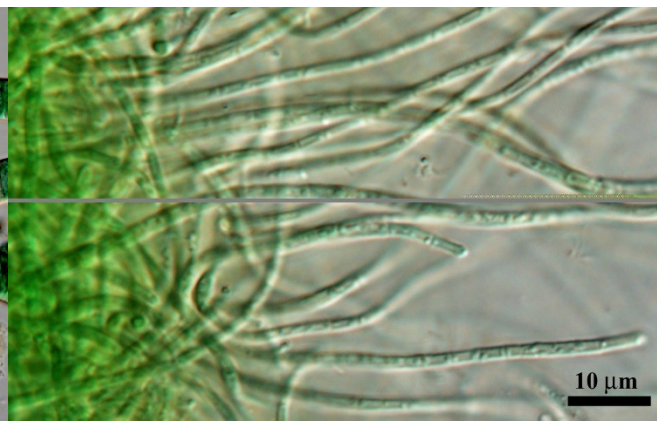
Sněžné řasy - Lecture 4

M. Barták, J. Kvíderová

Oddělení fyziologie rostlin PŘF MU v Brně

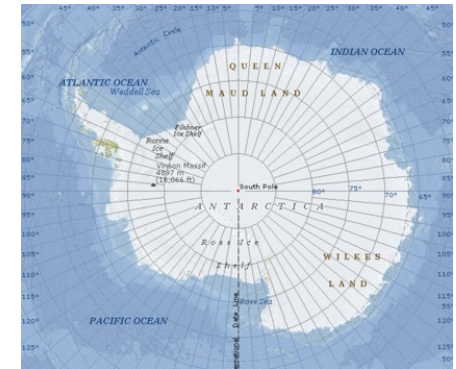


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➤ Severní ledový oceán

➤ vlhčí a teplejší –
propojenost s Atlantickým
oceánem, Golfský proud
až 250 mm srážek/rok

➤ rozsáhlá odledněná území

➤ 100 druhů vyšších rostlin

➤ Antarktický kontinent

➤ sušší a chladnější
Antarktický proud
0 mm srážek/rok (Ross
Desert), -88 C (stanice
Vostok)

➤ malá odledněná území

➤ 2 druhy vyšších rostlin
(*Deschampsia
antarctica* a
Colobanthus quitensis)

Typické ekosystémy

- Sněžné řasy
- Půdní řasy a sinice (povlaky, biofilmy)
- Tekoucí vody
- Mokřady
- Jezera a krátkodobé rezervoáry
- Trvale smáčené stěny
- Endolitická vegetace



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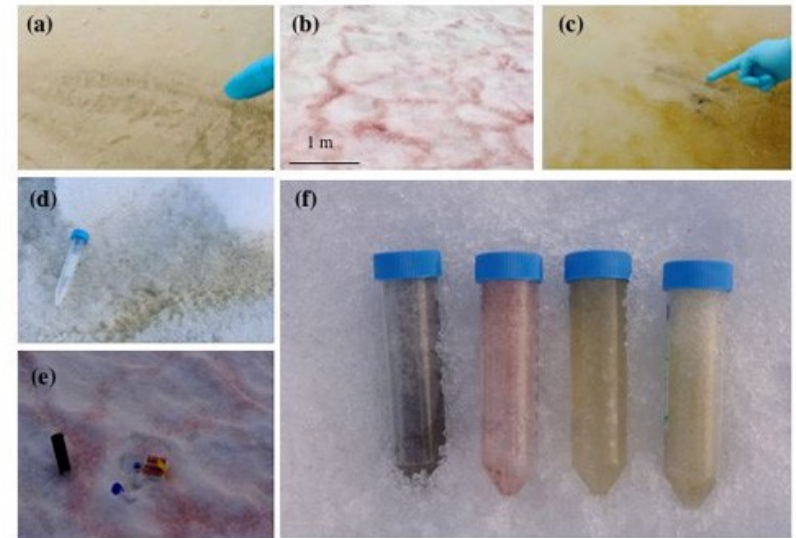
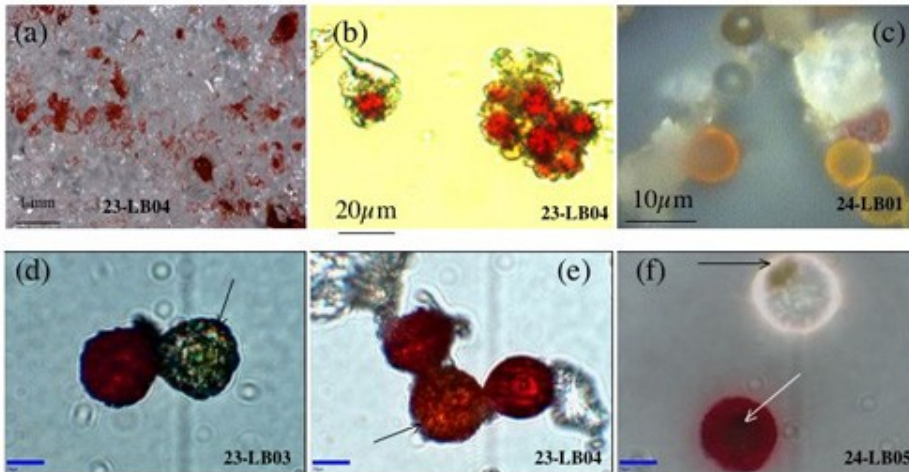




Sněžné řasy / Snow algae

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Variations in coloring of the snow algae samples: (a) high resolution photograph of brick-red snow algae sample area; (b) light microscopy of red cell cluster together with mineral dust; © mixed resting cells (red, yellow, orange, and clear) together with white mineral grains; image acquired with the Raman microscope just prior to analyses; (d) red and green (arrow) resting cells of *Chlamydomonas nivalis*; (e) red and orange resting cells with associated mineral grains; (f) red and light green /clear *Chlamydomonas nivalis* cells (arrows points to the position of chlorophyll in the green and red cell, respectively (see text); scale bars in © to (e) are all 10 µm.



Images of variously coloured snow algae sample sites with notations as shown in Table 1 and 2: (a) black algae: 23-LB03B; (b) dark brick red algae: 23-LB04; © yellow algae 24-LB02; (d) grey-black algae: 24-LB04 (e) dark red algae: 24-LB01; (f) centrifuge tubes with various algal samples. (Photos Storvik / AMASE 2005).

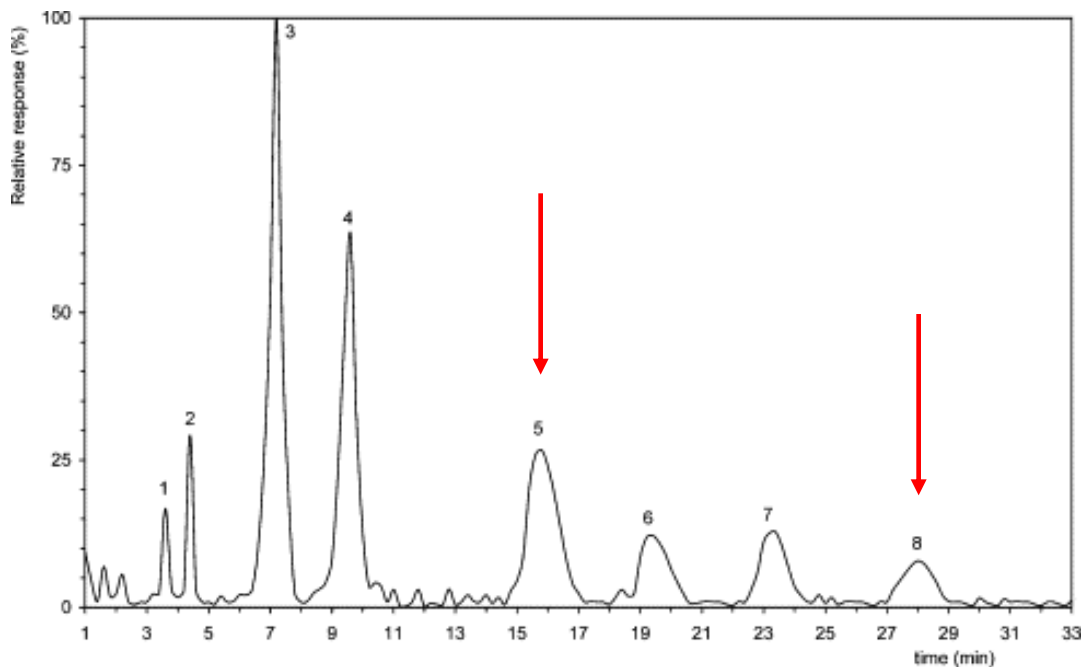
Source: <http://astrobiology2.arc.nasa.gov/nai/library-of-resources/annual-reports/2006/ciw/projects/project-6-molecular-and-isotopic-biosignatures/>

Preparative HPLC of total extract of carotenoids from *Chlamydomonas nivalis* collected in Austrian Alps,

- 1 (G-A-G),
- 2 (G-A),
- 3 (FA-G-A-G),
- 4 (FA-G-A-G-FA),
- 5 (xanthophylls),
- 6 (FA-A),
- 7 (FA-A-FA),
- 8 (carotenoid hydrocarbons).



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LC–MS/APCI identification of glucoside esters and diesters of astaxanthin from the snow alga *Chlamydomonas nivalis* including their optical stereoisomers

[Tomáš Řezanka](#)

[Linda Nedbalová](#)

[Irena Kolouchová](#)

[Karel Sigler](#)

A snow alga:
Chlamydomonas nivalis

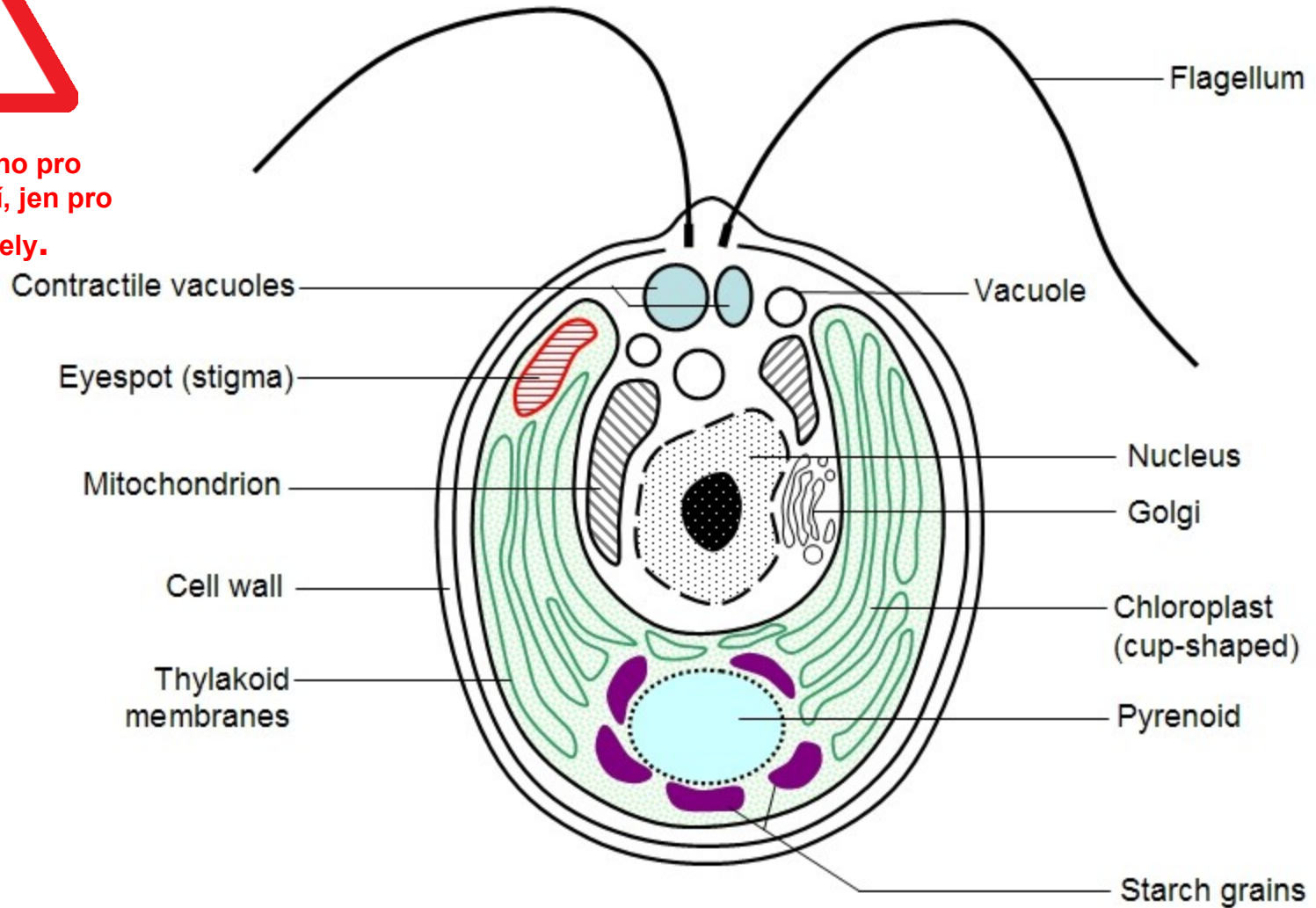


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Chlamydomonas



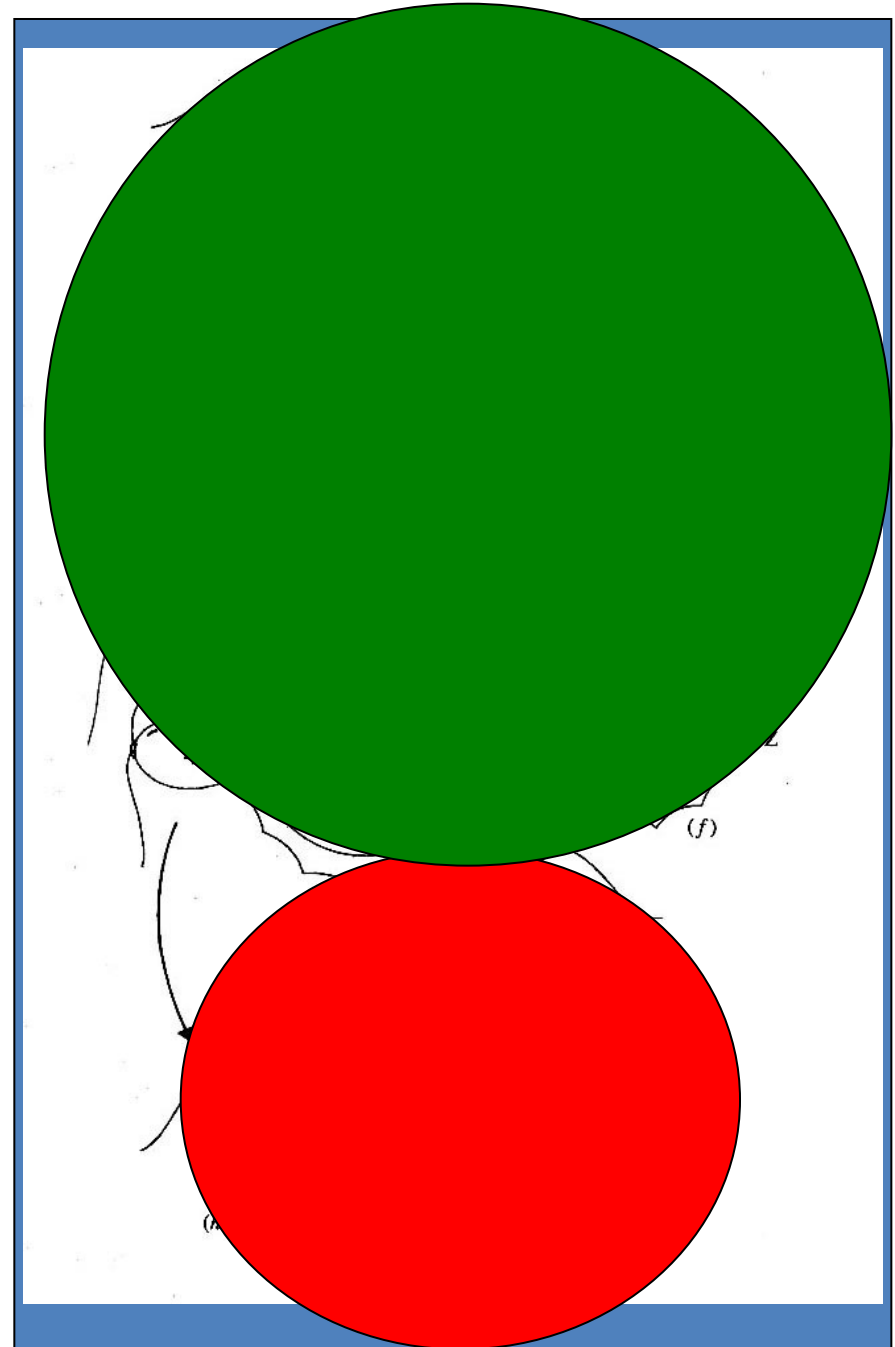
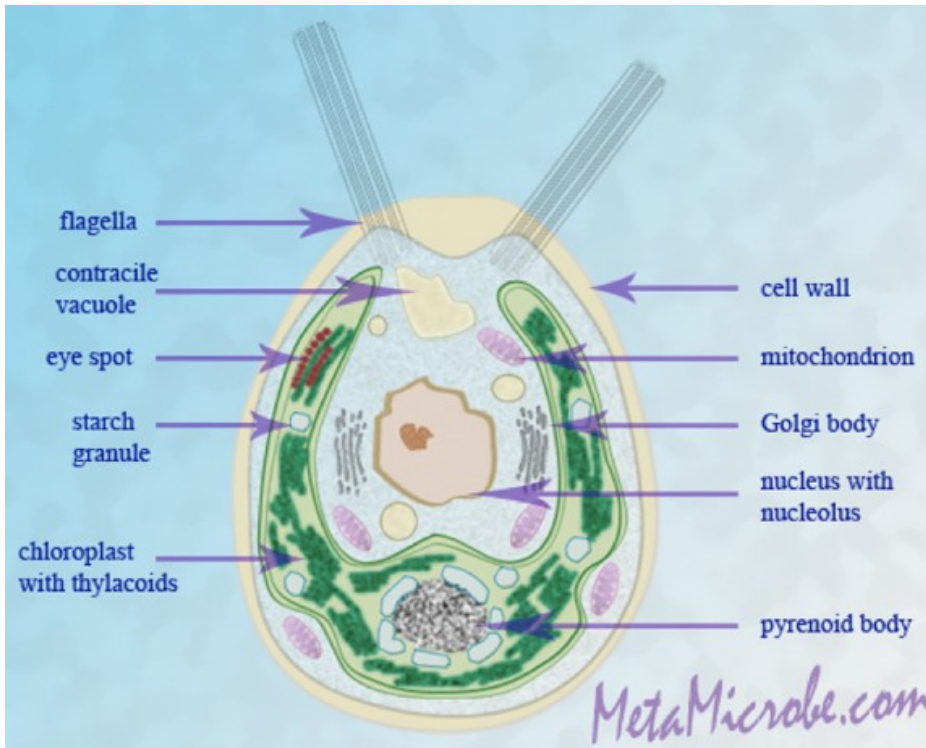
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Chlamydomonas nivalis

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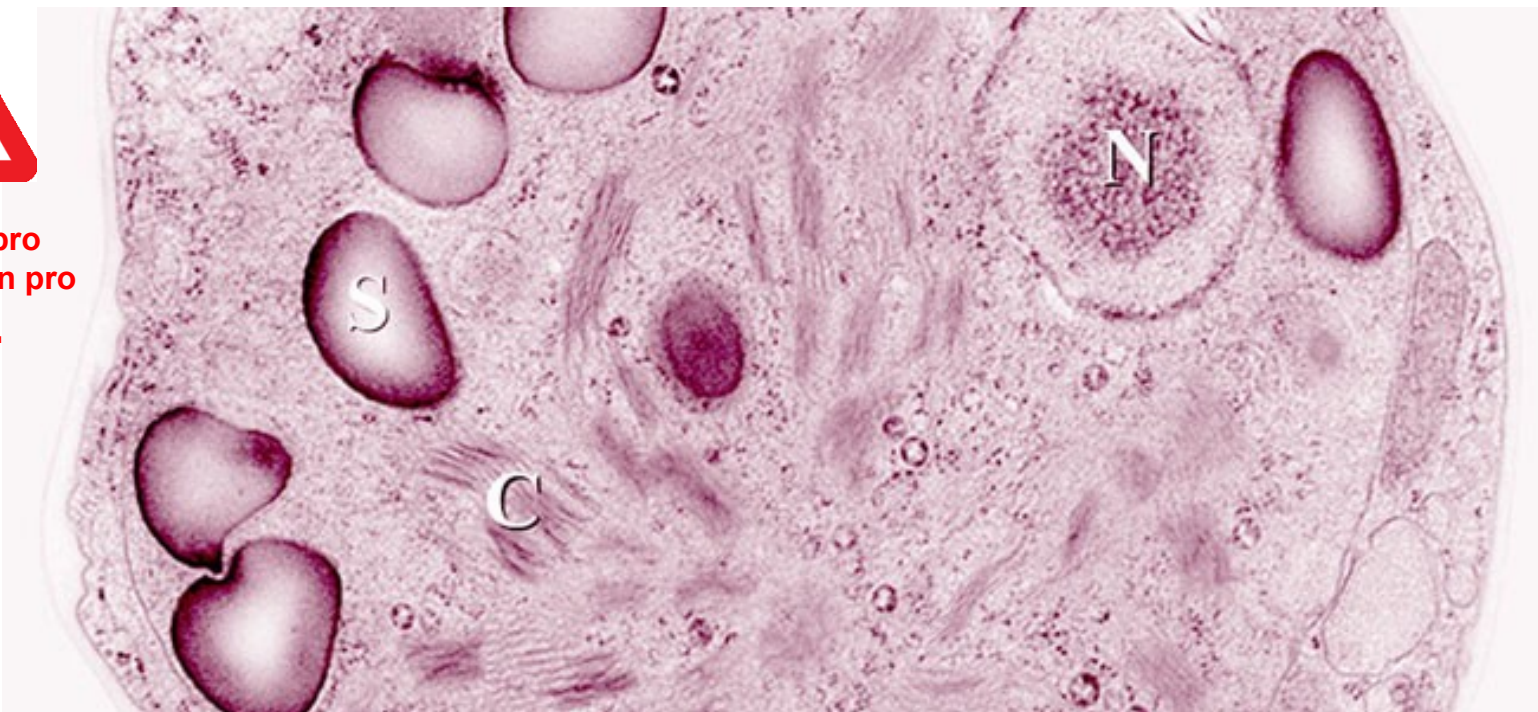


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- C = chloroplast
- S = starch grain
- N = nucleus



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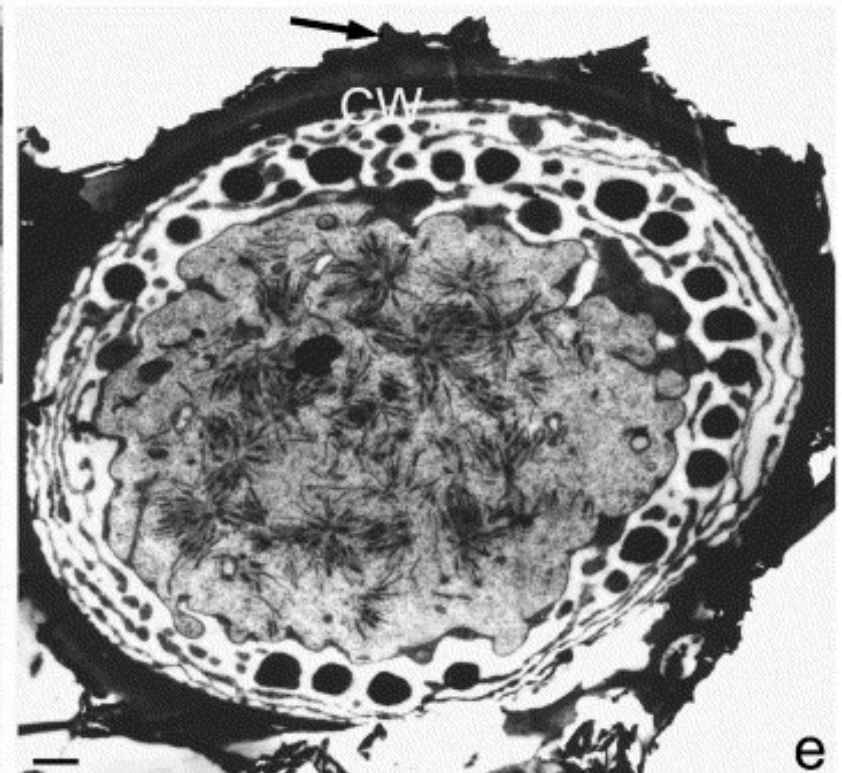
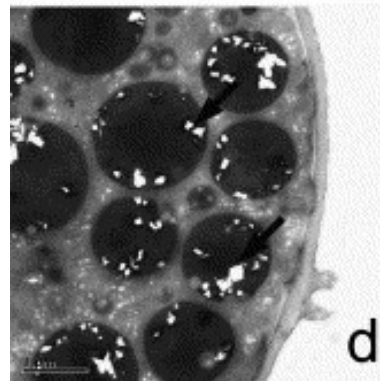
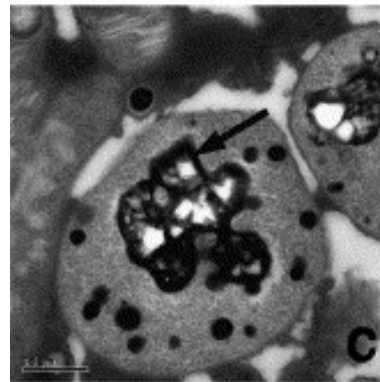
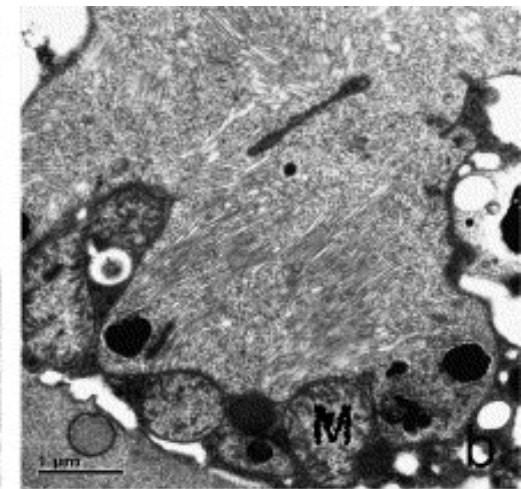
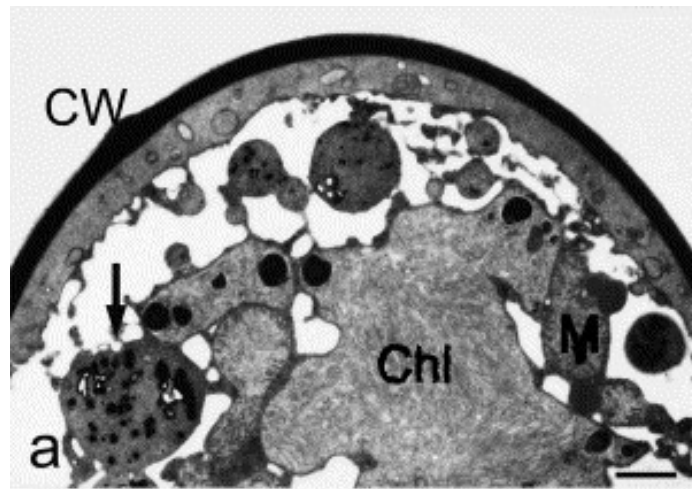
- Source: <http://www.asknature.org/strategy/5afcb0c36030f7f5767a27328f84c352>

Details of the ultrastructure of *C. nivalis* hypnoblasts collected in the Austrian Alps in Sölden 2700 m a.s.l. (a–d) or at Stubaier Gletscher 3000 m a.s.l. (e) A smooth surface of the cell wall (CW), globular structures in the cell cortex (arrow), central chloroplast (Chl), mitochondrion (M) (b) details of the chloroplast and surrounding mitochondria (M), (c–d) droplet structures with partially crystallized content (arrows), (e) cell wall (CW) covered with an substantial layer of inorganic particles (arrow). Samples fixed with high pressure freeze fixation, a–d substitution in 2% OsO₄ and 0.1% uranyl acetate in acetone, (d) with 1% OsO₄ including 1% A. dest in acetone. Bars (a–h). (d–e) 1 μm,

(c) 0.5 μm



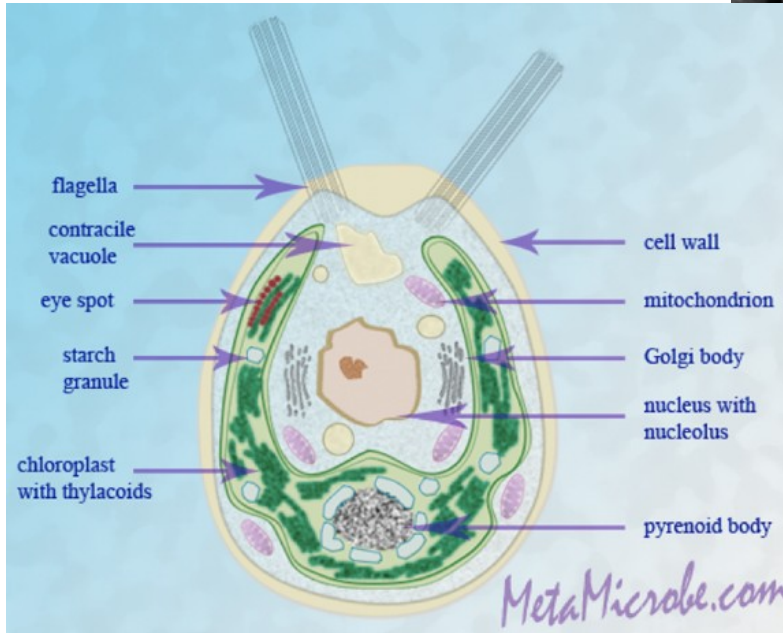
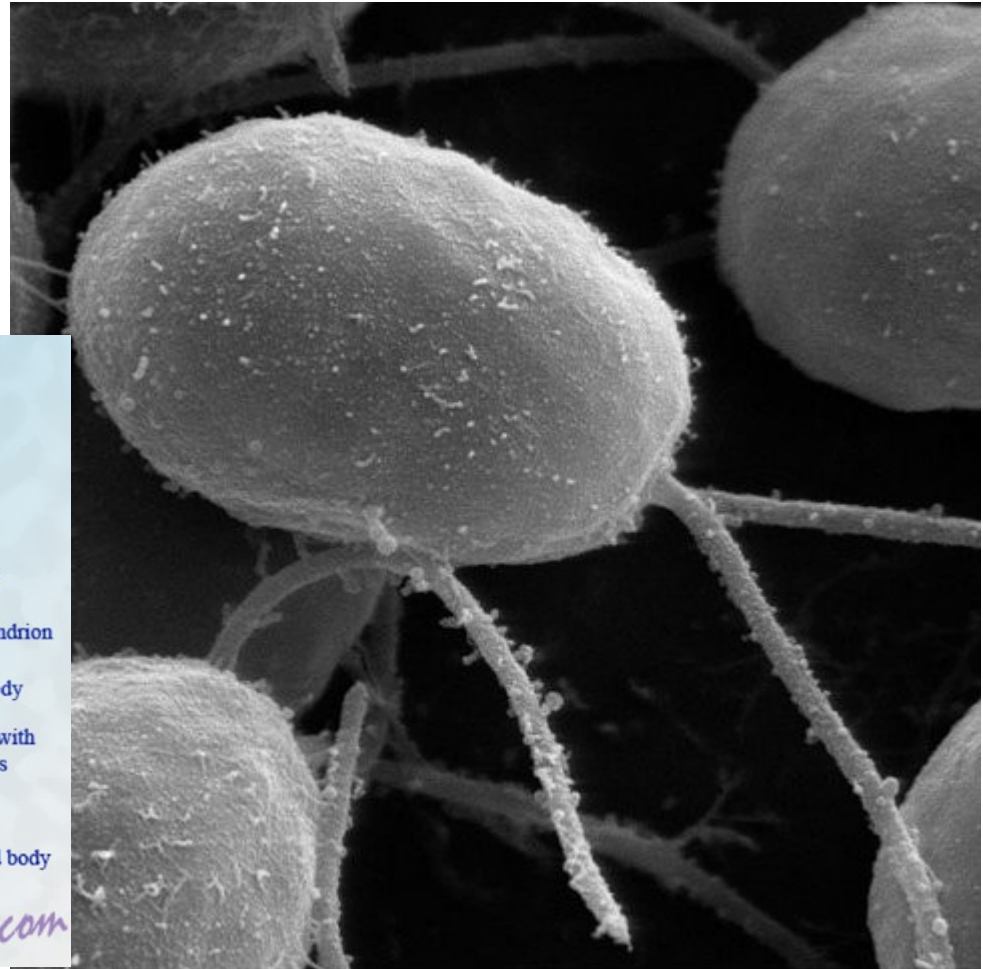
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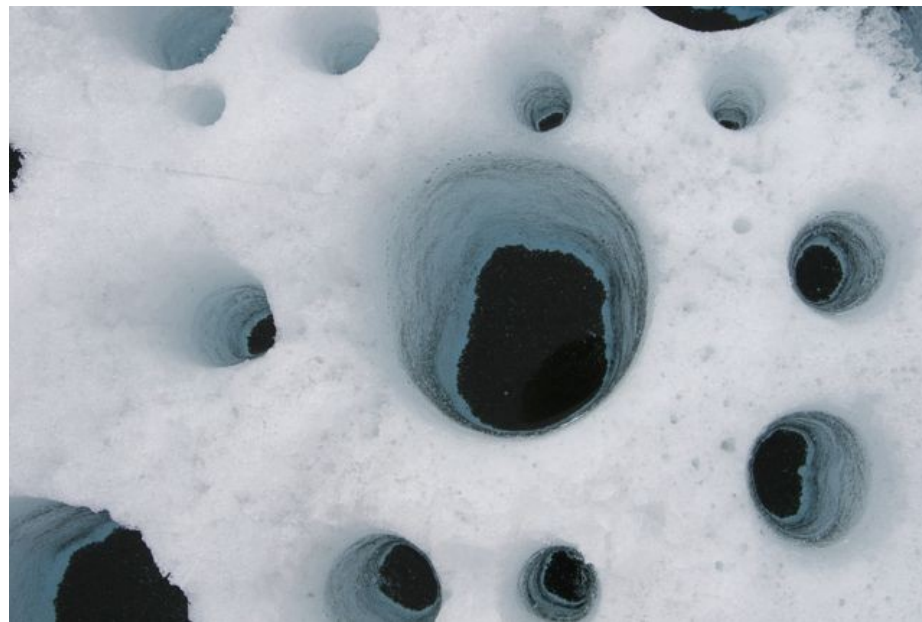
Chlamydomonas nivalis does possess two flagela





Cryoconites

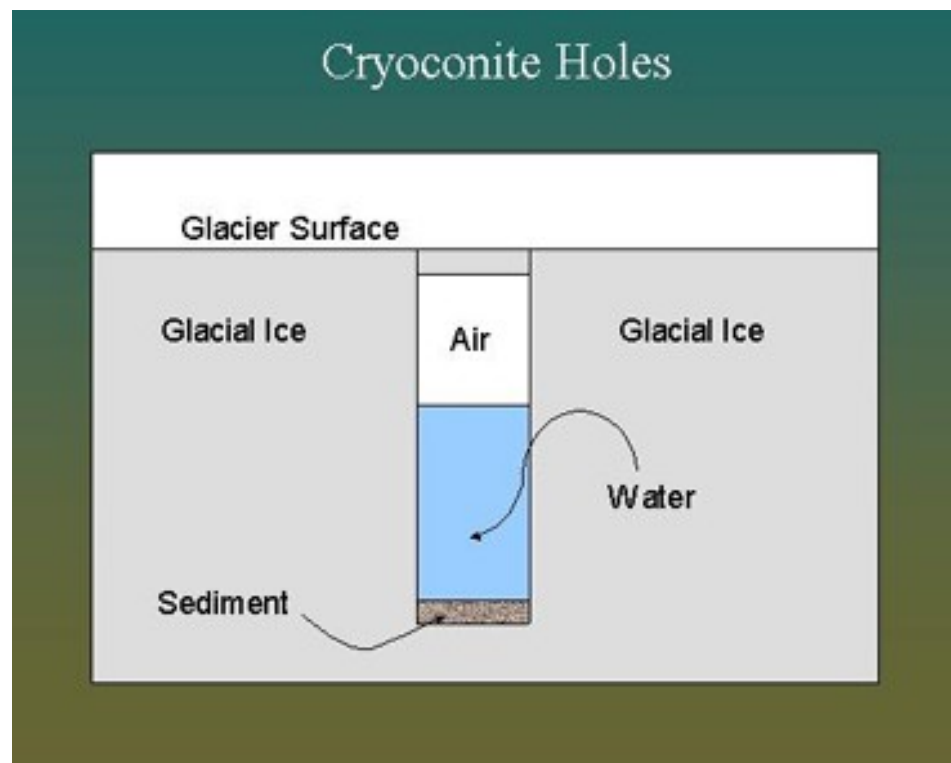
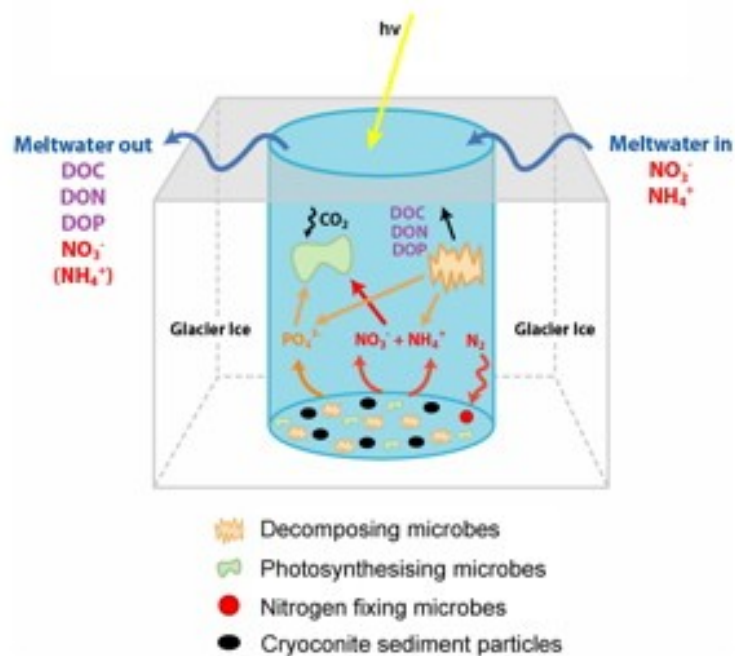
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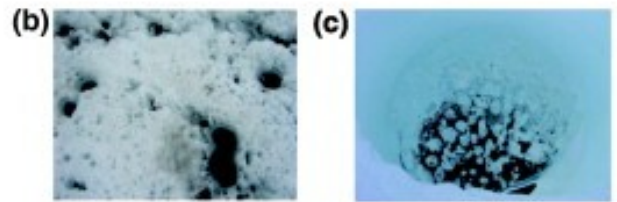
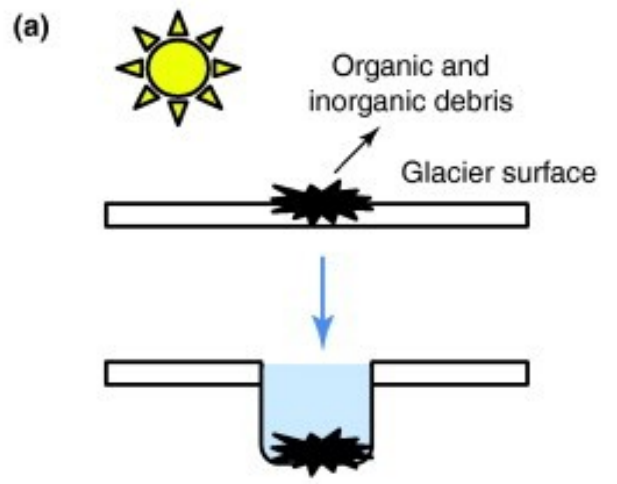
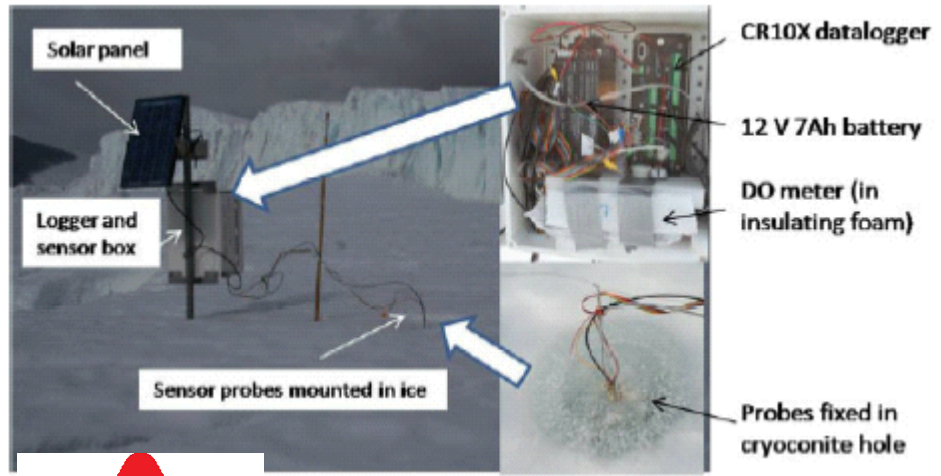
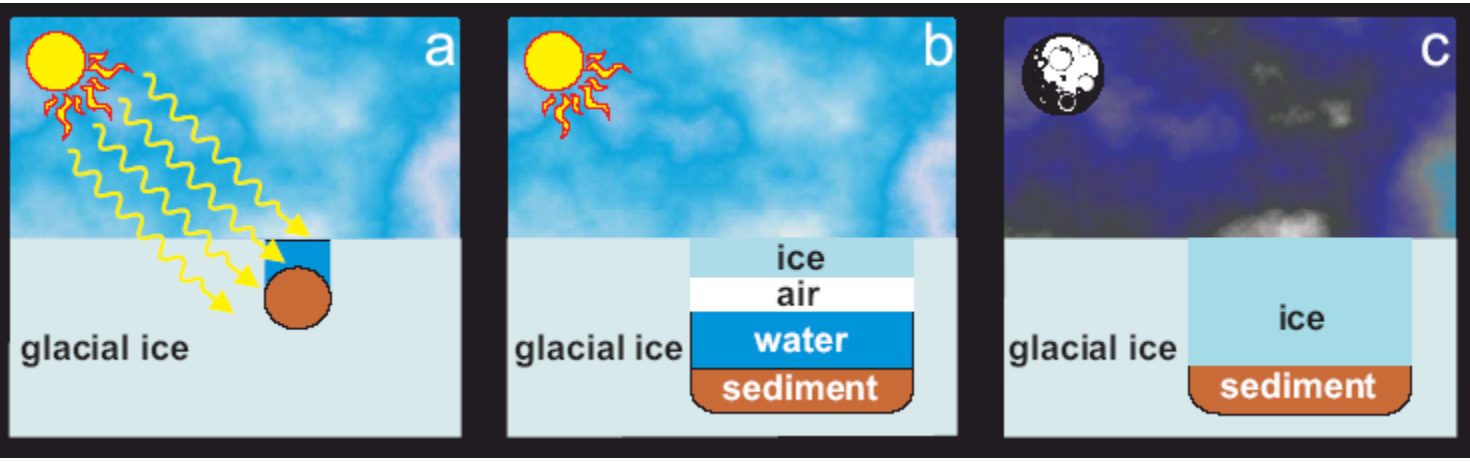




Cryoconites

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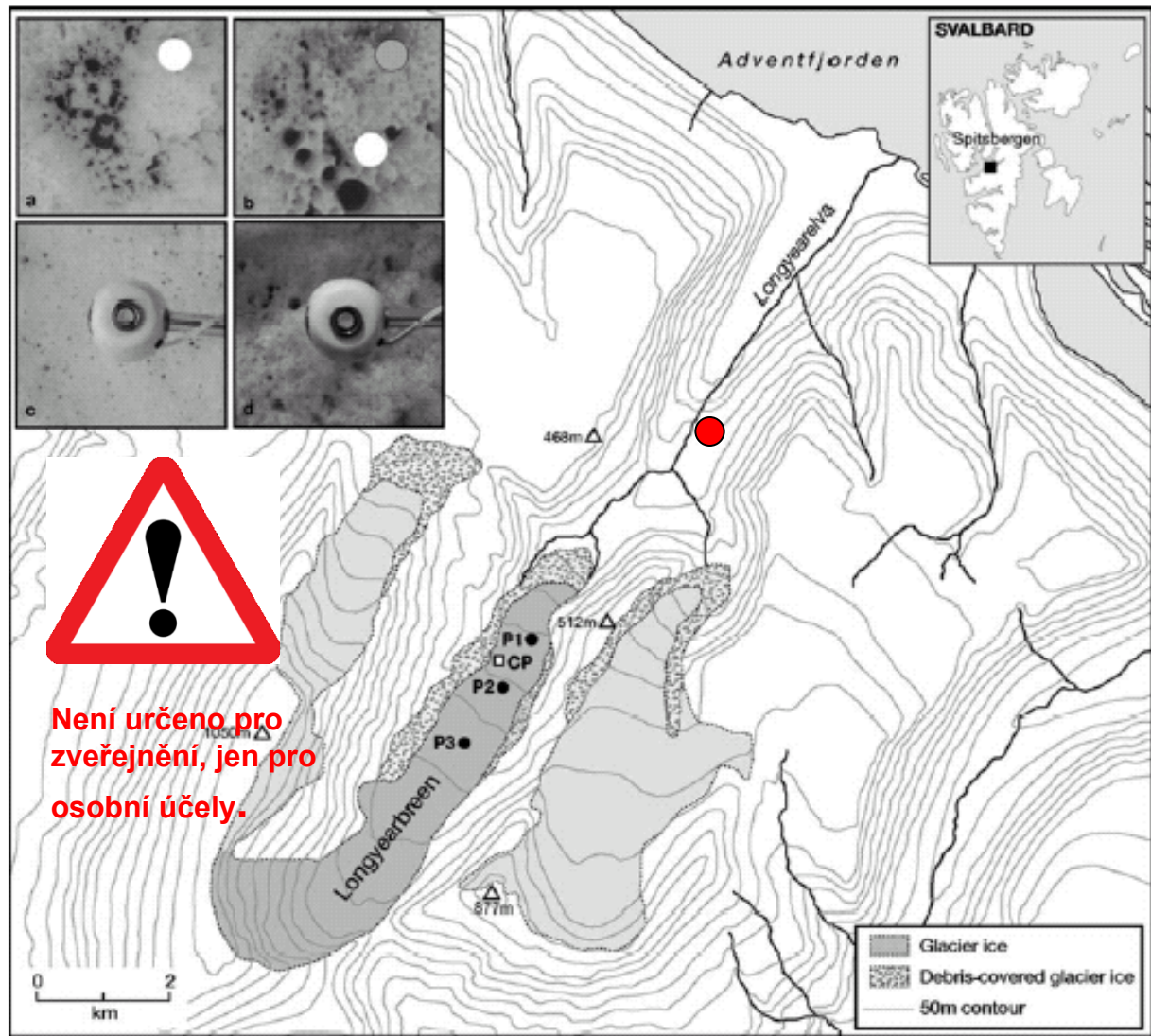
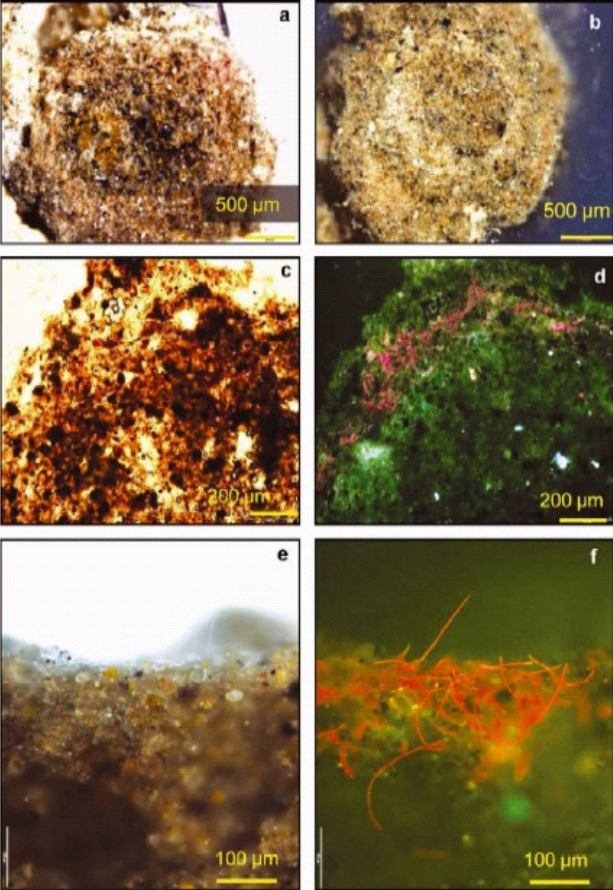


Fig. 1. Longyearbreen and the principal sites of interest during the investigation. P1–3 are the snow-pit locations and CP is the Control Patch. Insets (a) and (b) are the initial and near-final states respectively of the Cryoconite Patch. Insets (c) and (d) are the initial and near-final states respectively of the Control Patch. Dates are DOY 202–222. The white 47 mm calibration disc is also shown (its position changed, the grey disc).

- Source: <http://www.igsoc.org:8080/journal/56/196/j09J135.pdf>

Sněžné řasy

Jsou vázány trvale či dočasně na sněhovou pokrývku

Jejich teplotní optimum je pod 10 oC

Vysoký stupeň adaptace (polyoly, pigmenty, lipidy)

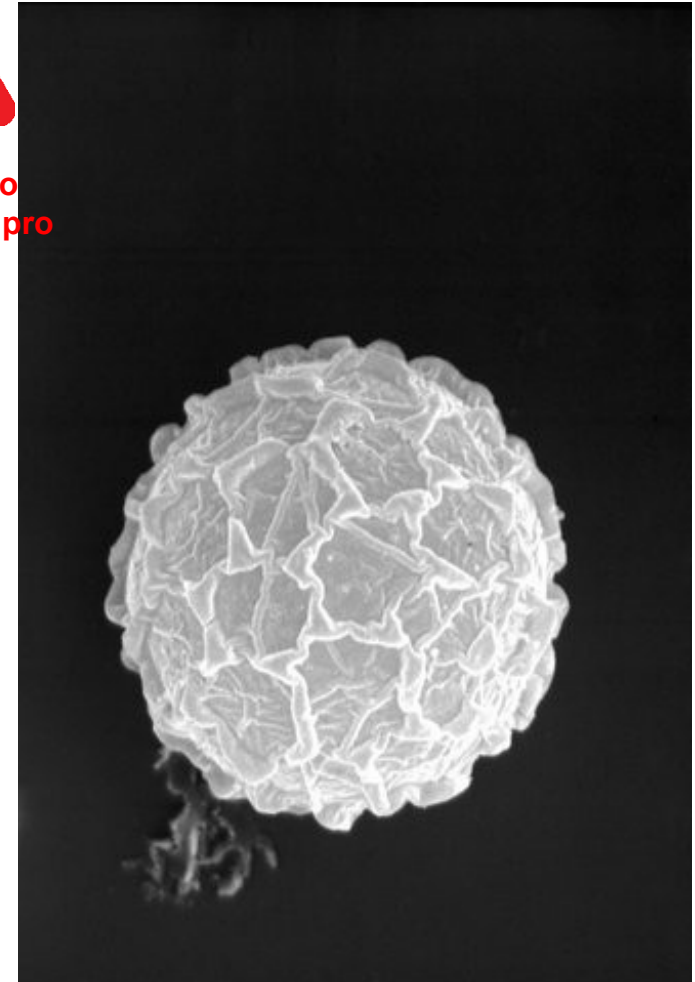
V době maximálního rozvoje 10⁵ to 10⁶ cells per mL.

Převažujícím rodem je *Chlamydomonds*
(jednobuněčné, dva bičíky)

Many of the snow algal species go through a complicated life cycle involving vegetative and or motile cells which are usually green in colour and immotile spores or cysts which may be red, orange or yellow green in colour. The green vegetative cells give rise to green snow and the red and orange snow are generally caused by the spore stages of the snow algae although some snow algae may be red-pigmented in their vegetative state. These pigments protect the cells from high light and UV radiation damage during the summer months. The pigments may take the form of iron tannin compounds, as in *M. berggrenii*, or orange to red-pigmented lipids as in the majority of the snow algae.



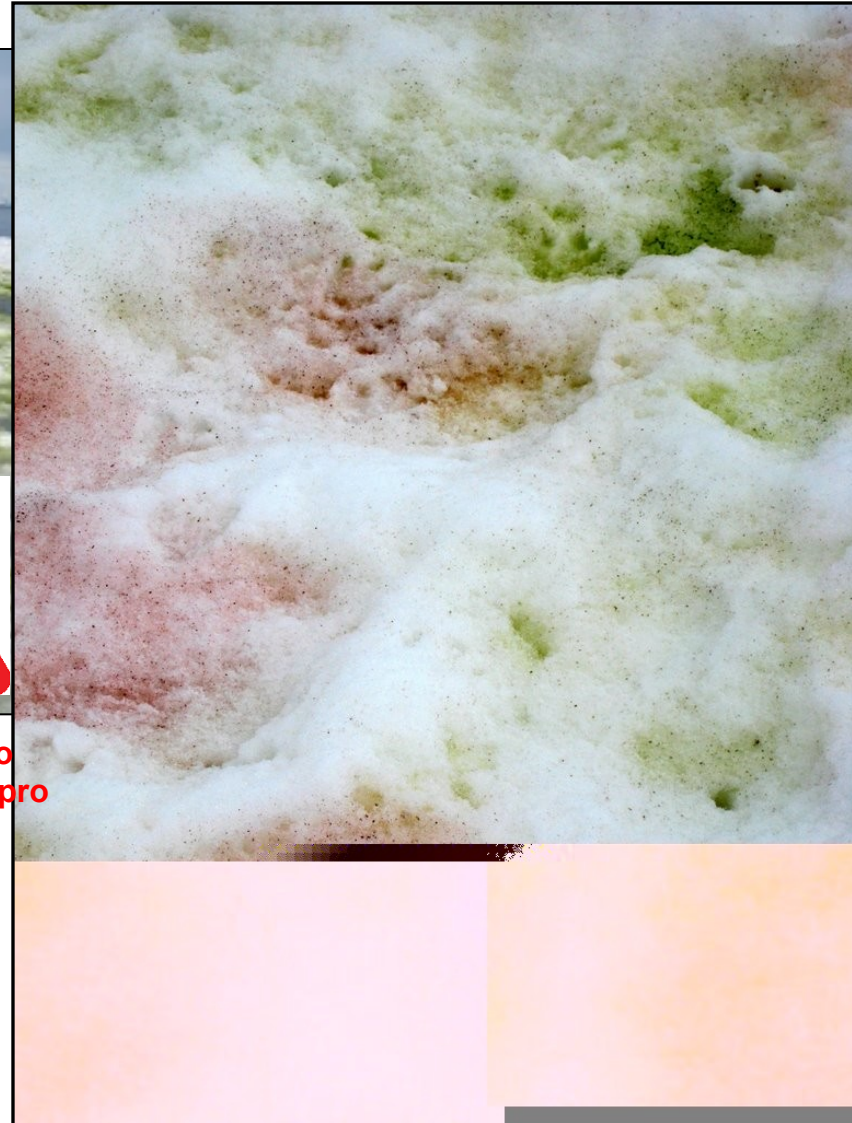
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Vegetativní stadium versus spory



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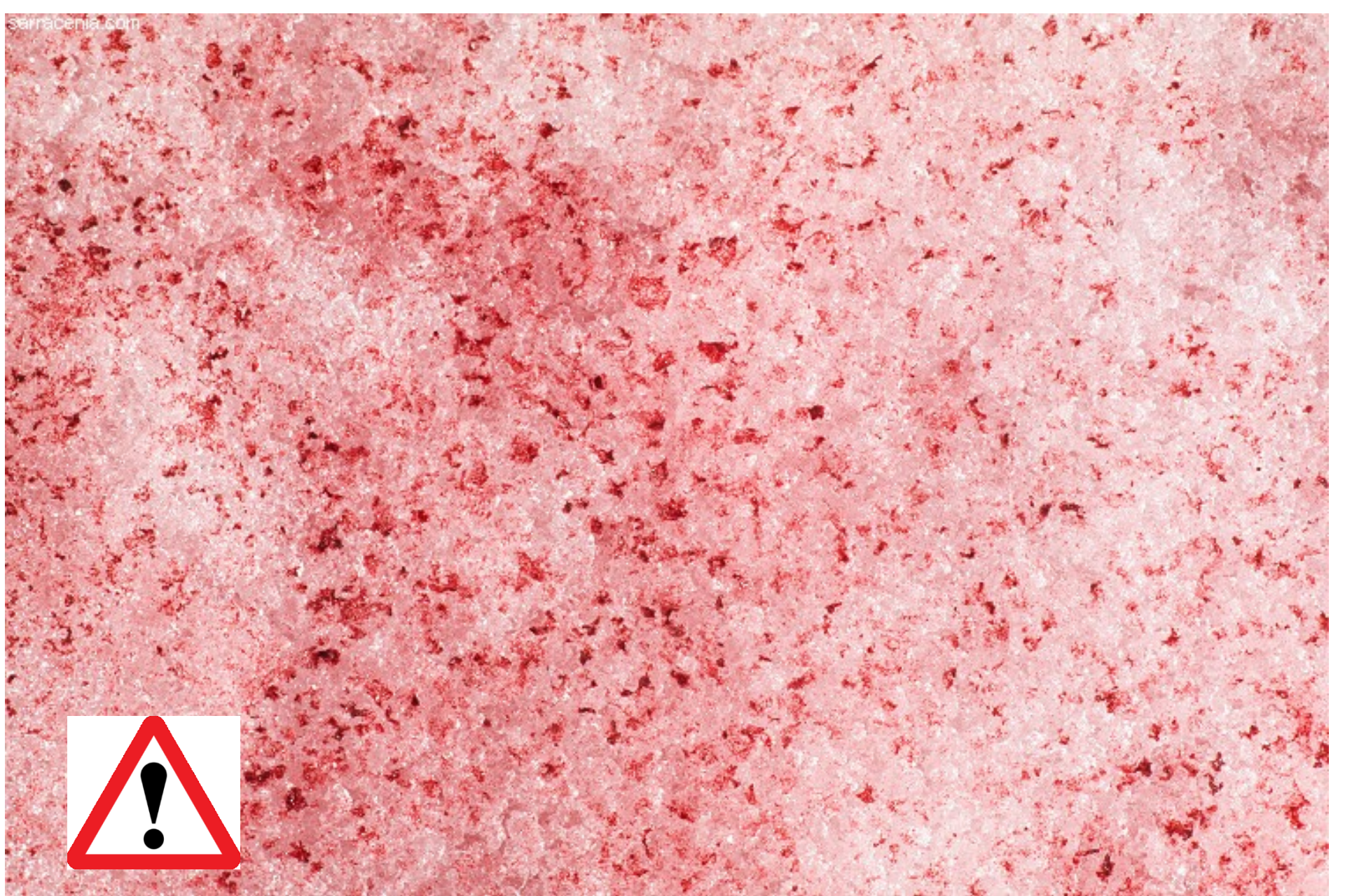


Zdroj: antarcticall.blogspot.com/

picasaweb.google.com/.../3oNmDNIWwAqVPINppwhc8A



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Krkonoše

Chloromonas nivalis (Chod.) Hoh. et Mull.



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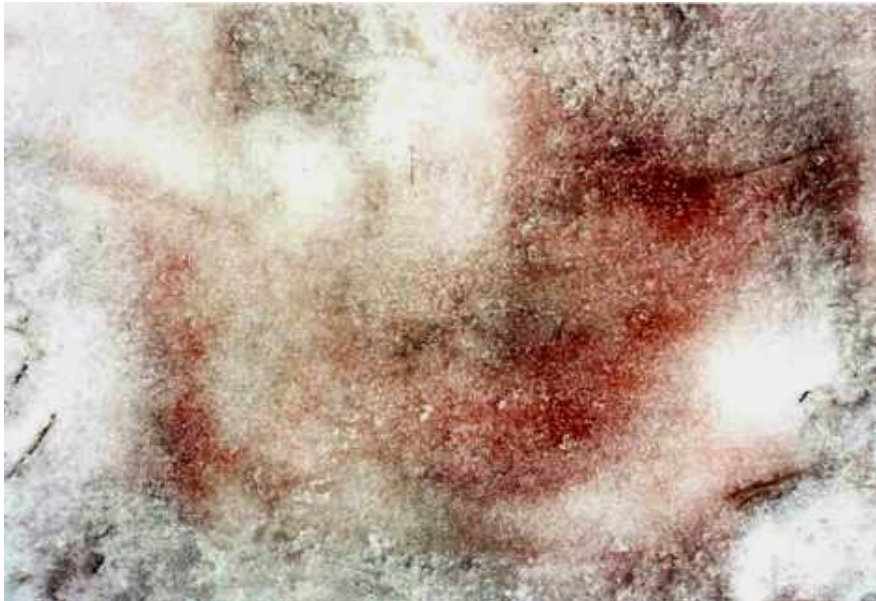
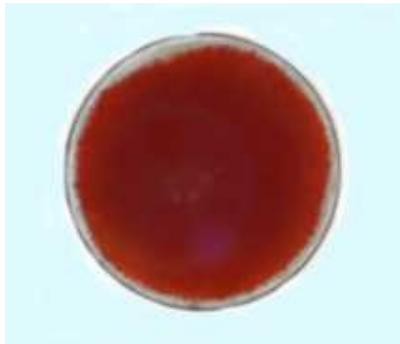
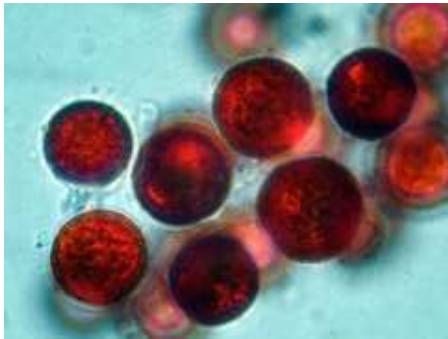




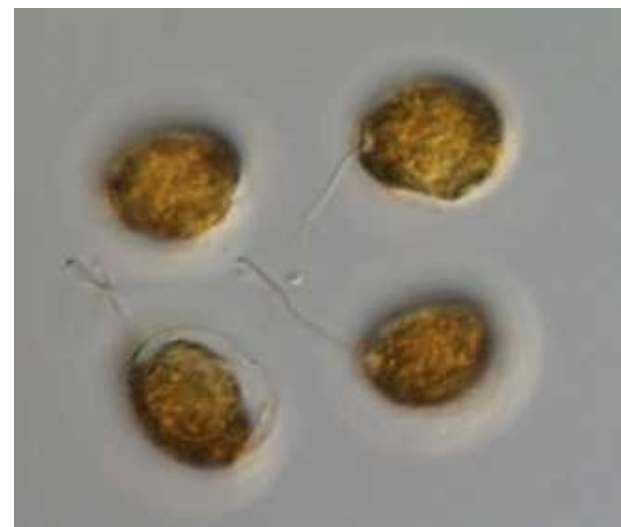
Vysoké Tatry

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Chlamydomonas cf. nivalis (Bauer) Wille



- Šumava, 200 m SV od hráze jezera Laka

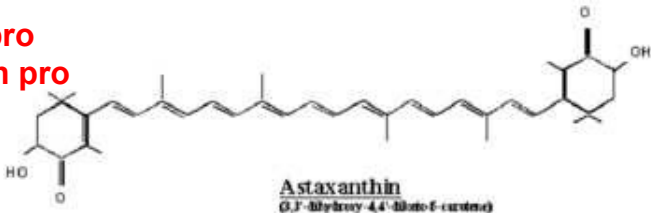


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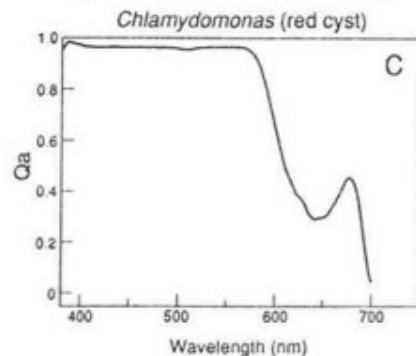
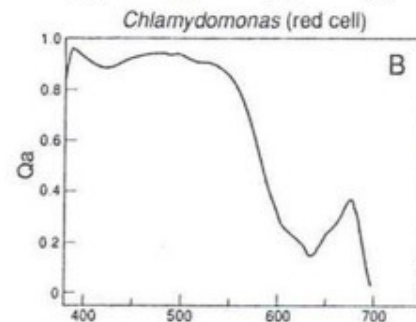
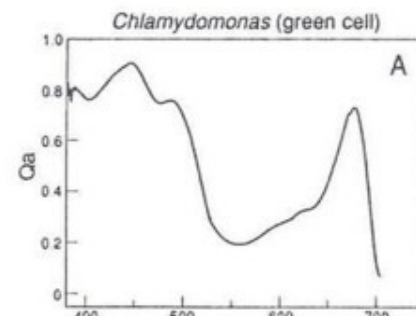
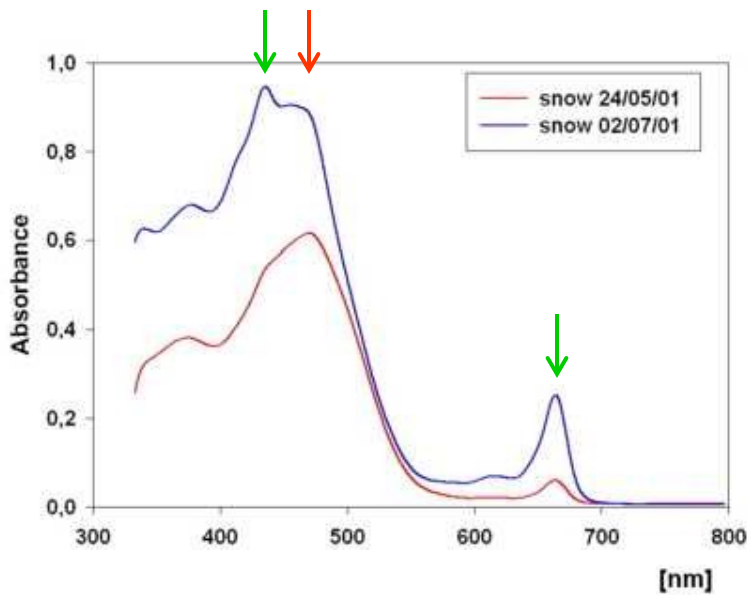


Adaptace: akumulace astaxanthinu

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Absorbční spektra vzorků „červeného sněhu“
L'adové pleso



[Bidigare *et al.*, 1993]

Tolerance vůči UV-B záření

[Photochem Photobiol.](#) 2003 Jun;77(6):608-15.

Ultraviolet radiation and the snow alga *Chlamydomonas nivalis* (Bauer) Wille.

[Gorton HL](#)¹, [Vogelmann TC](#).

[Author information](#)

Abstract

Aplanospores of *Chlamydomonas nivalis* are frequently found in high-altitude, persistent snowfields where they are photosynthetically active despite cold temperatures and high levels of visible and ultraviolet (UV) radiation. The goals of this work were to characterize the UV environment of the cells in the snow and to investigate the existence and localization of screening compounds that might prevent UV damage. UV irradiance decreased precipitously in snow, with UV radiation of wavelengths 280-315 nm and UV radiation of wavelengths 315-400 nm dropping to 50% of incident levels in the top 1 and 2 cm, respectively. Isolated cell walls exhibited UV absorbance, possibly by sporopollenin, but this absorbance was weak in images of broken or plasmolyzed cells observed through a UV microscope. The cells also contained UV-absorbing cytoplasmic compounds, with the extrachloroplastic carotenoid astaxanthin accounting for most of the screening. Additional screening compound(s) soluble in aqueous methanol had a maximum absorption at 335 nm played a minor role. Thus, cells are protected against potential UV damage by the snow itself when they live several centimeters beneath the surface. The effectiveness of cellular screening compounds, chiefly astaxanthin, when located near the surface is high.



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Photosynthesis, pigments and ultrastructure of the alpine snow alga *Chlamydomonas nivalis*

Daniel Remias , Ursula Lütz-Meindl & Cornelius Lütz

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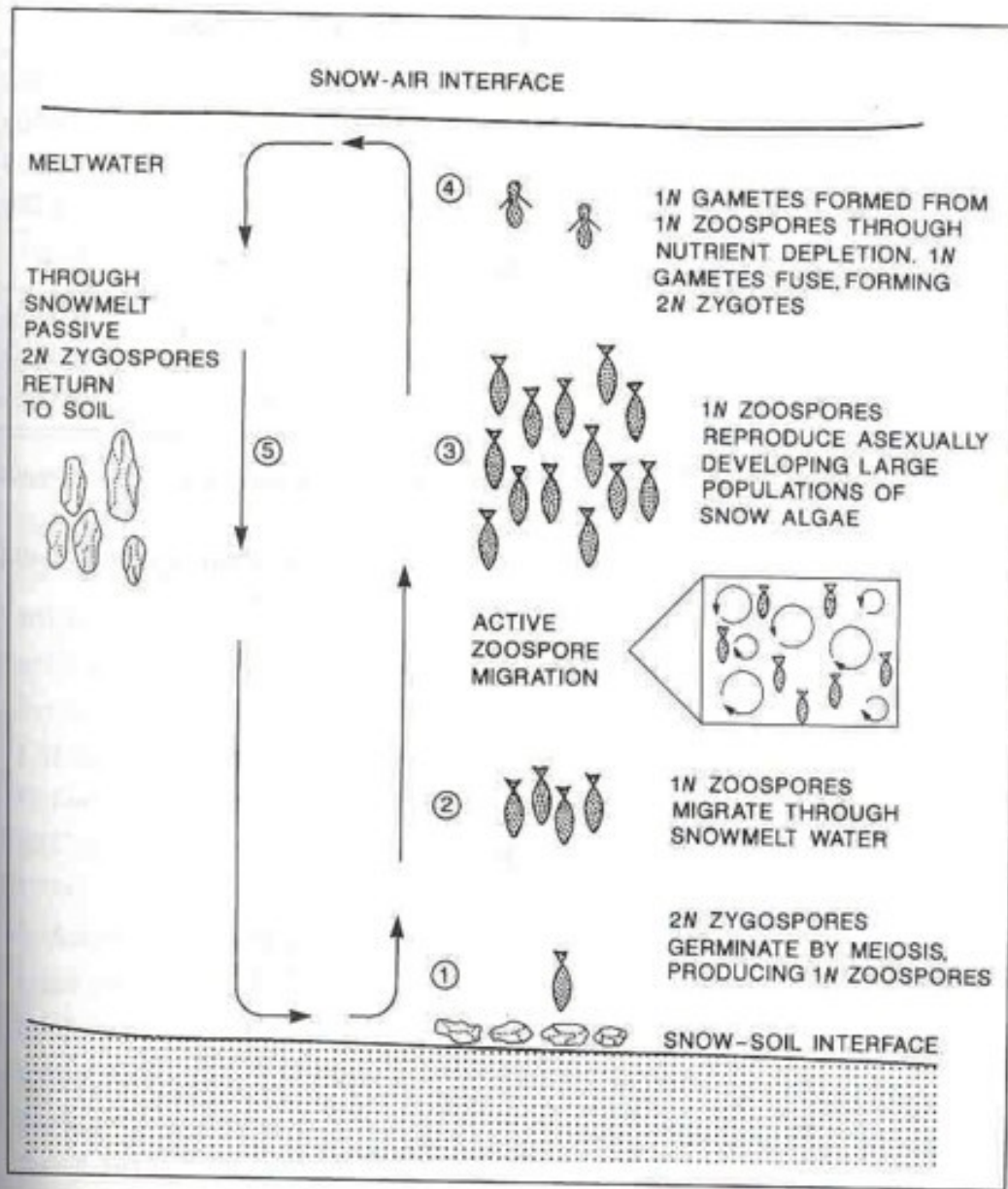


Figure 4.31. Life cycle of snow algal flagellate (*Chloromonas*) with sexual life history (modified from Gamache, 1990; Jones, 1991).

Životní

Cyklus

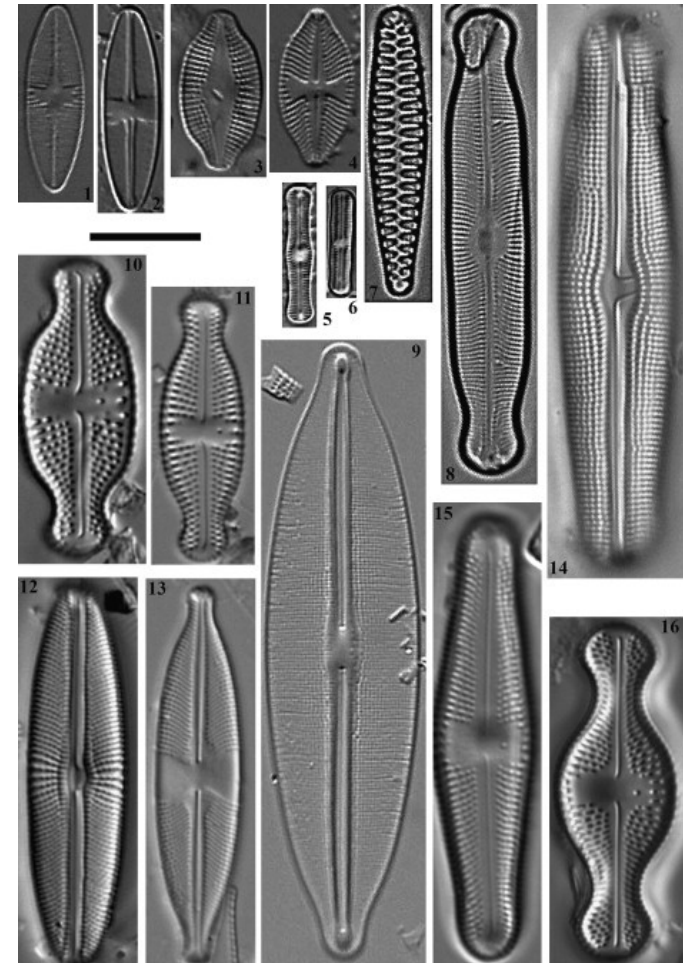
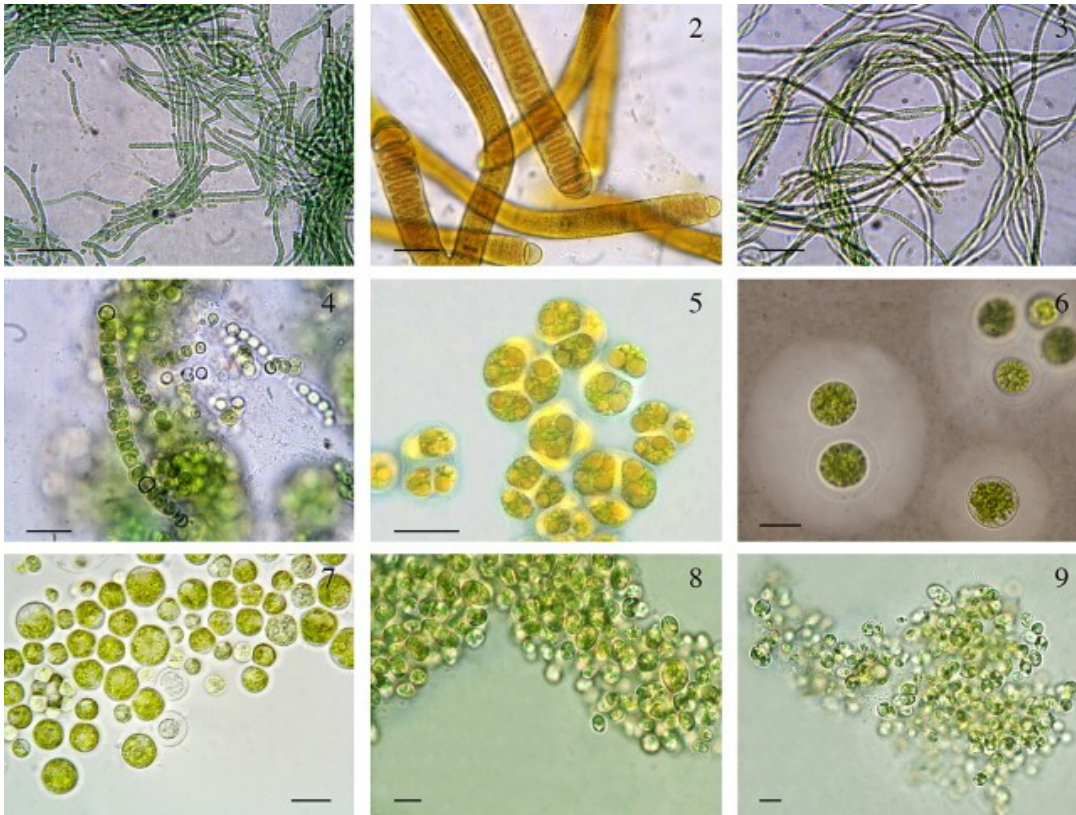
sněžných řas

obecné schéma



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Seepages



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Dámy a pánové, děkuji
Vám za pozornost



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