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Scientists (left to right) Nancy Bigelow, Mat Wooller, Soumaya Belmecheri and Kyungcheol Choy bond while capturing mud cores at St Paul Island, Alaska.

OUTSIDE THE LAB

Field your A Team

Life in the field can be gruelling — and so it is up to team leaders to turn the research grind into an adventurous and valuable experience for everyone.

BY KENDALL POWELL

In 2015, Gifford Miller was in the eastern Canadian Arctic working on two climate-change projects when he ran into a frequent frustration for field researchers — bad weather. Miller, a geologist at the University of Colorado Boulder, and his six-member team had to hole up in their cabin for a week thanks to freezing rain and fog. This barred them from collecting plant and rock samples revealed by melting ice to help them put the past century's warming into a geological context. Their transportation to the site, a helicopter, was grounded.

As the team watched the clock tick, Miller remembered another site nearby, accessible by boat, where they could at least collect samples of rocks dropped by moving glaciers. So he called in an Inuit guide who took the team by canoe to the site, where they spent a second, much more productive week collecting data.

Researchers who have been out in the field even once know that expeditions almost never go as planned. As a consequence, teams need to stay upbeat and nimble, and be able to pivot to plan B, C or D as required. Regardless of the complication — whether it is extreme weather, desolate locales, wildlife interlopers or other perils — veteran expedition leaders rely on two tenets: 'be prepared', followed by 'be flexible'.

Organization is crucial — scientists arranging trips for 2018 should start planning now. And leaders must be able to adapt to setbacks, such as equipment breakdowns, illness or shifts in the weather, says Mat Wooller, a biogeochemist at the University of Alaska Fairbanks. "Don't allow your A-type personality traits to take over," he says. "You need to fix it, be creative and work around it." Expedition managers must know how to keep teams working together productively in the face of adversity.

When big money is at stake, a detailed ▶

strategy is a must. Patrick Druckenmiller, a palaeontologist at the University of Alaska Museum of the North in Fairbanks, says that one week of field work in Alaska or Norway can cost upwards of US$30,000. He prepares early by securing permits and filing paperwork for site access at least six months before a trip. This first-stage work is particularly important for scientists who need samples from national parks, foreign countries or ecologically sensitive areas.

Effective leaders should prepare newcomers to the field in advance for harsh conditions, and hand out detailed gear lists that include such things as proper footwear, bug nets, dry bags, temperature-rated tents and sleeping bags. Druckenmiller, who hunts for marine-reptile and dinosaur fossils in the Arctic, works in mud-soaked coveralls at sites where the daily summertime average temperature hovers just above freezing. He invests in both individual mountaineering tents and group tents that serve as centres for team gatherings, cooking and drying out. "You don't ever want to deal with wet clothes and wet sleeping bags," he says.

GROUND CONTROL

Field researchers should also establish connections with local brainpower ahead of time. When Soumaya Belmecheri, a palaeoclimate scientist at the University of Arizona in Tucson, contemplates sampling tree rings at a new site, she seeks out a contact in that locale who can help her to navigate permissions and logistics in a foreign country. That expert might be a forest manager, a scientist from a nearby research institute or a community member who knows the terrain and cultural background of a site. "Try to anticipate all the worst-case scenarios as best you can and make a complete list of what might be needed," advises Belmecheri.

If local expertise isn't available, teams will need to bring their own. Wooller was co-leading a 12-member expedition to St Paul Island, Alaska, in 2013, where success depended on extracting a long mud core from beneath a frozen lake to estimate when mammoths died out in the area. Getting the sections of core was mechanically tricky, so he brought in Nancy Bigelow, a palaeoecologist also at the University of Alaska Fairbanks, who is renowned for capturing quality mud cores under difficult conditions. He left that endeavour to her, so that he could concentrate on other necessities. "It was her job to focus 100% on the coring, while I was off figuring out how to rent snowmobiles," he says. It worked. The team tucked the cored sections into sleeping bags and snowmobiled them back to camp, winding up with 13 metres of mud core covering a 10,000-year period.

Team-member selections are another huge component of success. Druckenmiller starts by finding scientists who are skilled in field logistics or problem solving, and who have enough expedition experience that he doesn't worry about them compromising team safety. He also takes along one or two lab members who will learn valuable skills from the experience, such as a doctoral student working on a related project, even if they aren't the outdoorsy type. Teams should also include a member who has top mechanical skills for making emergency equipment repairs.

"You want everyone pulling at the oars, and more importantly, pulling in the same direction."

Once on the ground, flexibility and group cohesion should rule. Palaeontologist Cathy Forster of the George Washington University in Washington DC and her team go on field expeditions to search for dinosaur fossils from the middle-Jurassic period in the Western Gobi desert in China, which can take place in sweltering, 38 °C-plus weather. In such gruelling conditions, everyone on the team needs to hang together. "They have to get up in the morning and pick up trash or help cook breakfast, and do all the non-palaeo stuff that needs to get done without being asked 5,000 times," says Forster.

Miller places high priority on choosing a good campsite because a poor spot can quickly sap team morale. His Arctic campsites must be safely accessible, have a good freshwater source nearby, have enough flat spaces to pitch tents and provide a commanding view — not just for pleasure, but for spotting polar bears. And teams need a comfortable camp space in which they can eat together and relax daily.

Miller also brings a few things to share with everyone (see 'Treats to make field life fun'), and makes time for entertainment. One group made moss moustaches, which helped to dissipate tension. "It makes a big difference if your colleagues feel like you made an effort to make it fun and comfortable after all the hard days spent cold and freezing on a boat," he says.

At the East Greenland Ice-core Project site, teams drill cores from the ice sheet in round-the-clock shiftwork for three months at a time. The site hosts a semi-permanent camp with a kitchen and communal dining area, workspace and a movie theatre. The dining room has a 'no devices' rule, and the team eats meals together to encourage a sense of community, says Dorthe Dahl-Jensen, who leads the Centre for Ice and Climate at the University of Copenhagen.

And good food — high quality and in copious amounts — is essential. Druckenmiller says that rationing food or feeding the team bland, rehydrated fare will demoralize everyone. In Iceland, Wooller procured local lamb for meals. He also encourages people to cook their favourite camping dishes. Belmecheri bakes breads in a cast-iron skillet, and once, even cooked live lobsters in the field.

Some leaders blend good food with fun rituals to encourage team bonding. Wooller was inspired to start an 'Extreme Dining Society' to provide whimsy for overworked field teams. Members dress in black tie and find an unlikely spot for a gourmet picnic dinner, which helps to build trust among international colleagues who might not know each other. They have dined on sandbars 24 kilometres off the coast of Belize and in Icelandic underground lava-tube caves.

MOOD MENDER

After 30 field seasons, Druckenmiller needs only a dry tent to be happy. But he keeps a sharp eye out for anyone who might be overwhelmed by miserable conditions. If he spots someone who seems distressed, he pulls them aside for a pep talk. Just one person's bad attitude can sour the whole group — it's the leader's responsibility to mediate between difficult personalities that threaten to knock a team off track. "You want everyone pulling at the oars, and more importantly, pulling in the same direction," says Jim White, director of the Institute of Arctic and Alpine Research at the University of Colorado Boulder. He and Miller have both sent disruptive team members home on the next boat or snowmobile.

But in Greenland, Dahl-Jensen doesn't always have that luxury — sometimes, the next aeroplane isn't due for weeks. Although it's rare for someone not to thrive in the camp,

PACK SOME SURPRISES

Treats to make field life fun

Veteran team leaders throw something extra into their bag to keep team morale high and light-hearted, even in tough conditions. Here are some favourite packable distractions:

- MSR Reactor stove for heating water quickly and surprising the team with a hot cup of coffee, tea or chocolate — palaeontologist Patrick Druckenmiller, University of Alaska Museum of the North in Fairbanks
- Essential cooking spices (black pepper, cumin, paprika, turmeric, chilli powder), Bialetti Moka portable espresso maker, Fisher-Price record player to spin Billie Holiday and Charles Mingus albums — palaeoclimate scientist Soumaya Belmecheri, University of Arizona in Tucson
- Travel croquet set for six players and mala beads for meditating — biogeochemist Mat Wooller, University of Alaska Fairbanks
- Belgian chocolate to share — palaeoclimatologist Dorthe Dahl-Jensen, University of Copenhagen
- Balvenie whiskey for those of age, bouncy ball and deck of cards — geologist Gifford Miller, University of Colorado Boulder K.P.

Dorthe Dahl-Jensen and her team in Greenland hit the snow for some volleyball in their down time.

KENJI KAWAMURA/NEEM

she says, it's imperative to halt the decline before it infects the whole team. She watches for team members who isolate themselves or manifest other antisocial behaviour, and for members who don't get out of bed and lack enthusiasm for the work. When she sees someone in trouble, she finds the most well-liked researcher in camp and asks that person to work as a buddy with the unhappy camper.

When disaster strikes (and it will), team leaders' moods are mirrored by the entire crew. Wooller recommends channelling optimism and a sense of adventure. "If whoever is in charge looks like they are unhappy, stressed out or worried, everyone else gets that way, too," says Druckenmiller. "Keep your calm and do your best to put a good face on bad situations." That advice is also helpful for team members who become physically ill, often because of altitude or heat. They need to know, says Forster, that they can spend a day or two recovering in their tent. "Don't kill yourself, that's the first rule," she says. "And don't kill anyone else."

Still, even the most carefully planned expeditions can derail. For the trip to St Paul Island, Belmecheri and Wooller led a team that checked field equipment as luggage — but it got bumped from the flight and was delayed by three days because of an airline backlog. While waiting, the team leaders encouraged everyone to tour the island, meet with locals, brainstorm hypotheses and revise schedules. It wasn't all for naught — when they shared their work with locals, some islanders brought them more mammoth teeth and tusks to study.

Wooller recalls a field trip to drill a core at the Wolfe Creek meteorite crater in Australia, during which a political skirmish suspended their permission to drill. While some team members left to try to renegotiate permission, Wooller and the rest of the team dreamt up ways to do other science. "The cool thing about being an isotope biogeochemist is that the world is made of isotopes," he says. So they surveyed the chemistry in the crater's plants and soils, which salvaged the trip — they never did get permission to core — and earned them a publication later.

Yet, sometimes, there's no way but out. When conditions compromise the research or team safety, team leaders ultimately have to decide to abandon ship. Belmecheri recounts trying to core lake sediments in the Republic of Georgia with high winds lashing the boat. "We had to call it quits — it was too dangerous," she says. "No research is worth making stupid decisions."

Druckenmiller also says that safety is his foremost concern. Field sites can be days away from a hospital, and they often include hazards such as grizzly or polar bears, heavy equipment, aircraft and watercraft, landslides and severe weather. To forestall avoidable disasters, he keeps close tabs on team members' level of alertness. "Don't let your team get distracted by physical discomforts or lack of sleep — it becomes too easy to forget your helmet or bear spray."

Ultimately, team happiness in the field correlates with research success. For each crew that comes to work on the Greenland ice sheet, Dahl-Jensen says, it takes about a week for team members to gel and focus on their task. "How important it is then that the morale is good," she says. "Happy, motivated people work better and produce better results." ■

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BIAS

Equality in research

Gender bias in science lives on, says a publication from an association of European research funders, institutions and universities that aims to improve gender equality in research. Science Europe, which represents more than 40 member organizations in 27 nations and was founded in 2011 in Brussels, has released its *Practical Guide to Improving Gender Equality in Research Organisations*. It discusses avoiding unconscious bias in peer review, monitoring progress towards gender equality and improving grant-management practices. Organizations should define and carry out measurable objectives for improving gender equality and publish data on their results, the report says. It notes that some member groups have made progress: the Irish Research Council uses gender-blinded assessments in its early-career researcher programmes, for example, and the German Research Foundation (DFG) allows female and male grant holders to reduce their working hours by up to 50% for family reasons. The publication encourages Science Europe members to learn from other members' efforts to tackle bias and boost equality.

SALARIES

Gender pay disparity

Female representation is climbing in academia's highest administrative ranks in the United States — but women in those jobs earn less than men do in the same positions, finds a report by the College and University Professional Association for Human Resources in Knoxville, Tennessee. *The Gender Pay Gap and the Representation of Women in Higher Education Administrative Positions* says that, by 2016, about half of university administration positions combined — such as department head or dean — were held by women. But pay equity has not kept up. In 2001, women in such positions earned about US$0.77 for every $1 earned by men in those jobs, a gap of $0.23. That narrowed to about $0.20 in 2016, the report finds, which translates into a difference of about $20,000 in annual pay. It says that the discrepancy could be due to the smaller number of women in academia's highest administrative ranks, which also pay the most. Although women hold more than half of all department-head positions (54%), less than 30% of top university executives are female. The pay gap narrows with increasing seniority but widens again after 17 years of service.