

Polar Genomics Workshop

16 - 18 May 2022
Bielefeld, Germany



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Organizers

Joe Hoffman

Ulf Karsten

Rebecca Nagel

Anneke Paijmans

David Vendrami

Practical information

THE MEETING The aim of this topic workshop is to bring together an international group of researchers working on the genomics of polar organisms. Specifically, we hope to discuss objectives, approaches and recent progress in the use of genomic approaches to investigate patterns of biological diversity, adaptation to extreme environments and responses to environmental change in polar organisms. The meeting has been organized as part of the Deutsche Forschungsgemeinschaft (DFG, German Science Foundation) Priority Programme 1158, “[Antarctic Research with Comparative Investigations in Arctic Ice Areas](#)”.

There will be 38 participants at the meeting and we are happy that Melody Clark (British Antarctic Survey, UK), Charlotte Havermans (Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany) and Kenneth Halanych (University of North Carolina Wilmington, USA) will each give a plenary talk. In addition, Oliver Krüger (Bielefeld University, Germany) will give an informal evening lecture. Details of these talks can be found on pages 13-14 of the programme.

By keeping the meeting small, we aim to foster an informal and interactive atmosphere with plenty of time for questions and discussions during the talks. Each talk slot will be 20 minutes including approx. 5 minutes for questions and discussion. In order to keep the meeting on schedule, it is important that all of the speakers keep their talks within the allocated time windows. We encourage participants to present work in progress and to facilitate this, we ask that participants do not post pictures or reports on social media (or elsewhere) about the presented results without the permission of the presenter. We kindly ask all participants to upload their talks to the workshop laptop on the morning of their scheduled talk, between 8:00 and 8:45.

THE VENUE The meeting will take place at [Brand’s Busch hotel](#), which is located in the Teutoberger Wald around 2km southeast of Bielefeld city centre. The address of the hotel is [Furtwänglerstraße 52, 33604 Bielefeld](#) and the contact telephone number is 0049 (521) 2383735.

EXPENSES The costs of all food and accommodation during the meeting will be covered by the DFG priority programme. Specifically, accommodation will be provided at Brand’s Busch for the night before the meeting (15.05.22) as well as for the nights of 16.05.22 and 17.05.22. All participants will have their own single room. All meals will be provided on 16.05.22 and 17.05.22 plus breakfast and lunch on 18.05.22, after which the meeting will close. Alcoholic drinks can be purchased at own expense from the Brand’s Busch fully licensed bar. Please let us know in advance if you have any dietary requests or requirements. Participants can claim their travel expenses from the SPP (for details, please contact Dr. Angelika Graiff on [\(XXXX\)](#)).

TRAVEL
TO BIELEFELD

The closest airports to Bielefeld are the Düsseldorf International Airport (DUS) and Hannover Airport (HAJ). Do not confuse Düsseldorf International Airport with Düsseldorf Weeze Airport (NRN), which we would not advise flying to as it is not on a convenient train route.

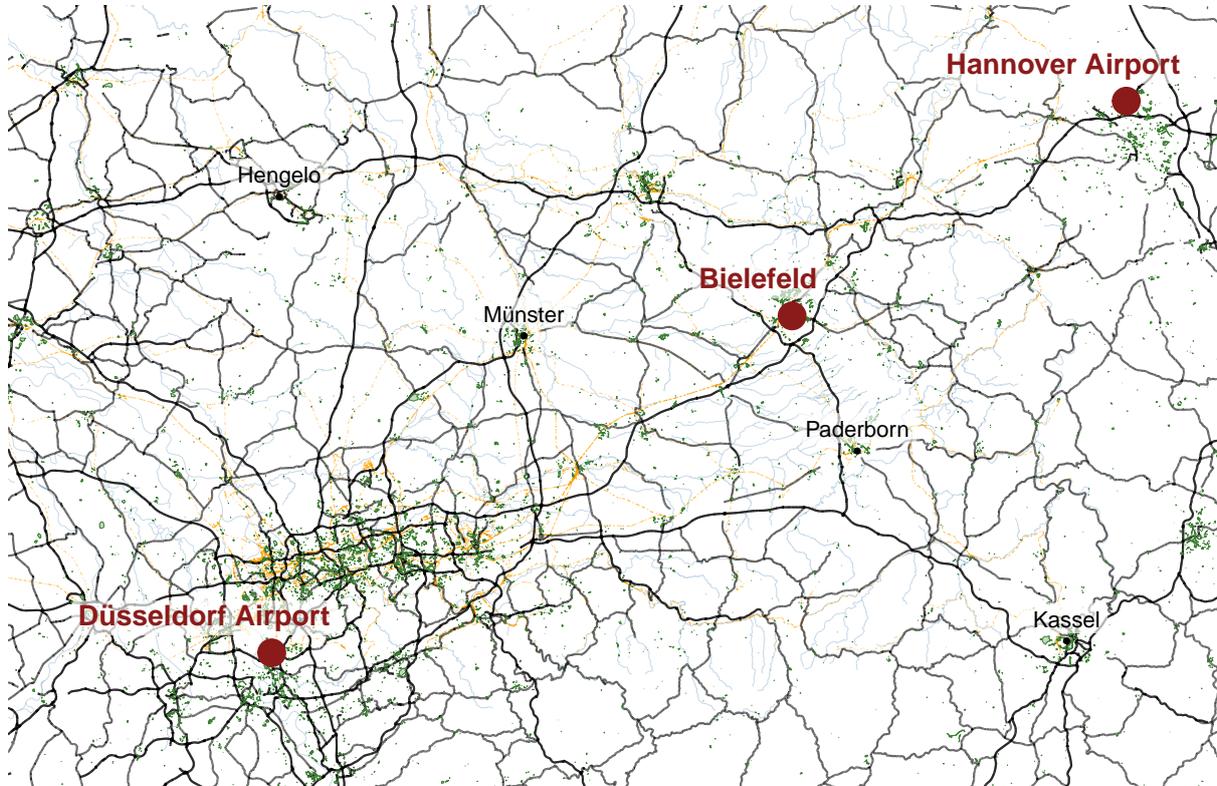
Train tickets can be booked via the [Deutsche Bahn website](#) and can also be purchased directly at the train station. Please feel free to ask us if you have any questions about international travel.

From Düsseldorf International Airport:

Bielefeld is quite straightforward to reach by train from Düsseldorf International Airport. There is an approx. ten minute sky train that links the airport to the Düsseldorf (Flughafen) train station. From there, usually around three trains per hour go to Bielefeld: the faster Intercity Express (ICE) trains go directly to Bielefeld with no changes (approx. 1:30 hours); there are also direct Regional Express (RE) trains that take around 2 hours.

From Hannover Airport:

If you fly to Hannover airport, you can get a tram to Hannover main station (Hauptbahnhof), from which there are usually around two direct trains per hour that go to Bielefeld, which take approx. 1 hour.



TRAVEL TO VENUE To reach Brand's Busch from the main railway station (Hauptbahnhof), one can take the (partly-underground) tram (S-Bahn) or a taxi. Note: The path from the tram stop to Brand's Busch is quite steep. In case you have heavy or difficult to carry luggage it is advisable to take a taxi.

By tram:

The entrance to the tram station is directly opposite the main railway station (Hauptbahnhof) in Bielefeld. Take Line 2 (green) in the direction of Sieker and get off at the stop Prießallee. This takes approx. 10 minutes and the trams run several times an hour.

For the tram, you need an adult zone 1 ticket (valid for 90 minutes anywhere in the city). These can be bought from the machines at the tram stops (€2.90 single, or €9.20 for a "4er" ticket valid for 4 separate journeys). Remember to validate (*entwerten*) your ticket by stamping it in one of the small, usually orange, machines on board (with the 4er ticket you have to stamp it in a different orientation for each journey, eventually stamping both ends on both sides).

From the tram stop Prießallee, it is a ten minute walk to Brand's Busch. To walk there you need to slightly track back from the tram stop, crossing the street called Joseph-Haydn-Straße, and take the path to the left called Friedrich-Oberschelp-Weg which leads up the hill. The path name will change to Steinweg, but just keep following until you reach Brand's Busch.

By taxi:

You can take a taxi in front of the railway station, which should bring you to Brand's Busch for around €10. This may be a good option if you have heavy luggage to carry.

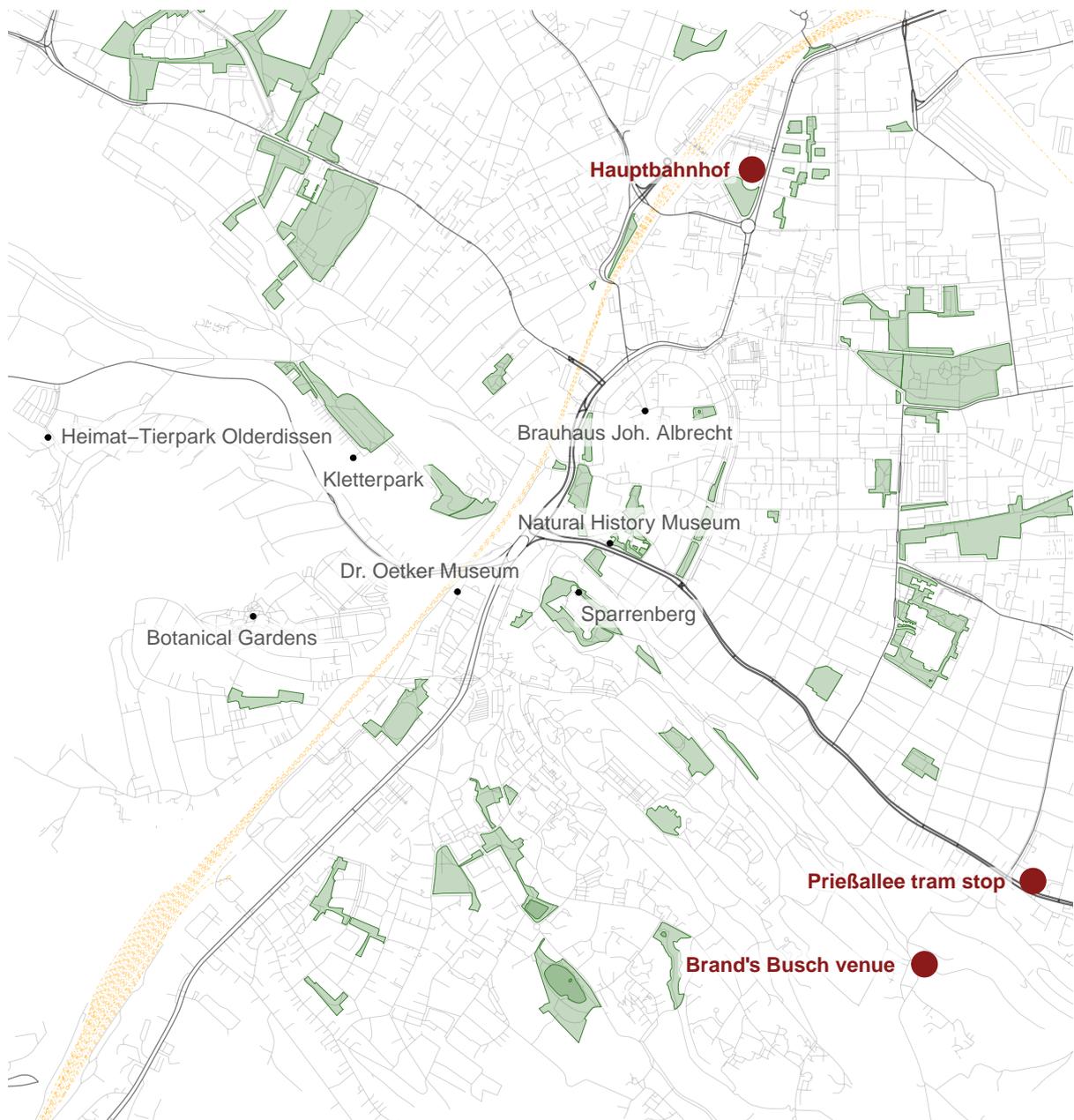
COVID-19 According to [local state regulations](#), there should be no covid restrictions in place in Bielefeld at the time of the workshop. We have also checked with the venue and they do not require the participants to be tested for COVID prior to the meeting. Furthermore, there will be no requirement for social distancing or mask wearing, although masks can of course be worn at each individual's discretion.

Nevertheless, to minimise any risks to the participants, we would be grateful if each participant could test themselves shortly before the meeting (rapid self-test, optional). We will also provide a sufficient number of rapid tests that all participants can test themselves on each day of the meeting (also optional).

EXPLORING BIELEFELD Bielefeld is a lively city that offers a number of family friendly activities. Some of our favorites include:

- [Heimat-Tierpark Olderdissen](#), a small zoo. free entry
- [Sparrenberg Castle](#), a restored fortress. free entry
- [Kletterpark](#), a fun outdoor climbing park
- [Dr. Oetker Museum](#), famous for its pizzas and desserts
- [Natural History Museum](#)
- [Botanical Gardens](#)

MAP OF BIELEFELD A map showing Bielefeld city centre together with the locations of the Hauptbahnhof (the main railway station), the Brand's Busch venue and a few family-friendly tourist attractions.



DINNER ON
SUNDAY, 15 MAY

We anticipate that most of you will arrive in Bielefeld on the afternoon or evening of May 15th. You will be able to check into your rooms at Brand's Busch between 14:00 and 23:00. Please let us know if you plan to arrive later. That evening, we plan to meet up informally for dinner at 19:00 at the [Brauhaus Joh. Albrecht](#), a traditional German restaurant in the centre of Bielefeld. The address is [Hagenbruchstraße 8, 33602 Bielefeld](#). Please let us know in advance if you would like to join us at the Brauhaus so that we can reserve a place for you.

EXCURSION

On Tuesday afternoon, we will make a short excursion to the [Naturschutzgroßprojekt Senne](#) ('large-scale conservation project'), a natural reserve around 10km south east of Bielefeld. The main aim of this project is to conserve, protect and develop the characteristic habitat types of the Senne region and the Teutoburger Forest. These include the historical heathland landscape of the Senne region that was produced prior to the 18th century by sheep and cattle grazing on traditional woodland pastures. Today, this is maintained by grazing highland cattle and Exmoor ponies.

The main features of the core area of the Naturschutzgroßprojekt are the remnants of large-scale heath and mire complex, acidophilous mixed beech and oak forests in the Westphalian lowlands. This habitat network supports an outstanding flora and fauna. For many species protected under the European Union Birds Directive and Annex II of the Habitats Directive, such as the kingfisher (*Alcedo atthis*), grey-headed woodpecker (*Picus canus*), woodlark (*Lullula arborea*), European brook lamprey (*Lampetra planeri*) and bullhead (*Cottus gobio*), this is the main area of distribution in North-Rhine Westphalia.

Weather permitting, a coach will leave Brand's Busch at 14:30 on Tuesday to take the group to the Naturschutzgroßprojekt. We anticipate going for an approximately 2.5 hour hike. We should be back at Brand's Busch at around 18:00.

WHAT TO
BRING

You may wish to bring your own laptop, although there will be a computer available for the presentations if needed. We recommend that you bring a travel adapter if necessary. As our excursion to the Senne will include a short hike, please bring suitable footwear (e.g. hiking boots) and warm and comfortable clothing including a waterproof jacket.

CONTACTS

If you need to reach us before the meeting, please feel free to phone us on our mobiles:

Joe: 0049 (1511) 1826336

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Schedule

SUNDAY, 15 MAY

14:00 - 23:00 check-in at the Brand's Busch hotel

19:00 *dinner*, Brauhaus Joh. Albrecht

MONDAY, 16 MAY

from 7:30 breakfast

09:00 - 09:20 Welcome / general information: Joe Hoffman

Adaptation and climate change I

09:20 - 10:20 **Plenary speaker: Melody Clark**
Polar marine responses to a changing world

10:20 - 11:00 *coffee break*

11:00 - 11:20 **Lucas Hueppe**
Exploring the impact of endogenous clocks on Antarctic krill phenology to understand their resilience to climate change

11:20 - 11:40 **Andreas Walberg**
The genomics of ecological adaptation in World Ocean krill

11:40 - 12:00 **Fatemeh Ghaderiardakani**
Adaptation of the green seaweed *Ulva* and its microbiome to cold temperature in Antarctica

12:00 - 12:20 **Lloyd Peck**
Where to look for the differences in Antarctic marine species

12:30 - 13:30 *lunch*

Adaptation and climate change II

13:40 - 14:00 **Magnus Lucassen**
Deciphering climate susceptibility of cold adapted animals: Linking genetic structure and transcriptomic responsiveness to physiological response mechanisms and whole animal performance

14:00 - 14:20 **Sarah Kempf**
The genetic response and adaptation potential to climate change of the Arctic keystone species polar cod (*Boreogadus saida*)

14:20 - 14:40	Tomaso Patarnello and Luca Bargelloni Back to temperate waters: comparative transcriptomics to investigate the (re)adaptation of notothenioid fish to sub-Antarctic conditions
14:40 - 15:10	Chris Cheng The Antarctic notothenioid <i>Lepidonotothen squamifrons</i> uniquely survives in the Southern Ocean without antifreeze protection
15:10 - 15:30	<i>coffee break</i>
	Metabarcoding, metagenomics & metatranscriptomics
15:30 - 15:50	Burkhard Becker Transcriptomics and Metabarcoding as useful tools to investigate the biology of soil crusts
15:50 - 16:10	Thomas Mock Microbial genomics: from genes to metagenome assembled genomes in warming polar oceans
16:10 - 16:30	Katherina Schimani eDNA Metabarcoding of polar benthic diatoms
16:30 - 16:50	Kathleen Stoof-Leichsenring Paleometagenomics on sedimentary ancient DNA to understand long-term biodiversity change in Polar regions
16:50 - 17:10	<i>coffee break</i>
	Polar genomes
17:10 - 17:30	Christian Printzen Development, application and potential of microsatellites markers in lichens
17:30 - 17:50	Kat Hodkinson Three become one: reassessing the <i>Fragilariopsis cylindrus</i> CCMP110 karyotype
17:50 - 18:10	Adam Monier Reconstructing the biogeography and evolution of the Arctic pico-alga <i>Micromonas polaris</i> through pan-genomics
18:30 - 19:45	<i>dinner</i>
20:00 - 21:00	Evening speaker: Oliver Krüger The greatest adventure ever

TUESDAY, MAY 17

from 7:30 *breakfast*

Community structure

- 09:00 - 10:00 **Plenary speaker: Charlotte Havermans**
Zooplankton in an ocean of change: evaluating the likelihood and consequences of poleward range expansions for pelagic ecosystems
- 10:20 - 10:40 *coffee break*
- 10:40 - 11:00 **Micaela Ruiz**
Understanding the trophic role of Southern Ocean gelatinous zooplankton
- 11:00 - 11:20 **Lea Wunder**
Metabolic potentials of the microbial community in glacially influenced surface sediments of Potter Cove
- 11:20 - 11:40 **Andreas Beck**
Accessory lichen symbionts in *Placopsis* collected from soils with different deglaciation times
- 11:40 - 12:00 **Uwe John**
Functional biogeography of marine plankton - insights into community processes and endemic signatures using meta-omics and single cell analysis
- 12:00 - 12:20 **Sylke Wohlrab**
Population genomics and adaptive trait evolution in eukaryotic microbes
- 12:30 - 13:30 *lunch*
- ### Trophic interactions
- 13:40 - 14:00 **Juan Masello**
Using next generation sequencing to disentangle the diet of Antarctic and sub-Antarctic penguins, with particular emphasis on optimal and sub-optimal locations
- 14:00 - 14:20 **Kenneth Dumack**
Interactions of polar algae, their predators and parasites
- 14:30 - 18:00 excursion to the Senne
- 18:30 - 19:45 *dinner*
- 20:00 - 21:00 special issue discussion (optional)

WEDNESDAY, 18 MAY

from 7:30 breakfast

Population genetics

- 09:00 - 10:00 **Plenary speaker: Kenneth M. Halanych**
Scanning and assembling polar genomes to study patterns of evolutionary history
- 10:20 - 10:40 *coffee break*
- 10:40 - 11:00 **Gemma Collins**
Evolutionary histories and ecological functions - DNA barcoding (Antarctica) and genomics (Europe) of soil invertebrates
- 11:00 - 11:20 **Bank Beszteri**
Microevolutionary genomics of pelagic diatoms of the Southern Ocean
- 11:20 - 11:40 **Christoph Held**
TBA
- 11:40 - 12:00 **Karin Noren**
Inbreeding depression and genetic rescue in the Scandinavian arctic fox: the impact of deleterious mutations
- 12:00 - 12:30 close of meeting
- 12:30 *lunch*



Melody Clark

British Antarctic Survey, UK

Polar marine responses to a changing world

Abstract We need to understand the mechanisms underpinning marine organisms' responses to climate change in order to predict the biodiversity of future ecosystems. One of the major tools we have at our disposal, which can help us in this, is transcriptomics. Evaluation of changes in gene expression levels in individuals of any particular species associated with a change in environmental conditions can provide insights into the cellular energetics and stress experienced by that individual and whether it is coping with the changed conditions. Although, most of these types of studies are conducted in the artificial environment of the laboratory/aquarium, it is important to supplement such studies with in situ experiments (if possible) and in situ "wild" collections to correlate laboratory results with "real life". Using examples from both the Antarctic (with heated settlement panels as in situ laboratories) and the Arctic (*Mytilus edulis* as a key indicator species of in situ responses to a warming intertidal), I'll explain how transcriptomic analyses can significantly aid our understanding of how marine species at both poles respond to changing environments, including future predicted sea temperatures.



Charlotte Havermans

Functional Ecology, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany

Zooplankton in an ocean of change: evaluating the likelihood and consequences of poleward range expansions for pelagic ecosystems

Abstract Climate change proceeding at unprecedented pace is currently redistributing life on Earth. Rapid warming of the upper ocean and the atmosphere have altered sea ice extent and seasonal dynamics in the Arctic and the Southern Ocean, in particular the southwest Atlantic sector. Poleward range expansions of temperate species into the polar oceans have already been noted for various planktonic groups, whereas genuine polar species have been seen to contract their ranges. These shifts have the potential to significantly alter pelagic communities, food web structure and energy flow to higher trophic levels such as seabirds, fish and mammals. For our studies, we focus on two so far neglected key pelagic groups: i) the predatory amphipod genus *Themisto* and 2) gelatinous zooplankton, including scyphozoans, hydrozoans, ctenophores and pelagic tunicates. For these taxa, major knowledge gaps persist in their ecology, genetic structure and resilience to change. In both polar regions, *Themisto*'s genetic and trophic connectivity as well as thermal response were investigated with state-of-the-art molecular methods. The role of gelatinous zooplankton in the Arctic and Antarctic food webs is assessed with molecular diet studies. We also explore the genetic connectivity of dominant gelatinous species across the Arctic Ocean and its adjacent seas. Finally, we apply environmental DNA to detect incoming species into the vulnerable polar systems and aim to set the baseline for future monitoring efforts of gelatinous zooplankton communities.



Kenneth M. Halanych

University of North Carolina Wilmington, USA

Scanning and assembling polar genomes to study patterns of evolutionary history

Abstract Genomic technologies provide an ever-expanding tool kit as to how organisms have adapted and evolved in Southern Ocean. Although much effort has been focused on microbes, mammals, and icefish, resources are becoming more widely used across the breadth of polar organisms. Major questions include 1) How have biogeographic ranges shifted over time? and how will anthropogenic climate change impact ranges? and 2) How have organisms adapted to Antarctic environments? Our understanding of biogeographic patterns has been addressed using genome-wide surveys, including Single Nucleotide Polymorphism (SNP) studies. Genome projects allow further understanding of adaptation and evolution. Here, in addition to highlighting SNP studies, I will present recent genome sequencing projects on Antarctic echinoderms (*Sterechinus*, *Astrotothoa*, *Ophionotus*, *Gorgonocephalus*) and hemichordates (*Cephalodiscus*). The discussion will focus on searching for signatures of selection versus genetic drift and the types of inferences about organismal biology that can be drawn from comparative genomics.



Oliver Krüger

Bielefeld University, Germany

The greatest adventure ever

Abstract The story of the endurance expedition led by Sir Ernest Shackleton is a wonderful source of admiration and inspiration. Blending historical pictures with photos taken over the last 25 years during more than 20 trips to Antarctica, I will try and do it justice. In the course of re-tracing the expedition steps, the lecture will take you to South Georgia, the Weddell Sea and the Antarctic Peninsula, its wonderful landscapes as well as its wildlife inhabitants.

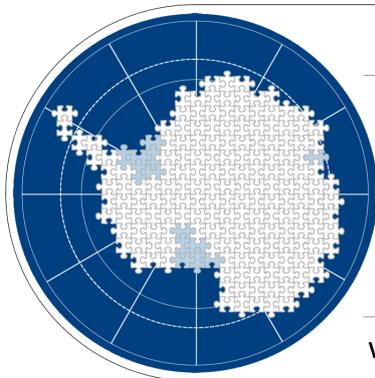
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ANTARCTIC RESEARCH

with comparative investigations in Arctic ice areas