

The Culture Collection of Cryophilic Algae – CCCryo

A bioresource of extremophiles for basic and applied research topics

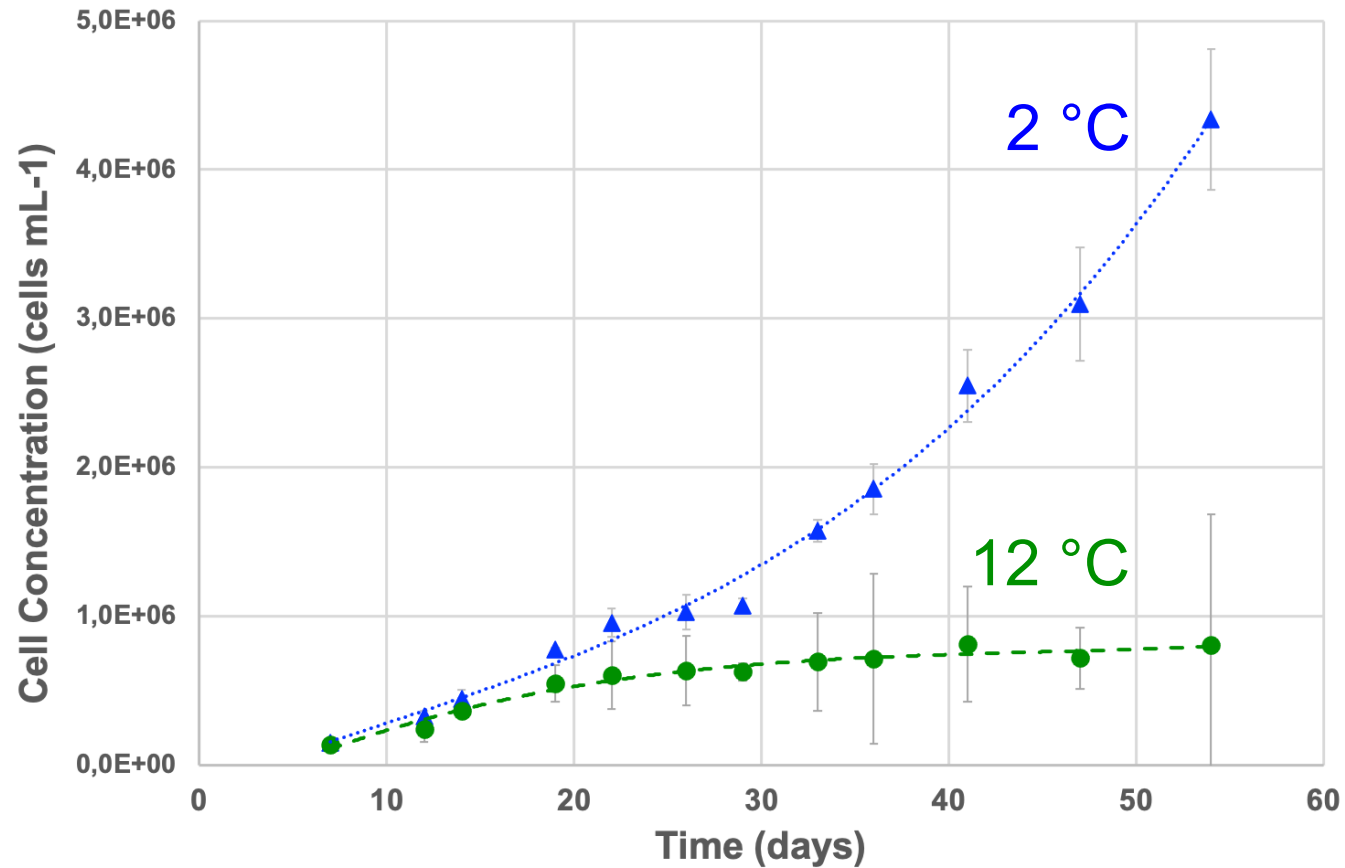
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Extremophile Research & Biobank CCCryo
<http://cccryo.fraunhofer.de>

Culture Collection
CCCryo
of Cryophilic Algae

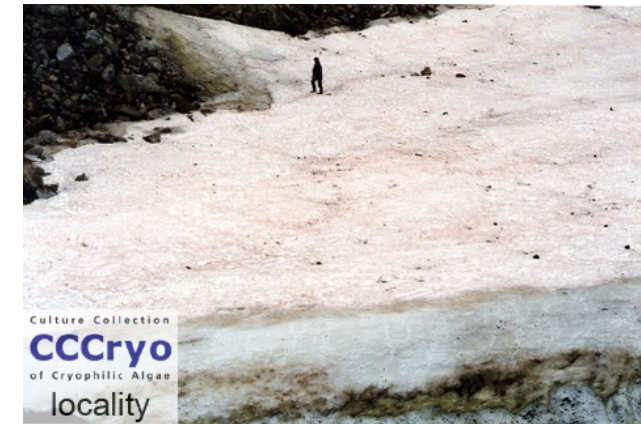
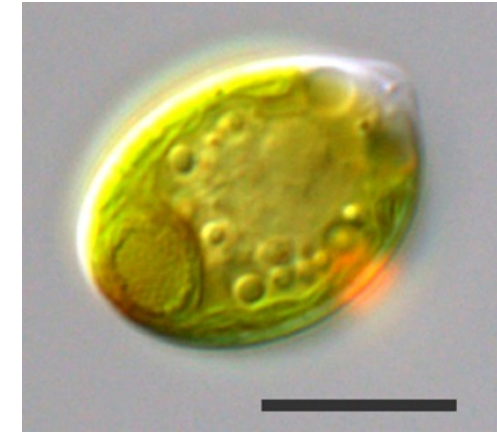


Growth of the psychrophilic strain CCCryo 050-99 of *Chlamydomonas klinobasis*

psychrophilic = cryophilic



Data \pm sd, n=3, 16:8 LD, 30 μ E m⁻² s⁻¹.
(data from Dressler (2021): Bachelor thesis)



Red Snow on Bautaen mountain, 70 m a.s.l., Hornsund (southern Spitsbergen), 9 Aug 2010



rocky mountain slopes

Red and **Orange** Snow





Sanguina nivaloides

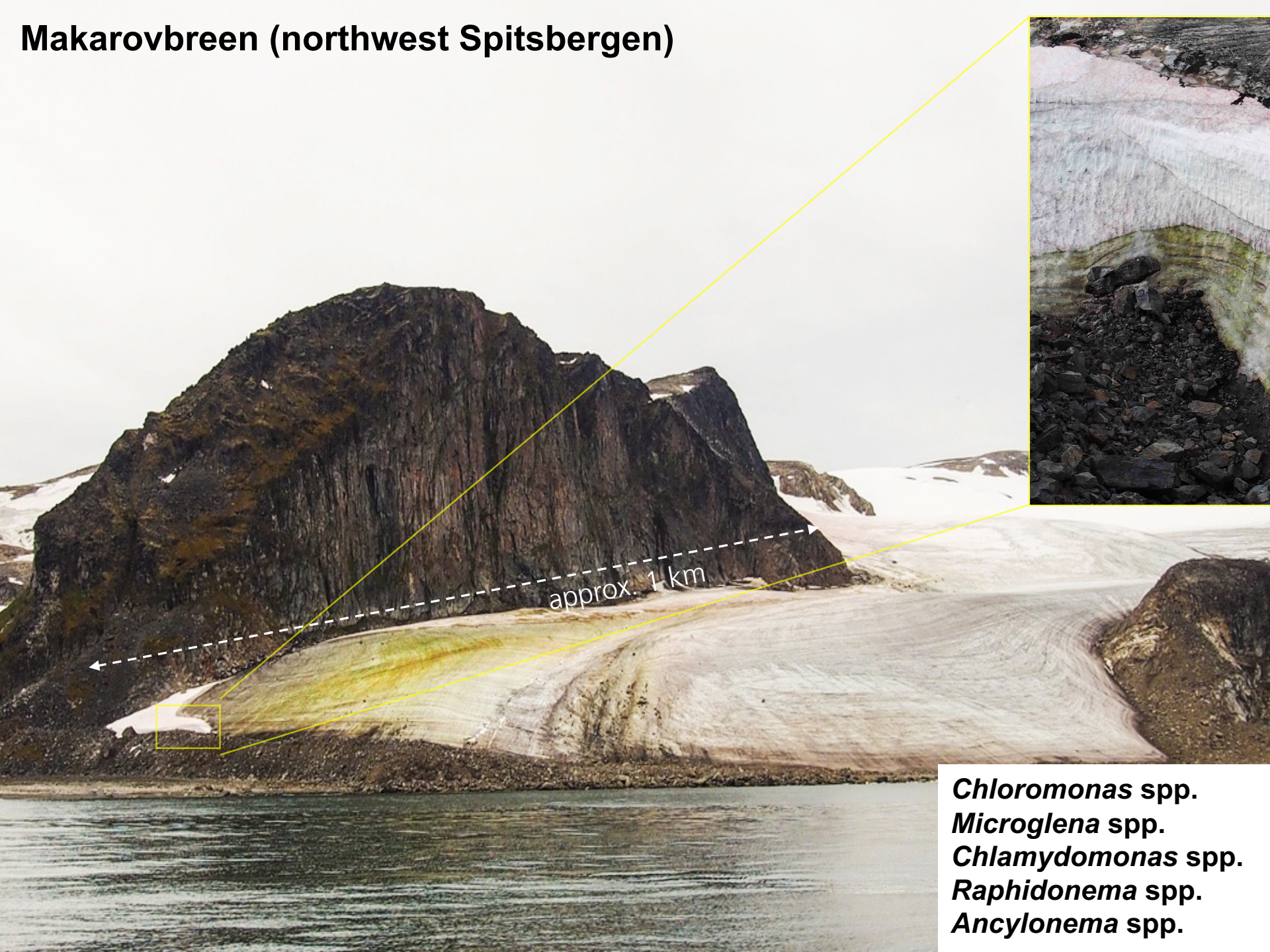
Syn. *Chlamydomonas nivalis* p.p.

Sanguina aurantia

(no life cultures/not for sale!)

for a revision of *Red Snow*:
Procházková et al. (2019) -
FEMS Microbiol. Ecol. **95**(6)

Makarovbreen (northwest Spitsbergen)



- Chloromonas* spp.
- Microglena* spp.
- Chlamydomonas* spp.
- Raphidonema* spp.
- Ancylonema* spp.



Makarovbreen (northwest Spitsbergen)
6 Aug 2013

CCCryo 050-99 *Chlamydomonas klinobasis*



true,
psychrophilic
snow algae



Stuphallet, Kongsfjorden, (Western-Spitsbergen), July 1998



Raphidonema sempervirens
and other *Raphidonema* spp.

for a revision of *Raphidonema* see:

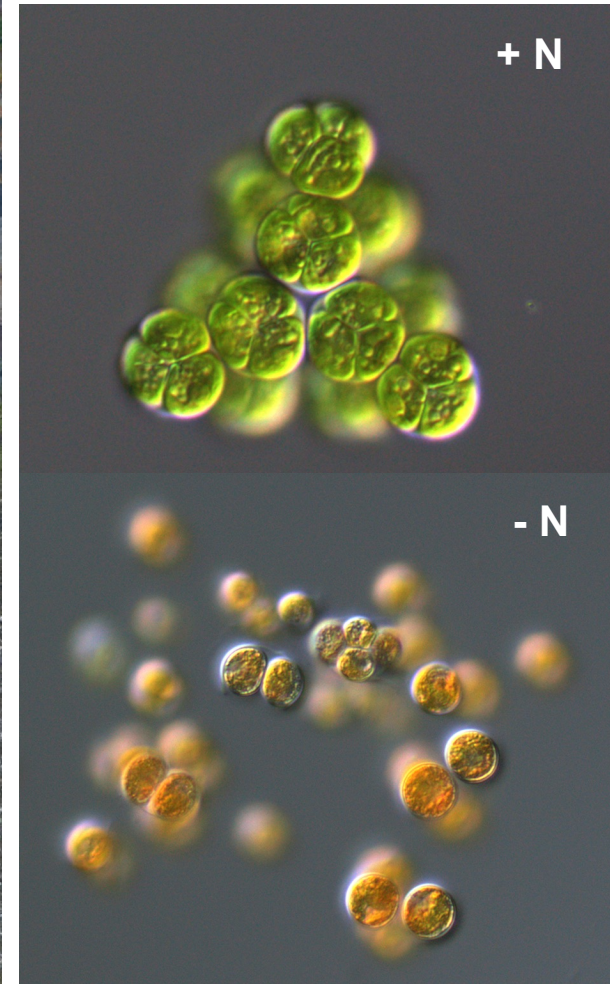
Yakimovich *et al.* (2021): - *J. Phycol.*
57(5):1419-1432



Alkefjellet (Eastern-Spitsbergen), 9 Aug 2013



< psychrophilic and
psychrotrophic >
permafrost algae

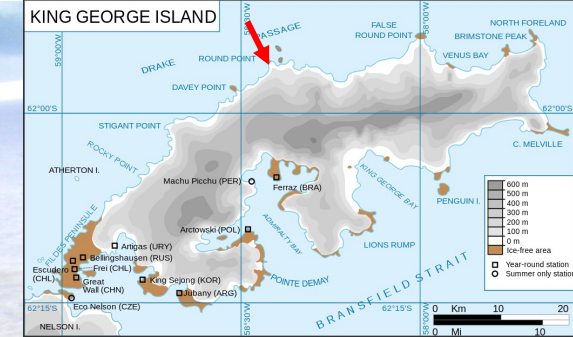


CCCRyo 101-99
cf. ***Sphaerocystis* sp.**
(revision in process)



saltwater

freshwater



Source (top): Wikimedia Commons, Attribution Share-alike 3.0 Unported, Original by Giovanni Fattori, mod. by Trex, Treehill

Chlorominima collina



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244-06



Green Snow

Gálvez et al. (2021) - *Front. Plant Sci.* 12(1050)

Green snow at a glacier near Round Point (on sea level)
King-George-Island (Antarctic Peninsula), 28 Jan 2006

CCCryo - Culture Collection of Cryophilic Algae (fd. 1999)

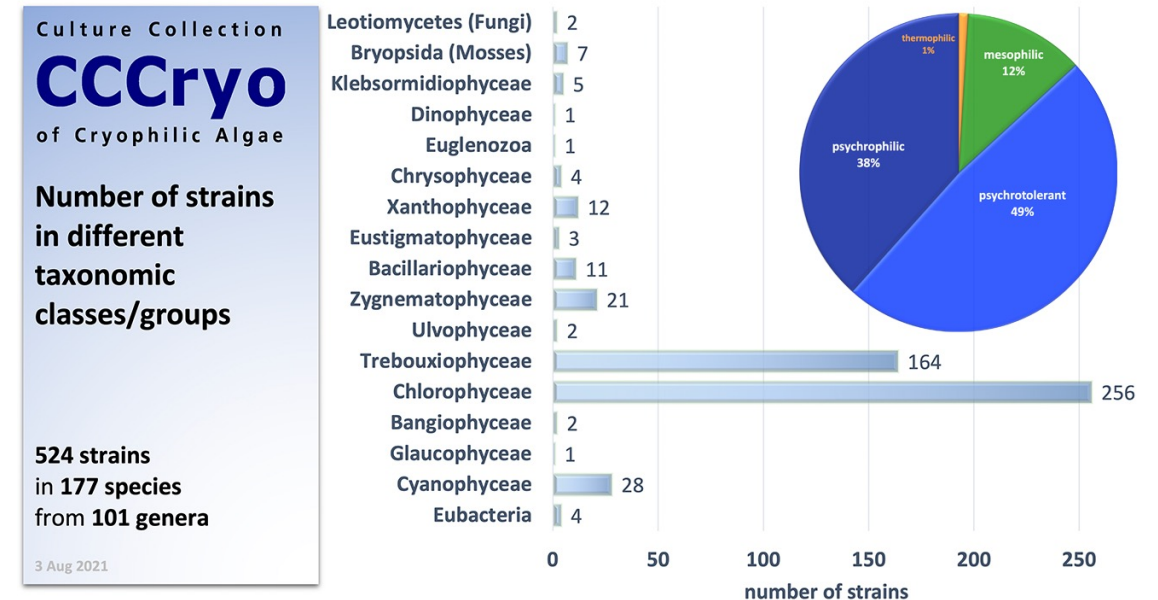
CCCryo primarily is a live biobank

- currently we hold:
524 strains from 177 species in 101 genera
- algae, cyanobacteria, fungi, mosses and eubacteria
- with a clear focus in cryophilic algae
> CCCryo is unique in its extend and diversity
- at 2 °C (or 15 / RT / 32 °C) in fridges with glass doors and cool rooms
- strains are transferred every 1-12 months
- approx. 110 strains need to be transferred every month
- Staff: 1 scientist and ½ technical assistant

Authentic/type strains

- we do hold authentic strains from types of taxonomic publications
- we do not hold patent strains

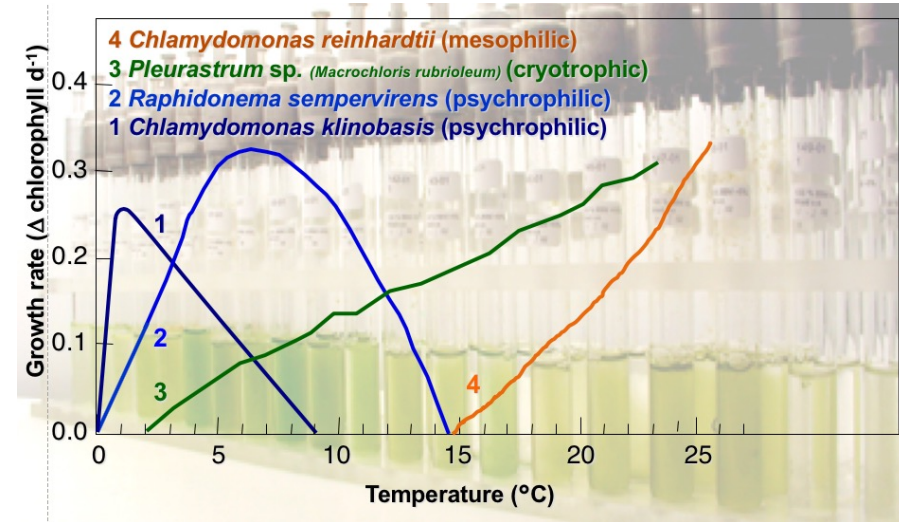
- online-catalogue at <https://cccryo.fraunhofer.de>
- we are member of the **WFCC** as WDCM 940
- we are member of **ECCO**
- **strains are available to the scientific community, industry, schools, art projects etc.**



They are special ... so what are they good for?

schematic

- $T_{\text{growth-opt}} = 0...15\text{ }^{\circ}\text{C}$
- $T_{\text{growth-max}} = 10...15...20...23\text{ }^{\circ}\text{C}$



- nutrient- & light stress



carotenoids, antioxidants, fatty acids/PUFA,
photolyases, photoreceptors

- low temperatures (cold stress)

→ osmotic stress



cold-induced
metabolites



fatty acids/PUFA

→ desiccation stress

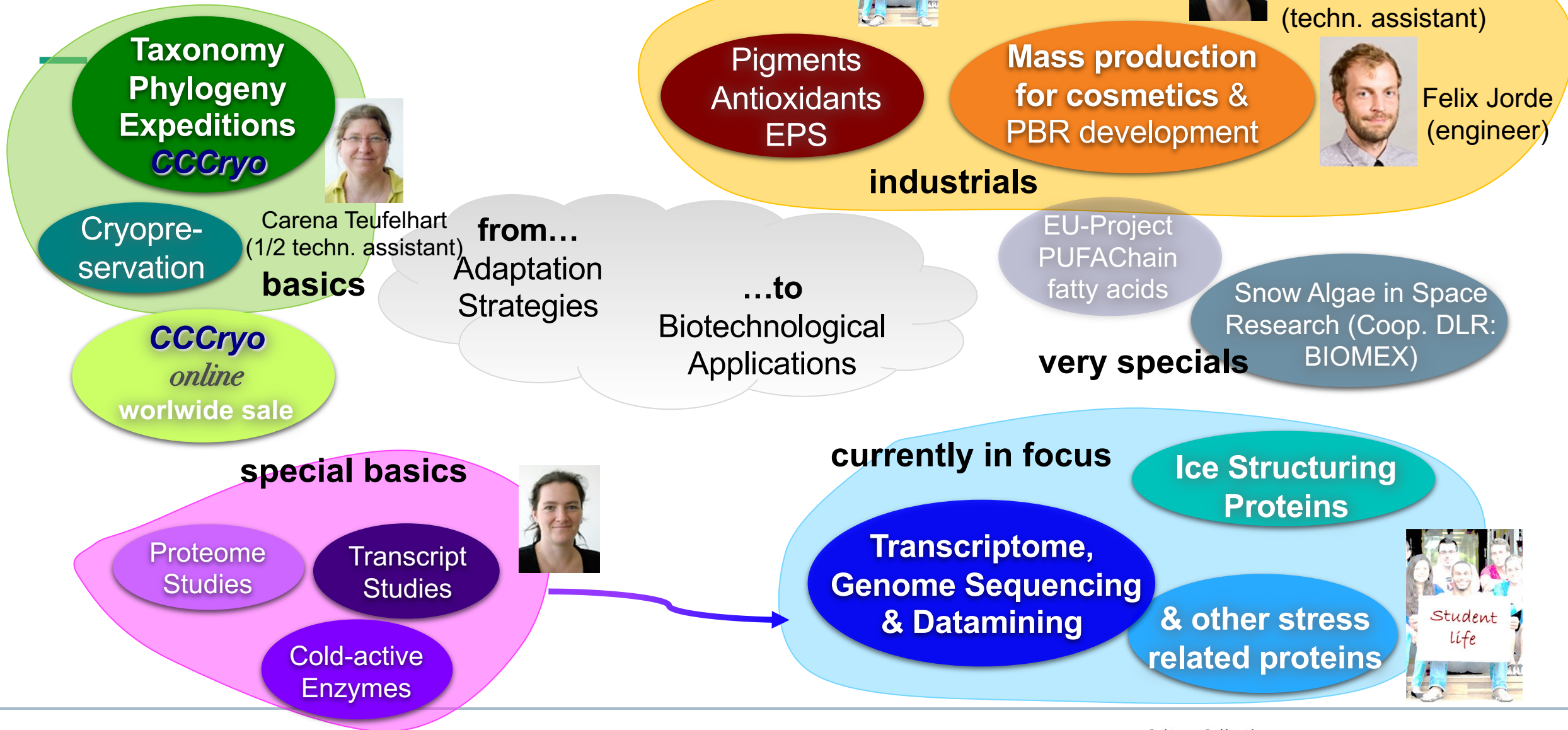


induction of cold-active/salt stress genes



cold-active enzymes
ice-structuring proteins

Snow algae topics in our workgroup



Industrial use of CCCryo strains

We develop PBR-systems to produce

- **pure** algal biomass
- in **vertical glass tube photobioreactors** using the *airlift* principle (*multiLoop*)
- in **variable modules** of 10-60 litres

for high-price products

- antioxidants
- pigments
- PUFA
- **special enzymes**

aiming for

- **cosmetics**
- human health products
- pharmaceuticals
- food/feed industry



Standards at CCCryo: Quality & risk management

Maintaining quality

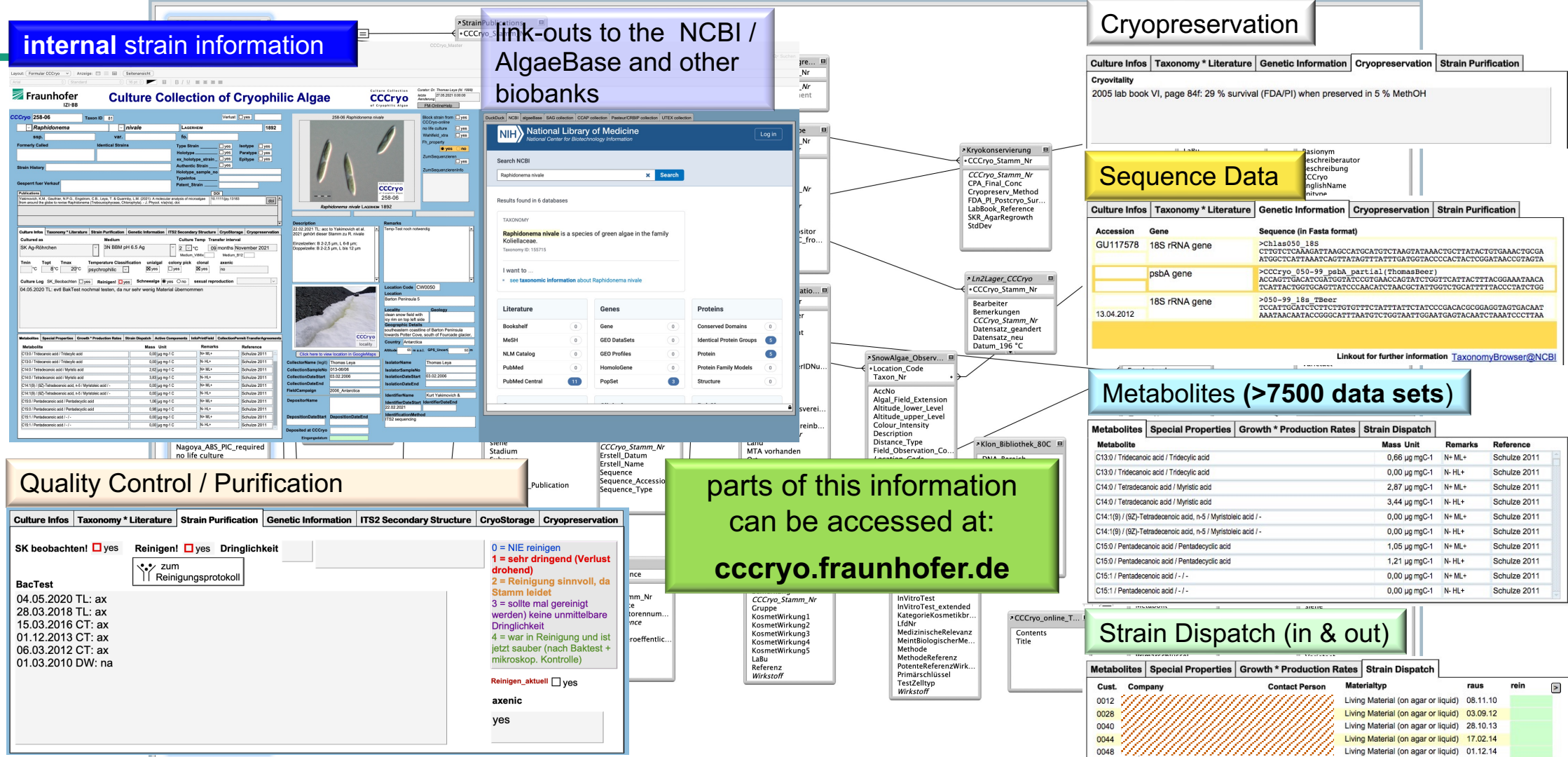
- **Contaminations**
 - **tests for bacteria and fungi**
 - **on enriched basal media** (+ beef extract, yeast extract, glucose, proteose peptone)
 - > each strain at **min. every 2 years**
 - + **light microscopy** when in doubt
 - **continuously every month** (binocular)
 - > contaminated strains will be purified (no antibiotics!)
 - about 2/3 of our strains are axenic
- **Identifications**
 - morphological taxonomy
 - light / fluorescent microscopy
 - 18S-/ITS-/rbcL-phylogeny

Backups

- approx. **20 % of strains are held as duplicates** at other algal biobanks or vice versa (CCALA, SAG, ASIB, ASW, CCAP, SVCK, UTEX or individual research collections)
- approx. **80 % of the strains are cryopreserved** at <-150 °C in liquid nitrogen (not all have been tested for survival! – and not all will have survived!)
 - we do not rely on this
- a partial **backup is also cryopreserved at the Fraunhofer IBMT** in Sulzbach

The CCryo database

All data about strains from sampling to sales are organised in a relational FileMaker database in 24 tables:



Use of CCCryo strains

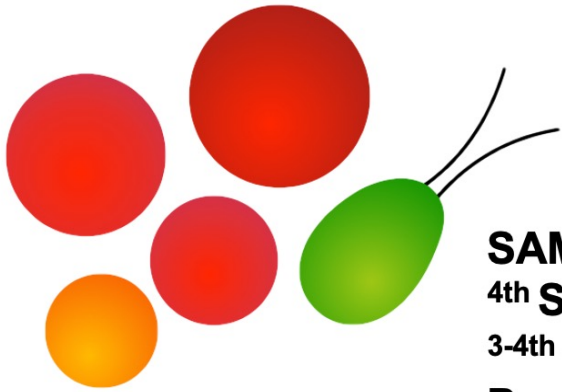
Scientific use

- strains are sold to universities and public or private R&D institutions
- no restrictions exist for scientific use
- Material Transfer Agreement (MTA) has to be signed (no commercial use!)

may or  may not lead to

Commercial use

- financial compensation is agreed upon in separate contracts and individually
- Fraunhofer is a non-profit organisation
- Fraunhofer's task is to develop products for Small-/Medium sized Enterprises (SME) in Germany (or other countries)



SAM 2022
4th Snow Algae Meeting
3-4th November 2022
Prague

I thank you for attending!