SAGIAM
Grenoble 2026

6th Snow Algae & Glacier Ice Algae Meeting

Grenoble, 24-25 Feb 2026

MACI (Maison de la Création et de l'Innovation)
339 Avenue Centrale, 38400 Saint-Martin-d'Hères
Université Grenoble Alpes
Information/registration: sagiam.grenoble.2026@gmail.com

Following the success of previous meetings, SAM has now evolved into SAGIAM, bringing together researchers from around the world working on snow and glacier ice algae. In the same spirit, no registration fee is requested (coffee, lunch breaks and Tuesday's dinner included) and we are delighted to welcome you once again to Université Grenoble Alpes. Please confirm your participation to Tuesday's evening at the Minnimistan restaurant, to help us controlling our expenses.

Session topics will follow the format of previous editions, fostering discussion, exchange, and collaboration. Colleagues investigating snow and ice algae in all their forms, and from any discipline, are warmly invited to present and share their research in an informal, workshop-like setting over these two full days.

The program includes oral presentations (15 min + 5 min for questions) and poster sessions covering all aspects of snow and ice microalgae. Coffee breaks and snacks are included in the registration. The scientific committee has made every effort to ensure a coherent and stimulating schedule.

SAGIAM is also a unique opportunity for early-career scientists to present their work in a stimulating and supportive environment.

The scientific committee includes Alberto Amato (LPCV Grenoble), Helen Feord (GFZ Potsdam, Germany), Trinity Hamilton (University of Minnesota, USA), Robin Kodner (Western Washington University, USA), and Eric Maréchal (LPCV Grenoble).

Bienvenue à Grenoble!

With support from: cea irig anr alpAlga UGA Université Grenoble Alpes

Tuesday, February 24th

08:30-09:30	Arrival / poster display
09:30-09:40	Welcome to SAGIAM2026
Session 1: Snow and ice algae through time and space: the old and the new Chair: *Daniel Remias*	
09:40-10:10	**O1-Red Snow in the History of Science: Over Two Millennia of Inquiry** Eric Maréchal
10:10-10:30	**O2-Archival red snow samples** Pierre Guenzi-Tiberi
10:30-10:50	**O3-LIVING SNOW PROJECT: A decade of data** Robin Kodner
10:50-11:30	**COFFEE BREAK**
Session 2: Systematics and Populations (part 1) Chair: *Robin Kodner*	
11:30-11:50	**O4-Highly endangered tropical glaciers in Colombia (South America) host supraglacial communities of microalgae at a “daytime climate”** Daniel Remias
11:50-12:10	**O5-Unveiling genetic and morphological variation in snow algae communities at forested sites: Central Europe and north-eastern USA** Lenka Procházková
12:10-12:30	**O6-A New *Chloromonas* Species from the Barton Peninsula (Antarctica) with Eurythermal Growth and Photoprotective Traits** Sung-Mi Cho
12:30-13:30	**LUNCH**
Session 2: Systematics and Populations (part 2) Chair: *Robin Kodner*	
13:30-13:50	**O7-Determining ploidy and clonality in *Chlainomonas* sp. via single cell genetics** Xander Geragotelis
Session 3: Snow algae, friends and foes Chair: *Helen Feord*	
13:50-14:10	**O8-Horizontal gene transfer underlies the freezing tolerance of Antarctic bdelloid rotifers** James Raymond
14:10-14:30	**O9-The Hidden Cleaner: *Phenoliferia psychrophenolica* in a Sea of Red Snow Blooms** Jade Ezzedine
14:30-14:50	**O10-SNOWGIANTS: Exploring Giant Virus Diversity and Cold-Adapted Enzymes in Arctic and Alpine Snow Algae** Zohaib Hassan
14:50-16:30	**COFFEE BREAK + Poster session + Group Photo**
Discussion forum Chair: *Helen Feord*	
16:30-17:30	**Discussion forum on** - **community projects related to snow and ice algae (e.g. CASP-ICE, LSP),** - **collections, datasets, and repositories**

18h30 we propose to gather at Minnimistan (https://minimistan.org/cafe-bar-restaurant/)

Wednesday, February 25th

09:00-09:30	Arrival / poster display
Session 4: Bloom monitoring and ecology Chair: *Lenka Procházková*	
09:30-09:50	**O11-Below the timberline: tracking snow algal blooms in mountain forests** Linda Nedbalová
09:50-10:10	**O12-Exploring Prokaryotic and Eukaryotic Diversity Among Snow Algal Communities in Montana and Wyoming** Ashley Beck
10:10-10:30	**O13-High-resolution sampling reveals the spatial structure of a glacier algal bloom** Chris Williamson
10:30-11:00	**COFFEE BREAK**
11:00-11:20	**O14-Remote sensing of algal blooms on snow and ice in the European Alps** Léon Roussel
11:20-11:40	**O15-Elevation-dependent shifts in snow algae blooms influence biological albedo reduction in western U.S. mountains** Pablo Almela
11:40-12:00	**O16-Habitat specific variability and response of active microbial communities on the north-western GrIS** Emily Broadwell
12:00-12:20	**O17- Evidence for carbon limitation in snow algae blooms across the Cascade Range and Rocky Mountains** Jeff Havig
12:00-13:30	**LUNCH**
Session 5: Physiology and function in extreme conditions Chair: *Alberto Amato*	
13:30-13:50	**O18-Antarctic snow algal responses to temperature - potential implications of climate change** Matt Davey
13:50-14:10	**O19-Glacier ice algae have a plant-like response to freezing stress** Helen Feord
14:10-14:30	**O20-The energetics of the motile cilium** Adrian Nievergelt
Discussion forum Chair: *Eric Maréchal*	
14:30-15:00	**Discussion forum on** - **Next SAGIAM** - **Future topis in snow and ice algal research** - **Perspectives of collaborative projects, financing opportunities** **Open discussion**
15:10-16:00	**COFFEE BREAK + Poster session**

Poster Session

1. **Beck, Ashley**, Carroll College, Helena, MT, USA
   Applying Place-Based Learning in the Undergraduate Laboratory: A Case Study in Snow Algae
2. **Burke, Rory**, LPCV, Grenoble, France
   Cellular and Physiological Responses of Arctic Diatoms to Sea Ice Conditions
3. **de Vries, Caitlin**, Newcastle University, UK
   The Environmental Biophysics of Microalgal Migration in Snow
4. **Feord, Helen**, GFZ Helmholtz Centre for Geosciences, Potsdam, Germany
   Optimizing the nutrient conditions for glacier ice algae cultivation
5. **Feord, Helen**, GFZ Helmholtz Centre for Geosciences, Potsdam, Germany
   The DEEP PURPLE project
6. **Fernández-Marín, Beatriz**, University of the Basque Country (UPV/EHU), Spain
   Desiccation Stress Responses of Red Snow Algae Communities from Livingston Island (Maritime Antarctica)
7. **Garcia-Plazaola, José Ignacio**, University of the Basque Country (UPV/EHU), Spain
   Deciphering Photochemical Responses of Complex Algal Communities in Antarctic Snow Using a PAM Fluorescence Microscope
8. **Giustini, Cécile**, LPCV, Grenoble, France
   3D Confocal-driven expansion microscopy approach for microalgal cell biology
9. **Holzinger, Andreas**, University of Innsbruck, Austria
   Seasonal Variations in Metabolite and Transcript Profiles in the Streptophyte Green Alga Zygogonium *ericetorum*
10. **Jíra, Stanislas**, Charles University, Prague, Czech Republic
    Beyond ice: Cryosphere-adjacent limestone rocks as reservoirs of cold-adapted green algae
11. **Johnson, Ben**, University of Bristol, UK
    GLASS: Glacier Algal Sampling Strategies
12. **Kodner, Robin**, Western Washington U.
    Living Snow Project as a global citizen science program
13. **Koritenská, Klára**, Charles University, Prague, Czech Republic
    Snow Algal Blooms under Climate Change: Nearly 50 Years of Observations in the Krkonoše Mountains
14. **Krueger-Hadfield, Stacy**, Virginia Institute of Marine Science, Eastern Shore Laboratory, USA
    Reproduction We Cannot See: Microbial Population Genetics
15. **Leroy-Basson, Gerhard**, University of the Basque Country (UPV/EHU), Spain
    Physiological Responses to Multiple Abiotic Stressors of Snow Algae Communities at Livingston Island (Maritime Antarctica)
16. **McKenzie, Caroline**, Sorbonne Université, CQSB, Paris, France
    Investigating Ice-Binding Proteins across the Phylogenetic, Biogeographical and Physiological Diversity of Cryophilic Algae
17. **Procházková, Lenka**, Charles University, Prague, Czech Republic
    Ecophysiology of Several New Species of Hydrurus
18. **Serbutoviez-Verville, Camille**, LPCV, Grenoble, France
    Homeoviscous response to low temperature and darkness in Phaeodactylum tricornutum
19. **Valay, Jean-Gabriel**, Jardin du Lautaret, France
    Snow Algae studies: Lautaret garden the place to be!
20. **Villain Gaelle**, LPCV, Grenoble, France
    Snow Algae studies: Lautaret garden the place to be!

List of Participants

Almela, Pablo
almel006@umn.edu
University of Minnesota, USA

Amato, Alberto
alberto.amato@cea.fr
LPCV, Grenoble, France

Beck, Ashley
abeck@carroll.edu
Carroll College, Helena, MT, USA

Besson, Arnaud
abeck@carroll.edu
Centre de Biologie Intégrative, CNRS Toulouse, France

Broadwell, Emily
elmb@envs.au.dk
Aarhus University, Denmark

Burke, Rory
rory.burke@cea.fr
LPCV, Grenoble, France

Cho, Sung Mi
smcho@kopri.re.kr
Korea Polar Research Institute, South Korea

Davey, Matthew
matt.davey@sams.ac.uk
Scottish Association for Marine Science, UK

de Vries, Caitlin
C.S.Devries2@newcastle.ac.uk
Newcastle University, UK

Detain, Alexandre
alexandre.detain@gmail.com
Nord University, Norway

Dorrell, Richard
richard.dorrell@sorbonne-universite.fr
Sorbonne Université, CQSB, Paris, France

Dumont, Marie
marie.dumont@meteo.fr
CNRM / Centre d'Études de la Neige, Grenoble, France

Ezzedine, Jade
jade.ezzedine@gmail.com
LPCV, Grenoble, France

Falconet, Denis
denis.falconet@free.fr
LPCV, Grenoble, France

Feord, Helen
helen.feord@gfz.de
GFZ Helmholtz Centre for Geosciences, Potsdam, Germany

Fernández-Marín, Beatriz
beatriz.fernandezm@ehu.eus
University of the Basque Country (UPV/EHU), Spain

Forêt, Jérôme
jerome.foret@univ-grenoble-alpes.fr
Jardin du Lautaret, France

Garcia-Plazaola, José Ignacio
joseignacio.garcia@ehu.eus
University of the Basque Country (UPV/EHU), Spain

Geragotelis, Xander
adgeragotelis@vims.edu
Virginia Institute of Marine Science, USA

Giustini, Cécile
cecile.giustini@cea.fr
LPCV, Grenoble, France

Guenzi-Tibéri, Pierre
pierre.guenzi.tiberi@gmail.com
LPCV & LECA, Grenoble, France

Hassan, Zohaib
zohaib.u.hassan@nord.no
Nord University, Norway

Havig, Jeff
jeffhavig@gmail.com
University of Minnesota, USA

Holzinger, Andreas
andreas.holzinger@uibk.ac.at
University of Innsbruck, Austria

Hulatt, Christopher
christopher.j.hulatt@nord.no
Nord University, Norway

Jíra, Stanislas
jirasta@natur.cuni.cz
Charles University, Prague, Czech Republic

Johnson, Ben
ben.johnson@bristol.ac.uk
University of Bristol, UK

Jouneau Pierre-Henri
pierre-henri.jouneau@cea.fr
MEM, Grenoble, France

Kodner, Robin
kodnerr@wwu.edu
Western Washington University, USA

Koritenská, Klára
koritenk@natur.cuni.cz
Charles University, Prague, Czech Republic

Krueger-Hadfield, Stacy
sakh@vims.edu
Virginia Institute of Marine Science, Eastern Shore Laboratory, USA

Larose, Catherine
catherine.larose@univ-grenoble-alpes.fr
IGE, Grenoble, France

Lavergne, Sébastien
sebastien.lavergne@univ-grenoble-alpes.fr
Université Grenoble Alpes, LECA, France

Leborgne-Castel, Nathalie
nathalie.leborgne-castel@inrae.fr
Université Bourgogne Europe, France

Leroy-Basson, Gerhard
3373827@myuwc.ac.za
University of the Basque Country (UPV/EHU), Spain

Maréchal, Eric
eric.marechal@cea.fr
LPCV, Grenoble, France

McKenzie, Caroline
caroline.mckenzie@sorbonne-universite.fr
Sorbonne Université, CQSB, Paris, France

Mulligan, Lucy
uu22868@bristol.ac.uk
University of Bristol, UK

Nedbalová, Linda
lindane@natur.cuni.cz
Charles University, Prague, Czech Republic

Nievergelt, Adrian
adrian.nievergelt@mpimp-golm.mpg.de
Max Planck Institute of Molecular Plant Physiology, Golm, Germany

Pernet, Lydia
lydia.pernet@cea.fr
LPCV, Grenoble, France

Procházková, Lenka
lenka.prochazkova@natur.cuni.cz
Charles University, Prague, Czech Republic

Puissant, Jérémy
jeremy.puissant@univ-grenoble-alpes.fr
LECA, Grenoble, France

Ravanel, Stéphane
stephane.ravanel@cea.fr
LPCV, Grenoble, France

Raymond, James
james.raymond@unlv.edu
University of Nevada, Las Vegas, USA

Remias, Daniel
daniel.remias@plus.ac.at
University of Salzburg, Austria

Roussel, Léon
leonroussel25620@gmail.com
CNRM / Centre d'Études de la Neige, Grenoble, France

Serbutoviez-Verville, Camille
camille.serbutoviezverville@cea.fr
LPCV, Grenoble, France

Si Larbi, Greg
gregory.si-larbi@cea.fr
LPCV, Grenoble, France

Suzuki, Hirono
hirono.suzuki1@gmail.com
Nord University & BIAM/CEA Cadarache, France

Valay, Jean-Gabriel
jean-gabriel.valay@univ-grenoble-alpes.fr
Jardin du Lautaret, France

Villain, Gaëlle
gaelle.villain@cea.fr
LPCV, Grenoble, France

Uwizeye, Clarisse
clarisse.uwizeye@cea.fr
LPCV, Grenoble, France

Williamson, Christopher
c.williamson@bristol.ac.uk
University of Bristol, UK

Tuesday, February 24th

18h30 we propose to gather at Minnimistan for a social event.

(https://minimistan.org/cafe-bar-restaurant/)

Rue des Minimes Cour Marcel Reymond, 38000 Grenoble

Please confirm your participation in advance, to help us controlling our expenses.

The buffet and two drinks are offered to registered participants.

Any additional drinks are at the attendee's expense.

Thursday, February 26th

We propose to organize a visit to the Exhibition “Rouge comme Neige” at the Museum of Natural History in Grenoble

Details can be found here (in French):

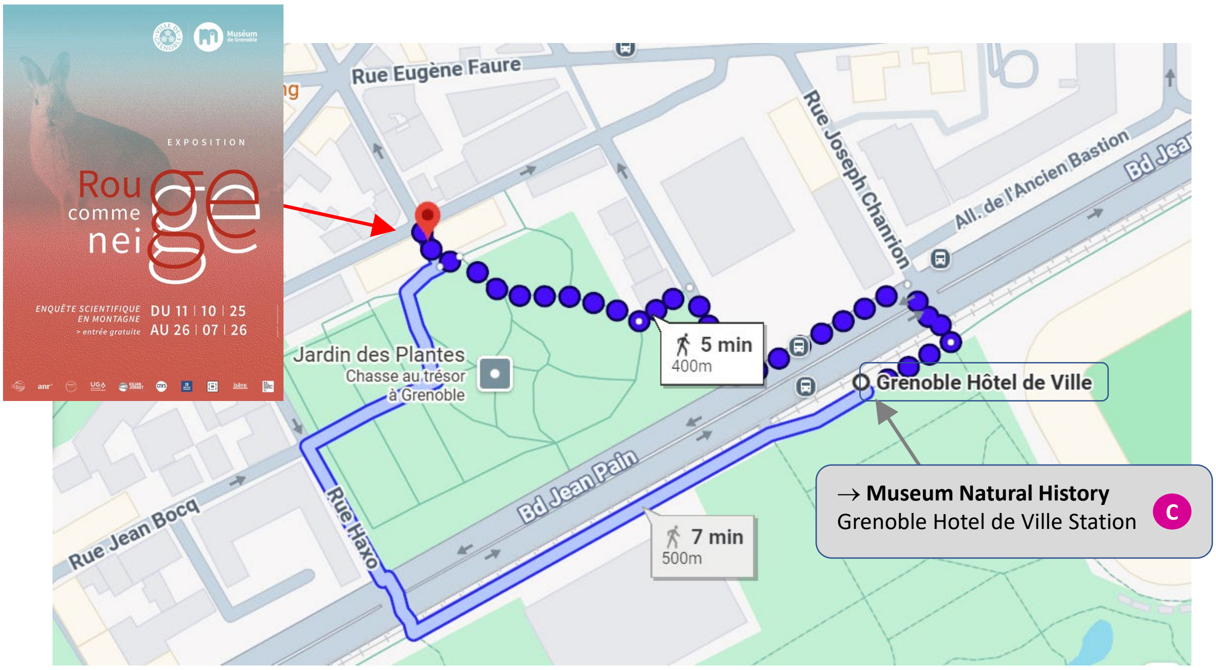
https://www.grenoble.fr/1105-rouge-comme-neige.htm

and here (in English):

https://alpalga.fr/en/expo2025-2026/

We hope you’ll appreciate this local outreach initiative!

The entrance is free, and you can go there by yourself, but if you wish, we can organize two group visits on Feb 26th, one beginning at 9:15 AM and a second at 10:30



→ **Minnimistan**
Notre Dame Station B

→ **SAGIAM @ MACI**
Gabriel Fauré Station B C

→ **Museum Natural History**
Hotel de Ville Station C

O1- Red Snow in the History of Science: Over Two Millennia of Inquiry

MARECHAL Eric

Laboratoire de Physiologie Cellulaire et Végétale, Grenoble, France

An overview of the evolution of red snow studies since the first written descriptions, across the history of science.

O2- Archival red snow samples

GUENZI-TIBERI Pierre[1], EZZEDINE Jade A[1]. RAYMOND Breanna[2], ELLIS Marina[3], ZHANG Shuya[3], SI LARBI Gregory[1], JOUNEAU Pierre-Henri[4], GIELLY Ludovic[5], VILLAIN Gaelle[1], LE GALL Line[6], VALAY Jean-Gabriel[7], AMATO Alberto[1], KODNER Robin[8], QUARMBY Lynne[2], ALLABY Robin G.[3], COISSAC Eric[5], MARECHAL Eric[1]

[1]Laboratoire de Physiologie Cellulaire et Végétale (LPCV), Grenoble, France; [2]Simon Fraser University, Burnaby, Canada; [3]School of Life Sciences, University of Warwick, Coventry, UK; [4]Laboratoire Modélisation et Exploration des Matériaux (MEM), Grenoble, France; [5]Laboratoire d'Ecologie Alpine (LECA), Grenoble, France ; [6]Muséum National d'Histoire Naturelle, Paris, France; [7]Jardin du Lautaret, Grenoble, France; [8]Department of Environmental Sciences, Western Washington University, WA, USA

A presentation of the analysis of archival samples of red snows conserved in herbaria since the XIXth century, combining genomic and imaging analyses.

O3-LIVING SNOW PROJECT: A decade of data

KODNER Robin

Western Washington University, USA

Snow algae blooms are thought to be increasing in frequency and intensity due to climate warming; however, data describing how these blooms vary across space and time remain extremely limited, and historical records documenting their extent and distribution are scarce. In addition, fundamental questions persist regarding how snow algae blooms form, how snow and ice algal communities are connected globally, and how bloom dynamics relate to rapidly changing snow and ice habitats. Addressing these questions requires large, geographically expansive datasets that combine observations and samples from diverse alpine and polar environments. To meet this need, I launched the Living Snow Project (LSP) in 2017, a community-supported (citizen science) program that engages outdoor recreationists in generating robust observational datasets. Volunteers report snow algae blooms using a mobile app and collect samples for DNA analysis while recreating in alpine environments. Over the past decade, the LSP has generated a substantial dataset of snow algae amplicon sequences, with more than 1000 samples collected primarily across North America since 2013. Here, I present results from a large-scale 18S V4 amplicon analysis from a decade of samples, examining patterns in seasonality, community composition and assembly, biogeography, and snow habitat type. These findings highlight the significant untapped potential of community-enabled approaches for studying snow microbiomes and challenges working with large amplicon datasets. Future improvements to the program should focus on expanding metadata collection, simplifying and standardizing sample processing and bioinformatics, and enhancing the resolution of shared amplicon reference libraries.

O4-Highly endangered tropical glaciers in Colombia (South America) host supraglacial communities of microalgae at a "daytime climate"

REMIAS Daniel[1], UETAKE Jun[2], CEBALOS Jorge L. [3], USUBA Suzunosuke[4], TAKEUCHI Nozomu[4], PROCHÁZKOVÁ Lenka[5]

[1]University Salzburg, Austria; [2]Japan; [3]Bogota, Colombia; [4]Chiba, Japan; [5]Charles University, Czech Republic

Glacier ice algae occur worldwide in polar and mid-latitude mountain ranges, causing surface blooms during the melting period at predominantly seasonal climates (summer/winter). In contrast, the rapidly vanishing equatorial glaciers harbour specific microbial communities at a diurnal climate (dry forenoon/wet afternoon). During an expedition in 2024, we sampled three Colombian glaciers in the National Parks Los Nevados and El Cocuy. The aim was to describe the tropical cryoflora for the first time, and to compare the communities at the metagenomic level with mid-latitude and Arctic glaciers. Two sets of ITS2 primers were applied, specifically targeting glacier ice algae and snow algae. For the genus *Ancylonema*, this showed interesting biogeographic patterns, suggesting that a cosmopolite taxon of *A. nordenskioeldii* was co-dominant in tropical communities, while *A. alaskanum* and a "third" *A.* species, previously reported from Arctic-Alpine sites, were absent in Colombia. Moreover, the tropical cryoflora hosts a so far undescribed, "fourth" *Ancylonema* species which is rarely present in mid-latitude and Arctic sites.

O5-Unveiling genetic and morphological variation in snow algae communities at forested sites: Central Europe and north-eastern USA

PROCHÁZKOVÁ Lenka[1], REMIAS Daniel[2], HEJDUKOVÁ Eva[1], KOCIÁNOVÁ, Milena[3], HOHAM Ronald W.[4], NEDBALOVÁ Linda[1]

[1]Charles University, Czech Republic; [2]University of Salzburg, Austria; [2]Krkonoše National Park Administration, Czech Republic; [4]Colgate University, NY, USA

Snow algae research focuses mainly on high-alpine and polar regions, largely overlooking forested ecosystems despite significant diversity of cryoflora. These lower-altitude algal communities in forested areas are endangered by changes in snow conditions due to ongoing climate change. We analysed snow bloom samples collected over the last 10 years from mountain sites across Central Europe (Krkonoše, Šumava, High Tatras, Alps) and North-Eastern USA (Appalachian Mountains). ITS2 Illumina data and light microscopy were used to characterize the samples. The research aims were: 1) to test how snow algal communities above and below the forest-limit from different geographical locations differ, 2) to assess altitudinal patterns of distribution of the most abundant algal ASVs, 3) to determine the effect of different vegetation types, and 4) to gain insights into snow algal biogeography. This is one of the first records of blooms below canopy in the Alps and complements it with insights from Appalachian Mountains in North America demonstrating an underestimated cryoflora biodiversity in the forest-limit area (ecotone) and below it - in a typical forest.

O6-A New *Chloromonas* Species from the Barton Peninsula (Antarctica) with Eurythermal Growth and Photoprotective Traits

LEE Namju[1], SO Jeongha[1], KIM Sanghee[1], CHO Sung Mi[1]

[1]Division of Life Sciences, Korea Polar Research Institute (KOPRI), Incheon 21990, South Korea

Genus *Chloromonas* is a dominant green alga commonly found in snowfields, displaying a wide range of snow coloration. In this study, we report a novel *Chloromonas* species isolated from snow and lichen-associated samples collected on the Barton Peninsula, Antarctica. Phylogenetic analysis placed this alga within the *Chloromonadinia* group, forming a distinct clade without a close sister lineage. Vegetative cells were ellipsoidal to nearly spherical, with a thickened cell wall, and reproduced asexually via two to eight autospores. The strain exhibited a eurythermal growth pattern, showing an optimal growth rate of 0.35 day^{-1} at 12 °C. Under low temperature conditions (2 °C), zoospores maintained a small and static size, whereas at 22 °C, cells enlarged considerably. During the exponential growth phase, the cell color gradually changed from green to pinkish orange, corresponding to the enhanced accumulation of carotenoid pigments under varying temperature conditions. Furthermore, this alga exhibited strong photo-regulatory capacity under irradiances exceeding 250 or even 1,000 $\mu\text{mol m}^{-2}\,\text{s}^{-1}$, suggesting high-light tolerance. This study presents the first *Chloromonas* species that has evolved independently within *Chloromonadinia*, characterized by eurythermal growth and high-light adaptation—traits that may contribute to its ecological success in Antarctic snow environments.

O7-Determining ploidy and clonality in Chlainomonas sp. via single cell genetics

GERAGOTELIS Alexander[1], HAMILTON Trinity[2], KODNER Robin[3,4], MIEUZET Lucie[5], PATA Honu[3], STOECKEL Solenn[6], KRUEGER-HADFIELD Stacy[1,7]

[1]Virginia Institute of Marine Science Eastern Shore Laboratory, Wachapreague, VA, USA [2]Department of Plant and Microbial Biology and The Biotechnology Institute, University of Minnesota, Saint Paul, MN, USA [3]Department of Biology, Western Washington University, Bellingham, WA, USA [4]Department of Environmental Science, Western Washington University, Bellingham, WA, USA [5]IGEPP, INRAE, Institut Agro, Université de Rennes, Le Rheu, France [6]DECOD, L'Institut Agro, IFREMER, INRAE, 35000, Rennes, France [7]Department of Biology, University of Alabama at Birmingham, Birmingham, AL, USA

Chlainomonas blooms have been well documented along the alpine slopes around Bagley Lake (North Cascade Mountains, USA). However, basic biology of the Bagley species of *Chlainomonas*, such as the life cycle or reproductive mode, remains enigmatic. Consequently, we require a genetic approach to answer these outstanding questions. This project analyzes genetic variation using microsatellite loci in *Chlainomonas* sp. to identify ploidy and individual genotypes in the population – the first steps to supporting the hypotheses about the life cycle and characterizing the reproductive mode. This research will illuminate basic aspects of the biology of *Chlainomonas* sp., generating more accurate forecasting of how both *Chlainomonas* sp. and other snow algae might respond to climate change. This project also develops single cell population genetics, a novel approach for understanding microorganism populations by surveying single cells of *Chlainomonas* sp. taken directly from bloom events.

O8-Horizontal gene transfer underlies the freezing tolerance of Antarctic bdelloid rotifers

RAYMOND James

University of Nevada, Las Vegas, NV USA

Bdelloid rotifers are well known for their abilities to survive long periods of freezing as well as acquire foreign genes. Here, I describe bdelloid rotifers inhabiting an algal patch in Antarctica that have multiple homologs of ice-binding genes. Predicted structures of the proteins are well designed for ice-binding and a recombinant protein showed strong ice-binding activity. Multiple bdelloid rotifers in the algal patch were revived in less than an hour after storage at −25 °C for 24 y, an apparent record for laboratory-controlled studies. Several characteristics of these genes point to bacteria as their source. The remarkable freezing tolerance of bdelloid rotifers can thus be at least partially attributed to horizontally acquired bacterial genes encoding ice-binding proteins.

O9-The Hidden Cleaner: *Phenoliferia psychrophenolica* in a Sea of Red Snow Blooms

EZZEDINE Jade A.[1], GUENZI-TIBERI Pierre[1], VILLAIN Gaëlle[1], AIESE CIGLIANO Riccardo[2], DIAGNE Yacine[1], FRANCESCHI Enzo[3], DRULA Elodie[4,5], FORÊT Jérôme[3], VALAY Jean-Gabriel[3], PROCHÁZKOVÁ Lenka[6], REMIAS Daniel[7], TERRAPON Nicolas[4], AMATO Alberto[1], MARÉCHAL Eric[1]

[1]Laboratoire de Physiologie Cellulaire et Végétale, Grenoble, France ; [2]Sequentia Biotech SL, Barcelona, Spain; [3]Jardin du Lautaret, Grenoble, France; [4]Architecture et Fonction des Macromolécules Biologiques, Marseille, France; [5]Biodiversité et Biotechnologie Fongique, Marseille, France; [6]Department of Ecology, Faculty of Science, Charles University, Prague, Czech Republic; [7]Department of Environment and Biodiversity, University of Salzburg, Salzburg, Austria.

Psychrophilic pucciniomycotinous yeasts are widespread in snowfields and glacier ecosystems but their ecological roles remain poorly understood. We isolated a clonal strain of *Phenoliferia psychrophenolica* (LCC-F-001-001) from an alpine red snowfield. Its nuclear genome spans ~42 Mbp and encodes 11,523 genes, including 37 ice-binding protein genes—the highest number recorded in fungi to date—largely acquired via horizontal gene transfers. The strain tolerates repeated freezing, grows optimally at 10 °C, and forms pseudohyphae when temperatures exceed ~15 °C. Metabolically, it can assimilate phenolic compounds and small metabolites; we also show it hydrolyzes carotenoid and phenolic pigments derived from snow and glacial algae. With ~500 carbohydrate-active enzyme genes, its enzymatic repertoire ranks among the most diverse in Microbotryomycetes, comparable to related permafrost species. Together, these findings indicate *P. psychrophenolica* is a key decomposer during algal bloom decline in cryospheric habitats. It likely contributes significantly to carbon cycling between snow/ice environments and soils, due to its metabolic versatility and ability to degrade complex organic matter.

O10-SNOWGIANTS: Exploring Giant Virus Diversity and Cold-Adapted Enzymes in Arctic and Alpine Snow Algae

UL HASSAN Zohaib, HULATT Christopher J.

Marie Skłodowska-Curie Fellow, Faculty of Bioscience and Aquaculture, Nord University, Norway

Giant viruses (phylum *Nucleocytoviricota*) are increasingly recognized as important components of aquatic ecosystems, yet their presence and ecological roles in cryospheric environments remain virtually unknown. The SNOWGIANTS project is a 24-month Marie Skłodowska-Curie Fellowship aimed at detecting and characterizing giant viruses associated with snow, glacier, and lake algae in Arctic and Alpine regions.

Recent discoveries have revealed that giant viruses can establish cryptic infections in green algae, integrating large genomic elements into their hosts. These viruses encode remarkable metabolic capabilities, including enzymes involved in energy metabolism that challenge traditional views of viruses as metabolically inert. Building on these findings, SNOWGIANTS investigates whether similar virus-host relationships exist in cold-adapted algal communities and related snow algae species.

The project combines different molecular biology techniques to discover novel viral genomes from environmental samples and algal cultures. A particular focus is the identification of cold-adapted enzymes encoded by these viruses, which may offer unique properties for biotechnological applications.

By bridging environmental virology with enzyme bioprospecting, SNOWGIANTS aims to expand our understanding of giant virus ecology in extreme cold environments while exploring their potential as sources of novel biomolecules.

O11-Below the timberline: tracking snow algal blooms in mountain forests

NEDBALOVÁ Linda[1], PROCHÁZKOVÁ Lenka[1], JURAS Roman[1,2], HEJDUKOVÁ Eva[1], KORITENSKÁ Klára[1], MAN Matěj[1,3], KOCIÁNOVÁ Milena[4]

[1]Charles University, Czech Republic; [2]Czech University of Life Sciences Prague, Czech Republic; [3]Institute of Botany CAS, Czech Republic; [4]Krkonoše National Park Administration, Czech Republic

Snow algal blooms are a striking feature of mountain and polar regions worldwide, formed by specialised microalgae, mostly of the order Chlamydomonadales (Chlorophyta). Although these extremophiles have received increased attention due to their significant influence on snowmelt dynamics, forested areas remain relatively understudied. This study investigates the seasonal development of snow algal blooms on a forested site (spruce) in the Labský důl Valley in the Krkonoše Mountains (Czech Republic). In February-April 2024 and 2025, we conducted weekly sampling to capture changes in physical and chemical characteristics of snow cover and community composition, (ITS2 metabarcoding combined with light microscopy). Blooms were formed by a surprisingly high number of *Chloromonas* species, most of them undescribed. Metabarcoding revealed temporal shifts in community composition, with increasing diversity throughout the season and individual species showed distinct occurrence patterns between surface and deeper snow layers. The results provide one of the first insights into the temporal dynamics and vertical distribution of snow algae in forest zone.

O12-Exploring Prokaryotic and Eukaryotic Diversity Among Snow Algal Communities in Montana and Wyoming

BECK Ashley[1], ALTERMATT Tiffany[1], AMEND Abbigail[1], CONWAY Christopher[1], GARVIN Jack[1], MOJZIS Michal[1], MOORE Joel[1]

[1]Carroll College, Helena, MT, USA

Snow algae are keystone members of a diverse microbiome, coexisting with bacteria, fungi, and protozoa to colonize seemingly uninhabitable environments. While symbiotic relationships are likely critical in these communities, relatively little is known about the interaction mechanisms driving their assembly and development. We performed exploratory sampling during the summers of 2024 and 2025 in Glacier National Park and in the Beartooth, Gravelly, and Gallatin mountain ranges, collecting samples for Nanopore sequencing along with temperature, pH, and light reflectance measurements. Profiling of 16S communities showed shifts in Psuedomonadota and Rhodothermota between Beartooth and Gravelly samples, and 18S profiling showed distinct differences in dominant snow algal genera present in meltwater pools in Glacier National Park compared to snow samples. In the long-term, this work advances project goals to monitor blooms annually and elucidate interactions through the use of metabolic-scale models.

O13-High-resolution sampling reveals the spatial structure of a glacier algal bloom

WILLIAMSON, Christopher[1], JOHNSON Ben[1], FENG Shunan[2], STEVENS Ian[2], OLIVAS Bea[2], ANESIO Alexandre[2]

[1]MicroLab@Bristol, School of Geographical Sciences, University of Bristol, UK; [2]Department of Environmental Science, Aarhus University, Roskilde, Denmark

Blooms of pigmented glacier algae accelerate surface melting on glaciers and ice sheets and play a key role in regional and global biogeochemical cycles. However, the spatial structure of blooms as they evolve through space and time across complex supraglacial ice surfaces remains unknown. This knowledge is important for advancing our understanding of glacier algal bloom ecology as well as defining methods for rigorous ground-truth sampling of blooms for calibration and validation of larger-scale remote-sensing and modelling efforts. Here, we report on the outcomes of high-resolution sampling of a glacier algal bloom during the 2024 summer melt season on the south-western Greenland Ice Sheet (Site S6 of the K-transect). Application of geostatistical techniques to glacier algal abundance datasets generated from approximately 200 surface ice samples allowed to describe key attributes of bloom spatial structuring. Complementary UAV drone surveys allowed for production of high-resolution Digital Elevation Models of the sampled ice surface and first-order comparisons of glacier algal bloom spatial structure to fine-scale ice surface topology. Integration of findings allows us to contribute new knowledge on potential controls of glacier algal blooms in Greenland and to outline effective sampling techniques for ground-truth dataset production.

O14-Remote sensing of algal blooms on snow and ice in the European Alps

ROUSSEL Léon[1], DUMONT Marie[1], GASCOIN Simon[2], DI MAURO Biagio[3], MONTEIRO Diego[1], BAVAY Mathias[4], NABAT Pierre[5], EZZEDINE Jade A[6], FRUCTUS Mathieu[1], LAFAYSSE Matthieu[1], MORIN Samuel[5], MARECHAL Eric[6]

[1]Centre d'Études de la Neige, Université Grenoble Alpes, Université de Toulouse, Météo-France, CNRS, Centre Nationale Recherches Météorologiques (CNRM), Grenoble 38000, France; [2]Centre d'Études Spatiales de la Biosphère (CESBIO), Université de Toulouse, Toulouse 31000, France ; [3]Institute of Polar Sciences, National Research Council, Milan, Italy ; [4]Institut für Schnee und Lawinenforschung (SLF), Forschungsanstalt für Wald, Schnee und Landschaft (WSL), Davos Dorf 7260, Switzerland ; [5]Centre Nationale Recherches Météorologiques (CNRM), Université de Toulouse, Météo-France, CNRS, Toulouse 31000, Franc ; [6]Laboratoire de Physiologie Cellulaire et Végétale (LPCV), Grenoble 38000, France

Algal blooms decrease snow and ice albedo, accelerating the cryosphere melt and potentially feeding back on snow and glacier decline caused by climate change. Quantifying this feedback requires the understanding of bloom evolution with climate change. Little, however, is known about the drivers and the presence of algal blooms in the European Alps. Thus, we developed an algorithm to analyze 5 years of satellite data from the European Alps and separate the algal bloom occurrences on snow from similarly colored Saharan dust depositions. We also adapted this method to retrieve the presence of algae on the ice of Alpine glaciers. In a second step, we combine the occurrences of blooms with meteorological data and snowpack simulations to identify the drivers of blooms on snow. Results show that the upward migration of algae through the snowpack and blooming requires the presence of liquid water throughout the whole snow column for at least one month and a half. This sensitivity of snow algal blooms to liquid water is finally analyzed in the context of climate change and decreasing snow cover.

O15-Elevation-dependent shifts in snow algae blooms influence biological albedo reduction in western U.S. mountains

ALMELA Pablo[1], GIERSCH J. Joseph[2], KLIP Helena C. L.[2], HOTALING Scott[3], ELSER James J.[2], HAMILTON Trinity L.[1]

[1] University of Minnesota, USA; [2] Flathead Lake Biological Station, University of Montana, USA 2; [3] Watershed Sciences, University of Utah, USA

Elevation structures the physical environment of mountain snowfields, yet its influence on snow algae and their effects on surface reflectance are not well understood. We examined snow algal communities, cellular traits, and optical properties across seasonal blooms spanning ~2,500 m of elevation in the Cascade Range (California, Oregon, Washington) and the Rocky Mountains (Utah, Wyoming, Montana, USA). *Sanguina nivaloides* dominated most samples, but neither taxonomic composition nor algal cell density varied systematically with elevation. In contrast, particulate organic carbon in snow and algal cell size increased with elevation, while pigment content per cell declined and the astaxanthin-to-chlorophyll-a ratio increased. Snow reflectance also increased with elevation. Together, these results show that dominant snow algae adjust key cellular traits along elevational gradients, linking physiological acclimation to radiative processes across mountain ecosystems.

O16-Habitat specific variability and response of active microbial communities on the north-western GrIS

BROADWELL Emily L. M.[1], PERINI Laura[1], ZERVAS Athanasios[1], BADSBERG OVERGAARD Johanne[1], GILL OLIVAS Beatriz[1], ROSSEL Pamela E.[2], KEUSCHNIG Christoph[2], ANTONY Runa[2], BENNING Liane G.[2,3], TRANTER Martyn[1], ANESIO Alexandre M.[1]

[1]Department of Environmental Science, Aarhus University, Roskilde, Denmark; [2]GFZ Helmholtz Centre for Geosciences, Potsdam, Germany; [3]Department of Earth Sciences, Freie Universität Berlin, Berlin, Germany

Environmental conditions and sampling strategy were found to influence the characterisation of active microbial communities associated with *Ancylonema* glacier ice algal blooms in north-western Greenland. Bulk-scale sampling (2 × 2 m) revealed relatively consistent eukaryotic communities but significantly different prokaryotic communities between the Qaanaaq ice cap and the nearby continental ice sheet, driven mainly by a higher relative abundance of cyanobacteria on the mainland ice sheet. Smaller scale 'micro-transect' sampling (20 × 20 cm) also revealed how the active microbial community spatial variability can shift even over ~2 m, with variations in shading, orientation, and proximity to small supraglacial streams revealing differences in both the taxonomic composition and functional gene expression. Different characterisations were produced from each sampling strategy in close proximity on the Qaanaaq ice cap, highlighting the importance of sampling strategy when comparing active microbial communities from ice surfaces across the wider cryosphere.

O17-Evidence for carbon limitation in snow algae blooms across the Cascade Range and Rocky Mountains

HAMILTON Trinity[1], ALMELA Pablo[1], HAVIG Jeff[1], KLIP Helena[2], ELSER Jim[2], GIERSCH Joe[2], HOTALING Scott[3]

[1]Department of Plant and Microbial Biology, University of Minnesota, St. Paul, Minnesota, USA; [2]Flathead Lake Biological Station, University of Montana, Polson, Montana, USA; [3]Department of Watershed Sciences, Utah State University, Logan, UT, USA

Snow algal blooms decrease snow albedo and accelerate melt. The abundance and distribution of algae are linked to the magnitude of the impact on melt. Factors that control the abundance and distribution of snow algae include liquid water and the availability of carbon, fixed nitrogen, and phosphorus, in addition to trace elements. Here, we used stable isotopes of carbon in snow algae biomass and dissolved inorganic carbon to examine the impact of inorganic carbon availability on snow algae abundance in the Cascade Range and the Rocky Mountains in the northwestern US. In both the Rocky Mountains and the Cascade Range, ^{13}C fractionation decreases with increasing biomass, consistent with carbon limitation as blooms increase in size.

O18-Antarctic snow algal responses to temperature - potential implications of climate change

DAVEY Matthew P.[1], RUIZ GONZALEZ Carla[1,2], GRIGG Vaila[1], THOMAS Naomi[1], THOMAS Alex[1], MACPHERSON Ewan[1], DILLON Lara[1], GOBER Emilie[1], SMITH Alison G.[3], COCKELL Charles[2], CONVEY Peter[4]

[1]Scottish Association for Marine Sciences, Dunbeg, Argyll, UK; [2]Physics and Astronomy, University of Edinburgh, Edinburgh, UK; [3]Department of Plant Sciences, University of Cambridge, UK; [4]British Antarctic Survey, Madingley Road, Cambridge, UK

*Corresponding presentor: Matthew P. Davey matt.davey@sams.ac.uk

Snow algae are important primary producers in Antarctic terrestrial ecosystems as they play key roles in nutrient cycling and carbon assimilation and impact the wider ecosystem by acting as an albedo reducing agent. As short-term Antarctic summer heatwaves approach 20°C, parameterising temperature tolerance for snow algal species is key to determining how climate change may affect community composition and primary productivity as their habitat range changes. Here, we studied three Antarctic snow algae strains isolated from the same region (Ryder Bay, Antarctic Peninsula). The strains were exposed to increasing temperatures (4°C to 20°C) across four experiments to assess the intraspecific and interspecific effects of temperature on growth, metabolite composition and photochemistry. Of these strains, *Limnomonas* sp. and *Chlorominima* sp. did not survive the 20°C treatment and demonstrated limited metabolic plasticity between the lower temperature parameters. *Micractinium* sp., conversely, grew well at all temperatures and displayed metabolomic parallels to the temperate alga Chlorella vulgaris. The photochemistry (Quantum Yield (QY) curves, O_2 production) of *Micractinium* sp. was also minimally affected by temperature, unlike *Limnomonas* sp. that showed reduced QY at higher temperatures and *Chlorominima* sp. that had the most varied QY and O_2 production between temperature treatments. Our findings suggest that heatwaves such as those increasingly being experienced in polar regions, as well as permanently increased temperatures, are very likely to lead to changes in cryomicrobial community composition, with psychrotolerant species such as *Micractinium* sp. being more resilient to these changes.

O19-Glacier ice algae have a plant-like response to freezing stress

FEORD Helen K.[1], ZERVAS Athanasios[2], SIPES Katie[2], KEUSCHNIG Christoph[1], JAARSMA Ate H.[3], BADSBERG OVERGAARD Johanne[2], ADRIAN Lorenz[4,5], TRANTER Martyn[2], ANESIO Alexandre M.[2], BENNING Liane G.[1,6]

[1]Interface Geochemistry, GFZ German Research Centre for Geosciences, Potsdam, Germany; [2]Department of Environmental Science, Aarhus University, Roskilde, Denmark ; [3]Netherlands Institute of Ecology (NIOO-KNAW), 6708 PB Wageningen, The Netherlands; [4]Department Molecular Environmental Biotechnology, Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany; [5]Chair of Geobiotechnology, Technische Universität Berlin, Berlin, Germany; [6]Department of Earth Sciences, Freie Universität Berlin, Berlin, Germany

Glacier bare ice surfaces are dominated by streptophyte glacier ice algae of the genus Ancylonema. Streptophyte algae are the only photosynthetic eukaryotes (and the biggest biomass fraction) to undergo vegetative growth and bloom on bare ice, suggesting unique cellular adaptations to this harsh environment. However, little is known about how they functionally respond to specific abiotic conditions such as freezing. We conducted a seasonal study over a 21-day period during the melt season, sampling from five bare ice patches on the Greenland Ice Sheet to assess algae-dominated community responses to different meteorological conditions including freezing events. The streptophyte algae did not vary in abundance during the freezing events, however functional analysis indicated an important algal freezing response linked to phytohormone and photoreceptor signalling, and cell wall remodelling. This algal response to freezing is similar to cold responses in land plant, indicating a shared ancestral streptophyte toolkit underlying the adaptation of land plants and streptophyte algae to cold stress.

O20-The energetics of the motile cilium

NIEVERGELT Adrian Pascal[1], PIGINO Gaia[2], VON APPEN Alexander[1], RODENFELS Jonathan[1]

[1]Max Planck Institute of Molecular Plant Physiology, Potsdam, Germany; [2]Human Technopole, Milano, Italy; [3]Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany

Motile cilia, found on many unicellular algae, dissipate energy during their beat cycle in order to generate a power-stroke. The amount of energy used is an important quantity of cilia biophysics that is necessary to better understand the mechanism of the periodic beating motion at a molecular level. However, how much energy is exactly dissipated over time has been a matter of some discussion for a long time. I will discuss how we use micro isothermal calorimetry to quantitatively dissect the energy use of the cilia of the green algal model *Chlamydomonas*. By measuring the heat generated from a well-defined growing population of cells, we can probe the swimming contribution to the total heat by mutagenesis, environmental conditions and the use of drugs that influence the swimming behavior. Our results show a significant and complex impact of motility on energy dissipation and life cycle of *Chlamydomonas*. Finally, by introducing light into our microcalorimeter setup, we see circadian effects on motility dependent heat production.

P1-Applying Place-Based Learning in the Undergraduate Laboratory: A Case Study in Snow Algae

BECK Ashley[1]

[1]Carroll College, Helena, MT, USA

Place-based learning integrates content knowledge within students' individual contexts and can increase motivation and interest by enhancing relevance to their daily lives. Montana is a biology educator's paradise and is home to many mountain ranges where snow algae can be found. The Advanced Research Experience in Genomics capstone lab course was piloted in the fall of 2025 to provide students experience conducting original research under the umbrella of a National Science Foundation funded project. Students worked in pairs to ask and answer a research question involving snow algae, resulting in both a written research proposal and an oral poster presentation. Although students started from the same theme, projects varied widely in scope, ranging from investigating temperature and precipitation patterns to pigment production to oxidative stress. This presentation highlights elements of the course structure that may be of interest to other educators, along with key knowledge and skills gained by students in the class.

P2-Cellular and Physiological Reponses of Arctic Diatoms to Sea Ice Conditions

BURKE Rory [1], **PLASSART Arthur** [2,3], **BOWLER Chris** [3],
BABIN Marcel [2], **MARÉCHAL Eric**[1]

[1]Laboratoire de Physiologie Cellulaire et Végétale, Grenoble, France; [2]Biology Department, Takuvik International Laboratory, Laval University - CNRS, Quebec, Canada ; [3]Plant and Diatom Genomics Laboratory, Institut de Biologie de l'École Normale Supérieure, Paris, France

Diatoms are a group of unicellular microalgae that have successfully colonized virtually every marine and freshwater habitat on the planet. They are thought to be responsible for up to 40% of all marine primary production, and thus contribute substantially to global biogeochemical cycles of carbon and other macronutrients. In the arctic ocean, diatoms are the most important primary producers, and are capable of growing underneath and even within the sea ice despite the incredibly harsh abiotic environment this habitat represents. Here, we describe the survival, growth and physiology of three different arctic diatoms species under salinity and low temperature stress representative of the sea ice environment. These species display differing responses to such conditions, indicative of their specific adaptations to varying extents of sea ice cover throughout the seasons.

P3-The environmental biophysics of microalgal migration in snow

DE VRIES Caitlin[1], **CROZE Ottavio**[1], **SANDELLS Melody**[2], **DAVEY Matthew**[3]

[1]Newcastle University; [2]Northumbria University; [3]Scottish Association for Marine Science, UK

The cyclical process of snow algal blooms forming on snowpack surfaces is facilitated by the availability of sunlight, nutrients and the presence of meltwater. Despite this knowledge, the mechanics of snow algae's migration through snow remains poorly understood. With relevance in biotechnological applications and responsibility for severe ecological and hydrological impacts to their environments, understanding snow algae migration is important from multiple perspectives. Currently in the methods development stage, we are investigating snow algae motility, cell-snow crystal interaction, and tactic behaviour. Using a cryo-photobioreactor containing synthetic snow, we plan to observe individual and collective behaviours under controlled gradients of light (phototaxis), nutrients (chemotaxis), fluid flow (gyrotaxis), and temperature (thermotaxis). We aim to quantify how these behaviours influence algal transport through snow and modify snowpack optical and thermodynamic properties.

P4-Optimizing the nutrient conditions for glacier ice algae cultivation

PAASCH Mirjam[1,2], **PARFILKO Maryna**[1], **PHAM Thanh Hang**[1], **ANTONY Runa**[1],
PEREZ Jeffrey Paulo H.[1], **TRANTER Martyn**[3], **ANESIO Alexandre M.** [3],
BENNING Liane G. [1,2], **FEORD Helen**[1]

[1]Interface Geochemistry, GFZ Helmholtz Centre for Geosciences, Potsdam, Germany; [2]Department of Earth Sciences, Freie Universität Berlin, Berlin, Germany; [3]Department of Environmental Science, Aarhus University, Roskilde, Denmark

Glacier ice algae of the genus *Ancylonema* grow on bare ice surfaces of glaciers and ice sheets. They are highly adapted to low temperatures, high light and limited nutrients. This specialization hampered our ability to grow them in culture until 2023, when two *Ancylonema* spp. strains were isolated from the Austrian Alps and the Greenland ice sheet. Both studies used different culture media: either standard SFM (Austrian strain) or 1% 3N BBM (Greenland strain). SFM contains higher nutrient concentrations (including N, Mg, Mn, Fe), while 1% 3N BBM is supplemented with soil extract, which increases the concentration of several micronutrients (including V, Mn, Fe, Zn). However, the optimal growth conditions and nutrient requirements for *Ancylonema* cultures have not been established. To address this knowledge gap, we evaluated the influence of media composition on both algal cultures by following their growth with cell counts and assessing changes in their photophysiology using Pulse-amplitude modulation fluorometry. Our results revealed higher growth rates and carrying capacities in SFM, while the addition of single macro- or micronutrients and vitamins did not show an effect on growth. This suggests a positive effect of a combination of macro- and micronutrients on *Ancylonema* growth rather than a response to higher concentrations of single nutrients.

P5-The DEEP PURPLE project

ANESIO Alexandre, BENNING Liane G., TRANTER Martyn, FEORD Helen, and the DEEP PURPLE research team

[1]Interface Geochemistry, GFZ Helmholtz Centre for Geosciences, Potsdam, Germany; [2]Department of Earth Sciences, Freie Universität Berlin, Berlin, Germany; [3]Department of Environmental Science, Aarhus University, Roskilde, Denmark

---

P6-Desiccation stress responses of red snow algae communities from Livingston Island (Maritime Antarctica)

FERNÁNDEZ-MARÍN Beatriz[1], BASSON Gerhard Leroy[1], BEREZIARTU Alotz[1], GONZALEZ GAYA Belen[1], PROCHÁZKOVÁ Lenka[2], ALDAY Enara[1], ARZAC Irati[1], LAZA Aitor[1], GARCIA-PLAZAOLA José Ignacio[1]

[1]Dpt. Plant Biology and Ecology, University of the Basque Country (EHU), Spain; [2]Dpt. Ecology, Charles University, Prague, Czech Republic

Snow melting exposes red snow communities, in particular *Sanguina nivaloides*, to an enhanced risk of desiccation. While it is assumed that cysts of this species are able to tolerate dehydration, very few is known about the mechanisms employed. In the present study we characterized the hydraulic responses of two distinctive red algae communities collected in the vicinity of the Spanish Antarctic Station Juan Carlos I in Livingston Island (Maritime Antarctica). The first corresponds to a seasonal snowbank, while the second is a permanent snow patch developed over a layer of glacial ice. Both communities differed in algal composition, but *S. nivaloides* was always the dominant species. Progressive desiccation induced a reversible drop in Fv/Fm at water potentials (WP) lower than -2 MPa. However, turgor loss point occurred at much lower WP (-4 MPa). Both communities showed the same behaviour in response to desiccation.

P7-Deciphering photochemical responses of complex algal communities in Antarctic snow by the use of a PAM fluorescence microscope

GARCIA-PLAZAOLA José Ignacio[1], PROCHÁZKOVÁ Lenka[2], BASSON Gerhard Leroy[1], ALDAY Enara[1], ARZAC Irati[1], LAZA Aitor[1], FERNÁNDEZ-MARÍN Beatriz[1]

[1]Dpt. Plant Biology and Ecology, University of the Basque Country (EHU), Spain; [2]Dpt. Ecology, Charles University, Prague, Czech Republic

Snow and glacier ice communities are formed by a number of species. When photosynthetic responses of complex communities are studied under field conditions the population is considered as a whole, but it is not possible to assign the responses observed to specific species. In the present work we have characterized the photochemical responses of algae communities in Livingston Island (Maritime Antarctica). Samples were collected in two snowbeds located in the vicinity of the Spanish Antarctic Station Juan Carlos I. After collection, samples were carried to the Station where a WALZ Imaging System coupled to an epifluorescence microscope was installed. *In vivo* analysis allowed to obtain a basic photochemical description (light curves, kinetic responses, Fv/Fm) of individual cells of four different species: *Ancylonema nordenskioeldii*, *Sanguina nivaloides*, *Chloromonas* sp., and *Raphidonema nivale*. In the case of *S. nivaloides*, the most abundant species in this study, different developmental stages were characterized separately.

P8-3D Confocal-driven expansion microscopy approach for microalgal cell biology

GIUSTINI Cécile[1*], PERNET Lydia[1], ALLORENT Guillaume[1], ALBANESE Pascal[1,2], FINAZZI Giovanni[1], UWIZEYE Clarisse[1]

[1]Univ. Grenoble Alpes, CNRS, CEA, INRAe, IRIG-LPCV, Grenoble, France; [2]Univ. Grenoble Alpes, Inserm, CNRS, CEA UAR2048 BGE-EDyP, France

[#]

¯Contributed equally to this work

Eukaryotic photosynthesis occurs in a specific organelle, the plastid, where atmospheric CO_2 is assimilated to produce reserve sugars. The efficiency of this process is closely linked to plastid structure, which varies among photosynthetic organisms. Therefore, understanding the relationship between plastid structure and function presents a significant challenge in the fields of plant and microalgal biology. This study demonstrates that combining three-dimensional expansion microscopy (3DExM) with confocal imaging provides a viable alternative to three-dimensional electron microscopy for analyzing microalgal cells and their plastids. This method improves spatial resolution by enlarging biological samples while maintaining cellular architecture and compatibility with fluorescence imaging. 3DExM employs low- to medium-magnification objectives (40/63) to achieve a resolution of approximately 30 nm. This enables high-quality 3D imaging of microalgal cells and detailed visualization of plastid organization, exceeding the limits of conventional confocal microscopy. The method supports protein labelling, enabling the localization of essential components, such as photosystems, photoprotective proteins, and nuclear markers. Finally, confocal-driven 3D expansion microscopy links structural and functional analyses, unlocking new insights into plastid architecture, light-induced remodeling of photosynthetic machinery, and microalgal cell physiology.

P9-Seasonal variations in metabolite and transcript profiles in the streptophyte green alga *Zygogonium ericetorum*

SCHINNERL Viktoria[1], ARC Erwann[1], STEGNER Moritz[1], KRANNER Ilse[1], PUSHKAREVA Ekaterina[2], BECKER Burkhard[2], HOLZINGER Andreas[1]

[1]University of Innsbruck, Department of Botany, Austria; [2]University of Cologne, Institute for Plant Sciences, Germany

The streptophyte green alga *Zygogonium ericetorum* (Zygnematophyceae) was examined in its natural alpine environment. The central hypothesis is, that significant changes in primary metabolites occur due to fluctuations in abiotic factors. This will provide insights into the species acclimation. Field samples were collected monthly during the summer season from Mount Schönwieskopf (2350 m a.s.l.), Obergurgl, Tyrol, Austria. *In situ*, algae experienced abiotic stress, including high light (~2000 µmol photons m^{-2} s^{-1}), UV-A (~5.5 mW cm^{-2}), UV-B (~23.5 µW cm^{-2}), acidic pH (5.5–6.2), and elevated water temperatures (up to 27.6 °C). Metabolite profiling was conducted via GC-MS, and revealed significant seasonal shifts as indicated by principal component analysis (PCA). Non-metric multi-dimensional scaling (NMDS) plot showed UV-A, UV-B and water temperature as significant abiotic factors. August showed the most differential pattern. Pigment analysis was performed via HPLC and pigment accumulations correlated with metabolic changes. Differential gene expression analysis using RNA-Seq was performed exemplarily and generated 23 million quality-filtered reads, assembled into 108,908 transcripts. Transcriptomic data suggest the presence of *Z. ericetorum* alongside other organisms such as the cyanobacterium *Scytonema* sp. Our findings enhance our understanding of *Z. ericetorum* acclimation to their natural environment.

This study was supported by Austrian Science Fund (FWF) project 10.55776/P34181 to AH.

P10-Beyond ice: Cryosphere-adjacent limestone rocks as reservoirs of cold-adapted green algae

JÍRA Stanislav[1], PROCHÁZKOVÁ Lenka[1], NEDBALOVÁ Linda[1]

[1]Charles University, Czech Republic

Snow and glacier ice algae have received considerable attention and intensive investigation during snowmelt periods; however, little is known about their persistence outside the snowpack. Simultaneously, mountain lithobiontic algae represent a widespread but understudied group in mountain environments. These knowledge gaps may partially overlap, as cold-exposed terrestrial habitats could harbour lineages related to cryosphere-associated algae. This work focused on the diversity of lithobiontic green algae in the Northern Calcareous Alps across an altitudinal gradient (800 to 2,655 m a.s.l.). Algal diversity, based on ITS2 rDNA metabarcoding, declined significantly with increasing elevation, indicating stronger environmental filtering at higher altitudes. Community composition was dominated by aerophytic and lithobiontic lineages, mostly typical of rock habitats. Several taxa among the dominant OTUs belonged to genera previously reported from alpine, polar, or periglacial terrestrial environments. Only a small subset of taxa showed documented associations with snow or glacier-influenced habitats *sensu stricto*. The results indicate that alpine limestone algal communities primarily overlap with cold terrestrial, cryosphere-adjacent ecosystems rather than with snow or glacier ice habitats. This suggests that exposed rock surfaces host predominantly strictly aerophytic lithobiontic algae, with limited representation of algae associated with glacier ice and snow.

P11-GLASS (Glacier Algal Sampling Strategies)

JOHNSON Benjamin[1], WILLIAMSON Christopher[1]

[1]University of Bristol, School of Geographical Sciences, MicroLab@Bristol

Glacier algae form widespread blooms during summer melt seasons, forming the basis of supraglacial food webs, driving carbon and nutrient cycling and contributing to melt through albedo feedback. Despite their importance, we still lack spatially resolved ground truth measurements of glacier algal blooms across the cryosphere, limiting our ability to calibrate and validate larger-scale remote sensing and modelling studies that are needed to understand their impacts at globally relevant scales. GLASS is a POLARIN and Tarfala Research Station funded project that aims to tackle this knowledge gap by undertaking high-resolution sampling and geostatistical analysis of a glacier algal bloom to develop a detailed understanding of how their spatial structure evolves, translating this into actionable methodologies for bloom monitoring by the wider scientific community (CASP-ICE network). Field sampling was carried out during the 2025 summer melt season on Storglaciären in Arctic Sweden, my poster presentation aims to present this project and its current progress.

P12-Living Snow Project as a global citizen science program

KODNER Robin[1], YOUNG KT[2], PATA Honu[1], HOVIND Katie[1], ROUSSEL Leon[2], EZZEDINE Jade[3], MARECHAL Eric[2,3], WILLIAMSON Chris[3], TAKEUCHI Nozomu[4]

[1]Western Washington University, Bellingham, WA, USA; [2]Université Grenoble Alpes, Grenoble, France; [3] Laboratoire de Physiologie Cellulaire & Végétale, CEA-Grenoble, Grenoble, France [4]University of Bristol, Bristol, United Kingdom; [5]Chiba University, Chiba, Japan

The Living Snow Project (LSP) is a community-enabled (citizen science) program that engages outdoor recreationists in collecting data on snow microbiome communities across mountain ranges. Through the Living Snow Project App and volunteer-generated samples, we are building large datasets that document snow algae blooms and the biodiversity of associated organisms. Initially focused on the Cascade Mountains, the LSP has expanded across North America over the past decade, and in 2025 extended to the European Alps and Japan. These expansions included translating the app into eight languages, integrating snow algae prediction maps, and adapting volunteer recruitment strategies to fit each cultural context. This broadened participation enables cross-range comparisons of annual snowpack dynamics and their effects on snow microbiomes in diverse alpine landscapes experiencing varying degrees of climate-driven environmental change. Next steps include engaging communities in understudied regions such as Central Asia and South America and strengthening connections between the LSP and the broader snow algae research community to better support shared scientific objectives.

P13-Snow algal blooms under climate change: nearly 50 years of observations in the Krkonoše Mountains (Czech Republic)

KORITENSKÁ Klára[1], JURAS Roman[1,2], PROCHÁZKOVÁ Lenka[1], HEJDUKOVÁ Eva[1], KOCIÁNOVÁ Milena[3], NEDBALOVÁ Linda[1]

[1]Charles University, Czech Republic; [2]Czech University of Life Sciences Prague, Czech Republic; [3]Krkonoše National Park Administration, Czech Republic

Mountain regions worldwide are experiencing significant changes in snow cover patterns due to climate change, affecting specialised snow algae communities. This study analyses a historical database of snow algal bloom occurrences (since 1976) in the Krkonoše Mountains (Czech Republic) to identify predictors of bloom onset and development. Long-term meteorological and hydrological data reveal that snow algal blooms occurred predominantly in May to June (until July in alpine zone). Their timing was linked to cumulative temperatures and streamflow patterns as blooms require specific microclimatic conditions, particularly prolonged melting periods with liquid water in the snowpack. The available records indicate a trend towards earlier occurrence of blooms each year, similar to snowmelt patterns. The year 2024 was exceptional, with blooms appearing as early as March. These findings suggest that ongoing climate change, characterised by shorter winters and earlier, more frequent melting periods, may significantly alter the temporal occurrence and spatial distribution of snow algal blooms in Central European mountains.

P14-Reproduction we cannot see: microbial population genetics

KRUEGER-HADFIELD Stacy[1], GERAGOTELIS Xander[1], HAMILTON Trinity[2], KODNER Robin[3,4], STOECKEL Solenn[5]

[1]Virginia Institute of Marine Science Eastern Shore Laboratory, Wachapreague, VA, USA; [2]Department of Plant and Microbial Biology and The Biotechnology Institute, University of Minnesota, Saint Paul, MN, USA; [3]Department of Biology, Western Washington University, Bellingham, WA, USA; [4]Department of Environmental Science, Western Washington University, Bellingham, WA, USA; [5]ECOD, INRAE, L'Institut Agro, IFREMER, Rennes, France

Unicellular and partially clonal eukaryotes are found across evolutionarily diverse lineages, including many algae. Yet, our understanding of their evolution is limited due to inherent challenges of using tools and predictions that were developed in multicellular and often obligately sexual taxa. These tools are often not tractable in microbial eukaryotes where extracting DNA from unique individuals is difficult. Further, population-level work on microbial eukaryotes has been done primarily on culturable taxa, thereby imposing artificial selection and leading to unrepresentative views of natural diversity. The characterization of microbial reproductive modes (i.e., sex vs. clonality) cannot be predicted by the observation of organisms themselves, especially for the unculturable majority. Therefore, characterization of microbial reproductive modes in natural populations is only possible through population genetic approaches. This poster will highlight recent single cell techniques and appropriate population genetic analyses.

P15-Physiological responses to multiple abiotic stressors of snow algae communities at Livingstone Island (Maritime Antarctica)

BASSON Gerhard Leroy[1], BEREZIARTU Alotz[1], GONZALEZ GAYA Belen[1], PROCHÁZKOVÁ Lenka[2], ALDAY Enara[1], ARZAC Irati[1], LAZA Aitor[1], FERNÁNDEZ-MARÍN Beatriz[1], GARCIA-PLAZAOLA José Ignacio[1]

[1]Dpt. Plant Biology and Ecology, University of the Basque Country (EHU), Spain; [2]Dpt. Ecology, Charles University, Prague, Czech Republic

As global warming accelerates, premature thawing events are becoming increasingly frequent in polar snowfields, abruptly exposing snow algae communities (SACs) to elevated stress and threatening their survival. In this study, we assessed the physiological responses of SACs using red snow collected near the Spanish Antarctic Station Juan Carlos I (Livingston Island, Maritime Antarctica). Samples were gently thawed, concentrated onto glass fiber filters, and exposed to desiccation, high light, and freezing stress. Chlorophyll fluorescence (Fv/Fm) revealed that SACs exhibited full tolerance to desiccation, while high light and experimental freezing induced photo-physiological damage from which cells could not fully recover. Additionally, pigment profiling by UHPLC-MS showed that more than 90 % of the pigment pool consisted of esterified astaxanthin. Overall, this study reveals a hierarchy of stress tolerance in SACs, with resilience to desiccation but limited recovery to high light and freezing.

Keywords : Snow algae, Chlorophyll fluorescence, Desiccation tolerance, Photoinhibition, Astaxanthin esters

---

P16-Investigating Ice-binding proteins across the phylogenetic, biogeographical, and physiological diversity of cryophilic algae

McKENZIE Caroline, GRAF Louis, DEMEULE Maïwen, DORRELL Richard

Sorbonne Université, Paris, France

Cryospheric habitats such as the Arctic and Southern Oceans, as well as polar and mountainous ice and snow, are inhabited by a diverse range of eukaryotic algae, originating from many different groups (diatoms, green algae, chrysophytes...). These taxa, although separated by hundreds of millions of years of evolution, possess convergent adaptations that allow them to tolerate low temperatures throughout the year. These adaptations include ice-binding proteins, which can form complexes around nascent ice crystals. Ice-binding proteins serve multiple functions including preventing osmotic shock during freezing transitions in the cytoplasm, or by allowing adhesion to and accumulation in floating sea ice during the polar winter. This project will use bioinformatics approaches to understand how ice-binding proteins function across the phylogenetic, biogeographical, and physiological diversity of cryophilic algae, incorporating newly sequenced species and metagenes, freshwater and continental snow habitats.

P17-Ecophysiology of several new species of *Hydrurus*

PROCHÁZKOVÁ Lenka[1], ANDERSEN Robert[2], LEYA Thomas[3], LUKEŠ Martin[4], ŘEZANKA Tomáš[4], NEDBALOVÁ Linda[1], REMIAS Daniel[5]

[1]Charles University, Czech Republic; [2]University of Washington, USA; [3]Fraunhofer Institute for Cell Therapy and Immunology, Germany; [4]Czech Academy of Sciences, Czech Republic; [5]University of Salzburg, Austria

Most chrysophyte algae inhabit lake plankton or cold streams. In this study, we investigated the golden-brown chrysophycean blooms that occur during snowmelt in polar and alpine regions. We isolated golden-brown strains from water-saturated snow, glacier streams, and snow depressions based on field campaigns in the last eight years in Svalbard, the High Tatras, and the Austrian Alps. Surprisingly, 18S rRNA phylogeny placed all eight new unicellular strains within the Hydrurales. Although closely related to the macroscopic stream species *Hydrurus foetidus*, these strains differed significantly in the ITS2 region. We propose that their flagellated forms facilitate active movement within the water-saturated snowpack, optimising light exposure. Fluorometric analyses of photosystems revealed adaptation to high light conditions. Fatty acids, pigments, and compatible solutes were analysed to gain further insight into the ecophysiology of these cryosestic chrysophytes.

P18-Homeoviscous response to low temperature and darkness in *Phaeodactylum tricornutum*

SERBUTOVIEZ-VERVILLE Camille, BONNARDE Rachel, MARECHAL Eric, AMATO Alberto

Laboratoire de Physiologie Cellulaire et Végétale, Grenoble, France

Glycerolipids are key components of biological membranes and play a central role in cellular adaptation to environmental fluctuations. In photosynthetic organisms, membrane fluidity is tightly regulated through lipid remodeling, particularly in response to cold and light availability. Diatoms, such as *Phaeodactylum tricornutum*, are ecologically important marine microalgae that display remarkable metabolic flexibility. Here, we investigated the lipidomic response of *P. tricornutum* exposed to low temperature (10 °C), darkness, or both, compared to standard growth conditions (20 °C, 12:12 light:dark). Cold and darkness induced major changes in lipid class distribution and fatty acid composition. Phosphatidylcholine and phosphatidylethanolamine levels increased, whereas plastidial galactolipids decreased, and triacylglycerols were absent in darkness. Cold stress enhanced fatty acid unsaturation in several membrane lipids, while light availability was essential for specific plastidial lipid remodeling. These results highlight light-dependent regulatory mechanisms underlying membrane adaptation to cold stress in diatoms.

P19-Snow algae studies: Lautaret Garden, the place to be!

FORET Jérôme[1], GAVOTY Eglantine[1], LIGER Lucie[1], VANNARD Eric[1], BOUDARD Céline[1] et VALAY Jean-Gabriel[1]

[1]Jardin du Lautaret; Université Grenoble Alpes, CNRS

The Jardin du Lautaret (Grenoble Alpes university; CNRS) was created in 1899. It provides accommodations, facilities, lab access and technical field support for researchers who study the consequences on ecosystems of climate and land-use changes. It is a site that enjoys beautiful bloom's seasons! Among being a research center that hosts local and international scientific projects and teams, it's also a tourist site open to the public every summer. Around thirty research projects are carried out there each year. The Jardin du Lautaret is a member of the Grenoble observatories of Earth sciences and astronomy (OSUG). It is also a member of several European research infrastructures (Analysis and experimentation on ecosystems – AnaEE; Integrated carbon observation system – ICOS; Integrated European long-term ecosystem, critical zone and socio-ecological research – eLTER); that funds transnational physical and virtual access.

P20-Family portrait of the Lautaret Culture Collection (LCC)

VILLAIN Gaëlle, Ezzedine Jade A., AMATO Alberto, MARECHAL Eric

Laboratoire de Physiologie Cellulaire et Végétale, Grenoble, France

This poster introduces the Lautaret Culture Collection (LCC), following algae and fungi strains' purification, from field samples collected in the context of the Alpalga and Greenlandia programs. Coverage of the biodiversity and storage strategies are illustrated.