CAREERS

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SOURAV SAHA

Some fieldwork, such as crossing a glacier to collect sediment samples, requires extra safety measures.

COLUMN

Put safety first

Junior researchers must know how to navigate dangers in the field, says **Elizabeth Orr**.

I still have flashbacks to the day I had a narrow brush with death during fieldwork in the Himalayas. I can still feel the bitter cold of the river, the muffled roar of the surging waters around me and the chest-crushing panic of oxygen deprivation. I remember the currents pulling at my rucksack, dragging and twisting me down underwater. My brain was screaming: you must breathe.

I am a third-year PhD student in geology at the University of Cincinnati, Ohio, and my two-month-long field seasons take me to the Himalayas each year. It had been an intense few days in the run-up to that fateful afternoon. A fellow PhD student and I were heading to the Bara Shigri valley in the Lahaul region of northern India, to collect sediment samples from the surface of the glacier.

As a glacial geologist and geomorphologist, I am among a few fortunates who have been able to transform a lifelong interest into a career. Conducting fieldwork has always been a privilege for me, whether it has involved pondering a sediment deposit in Ohio, wading through a bog in Scotland or scaling a Himalayan peak. During my undergraduate, master's and doctoral studies, I have found that it is common — as many may already know — for early-career scientists to conduct field research without a large team or veteran guide.

Risking my physical safety in the field is an inevitable but not always unwelcome part of my job. Similarly to many other junior scientists, I feel that I must prioritize my research and its contribution to the scientific community. Yet, I see a disconnect between the way we regard physical safety in the geosciences and how we practise it in the field.

NOWHERE TO GO

En route to the glacier, we battled heavy winds, frigid temperatures of −10 °C and biting snow. When we finally reached it, we realized that crossing it would be treacherous, thanks to a thick veneer of slippery debris that covered the entire ice mass. Each step was a gamble.

It took us a few hours to cross the glacier and collect our samples. We escaped unscathed, yet shaken — and we still faced a 10-kilometre trek to Batal, a village in the Spiti valley where we would find warm food and shelter. Our final hurdle was to cross a torrent of meltwater, which carved its way through the landscape like a knife. My colleague fearfully made his way across the river, using a makeshift rusted-wire pulley system. Local shepherds had advised me to trek upstream and find a safer crossing ▶

EMERGENCY PREP

Fieldwork survival strategies

Early-career geoscientists should consider the following tips before undertaking fieldwork in unfamiliar, hazardous or extreme environments:

- Plan your route to and in your field area in great detail, including emergency escape routes if you have to return to safety quickly.
- Carry topographic maps, a compass and a satellite-navigation receiver.
- Wear a waterproof watch that is not a smartwatch so that you don't run into battery issues early on.
- Notify your superviser(s) of your plans. Heed their advice concerning your safety risks.
- Decide in advance the duration of your fieldwork, and stick to that schedule.
- Prepare multiple methods of communication, including mobile phone, satellite phone, whistles and emergency flares.
- Update key contacts, including base-camp support personnel and academic advisers, at regular intervals with information on your (and your team's) progress while in the field.
- Use equipment designed specifically for the type of fieldwork or environment you are in. This includes research equipment, in addition to specialized clothing and footwear, hiking gear, skin protection and eye wear.
- Pack enough food, water, clothing and medical supplies to prepare you for possible delays in your fieldwork.
- Be prepared in the event you have to spend an unplanned night out in the field: having an emergency shelter on hand can be useful.
- Monitor weather conditions before and during your fieldwork. Regularly reassess the risks and changes to the environmental conditions of your field area.
- Return to safety before conditions become too hazardous.
- Do not overexert yourself or challenge your physical capabilities when in the field. This can cause dangerous health conditions including exhaustion, nausea and altitude sickness.
- Be self aware, and communicate with your team about how you are feeling.
- Regularly reassess your physical condition, and allow your body time to rest, acclimatize or recover. E.O.

▶ where the waters were shallower and calmer.

But no such place existed. The river snaked up into a steep-sided gorge, forcing me to venture in and wade upstream while holding on to the rock walls. I couldn't find a suitable crossing and, as the light faded, my core body temperature plummeted. Trying to suppress rising panic, I chose a stretch of river that looked shallow, and pushed myself away from the security of the gorge wall.

The force of the raging meltwater was terrifying and impressive. The surges wrenched at my arms as I drove my poles into the riverbed with each step. Submerged to my waist, I could hear boulders somersaulting down the river around me. Then, it happened: I faltered, lost my balance and was dragged into the river's depths.

Elizabeth Orr treks in the Himalayas for research.

SOURAV SAHA

SAFETY MEASURES

It might well be that most research groups, expeditions and scientists approach field safety seriously and have long-standing, vetted measures for mitigating risk and danger and dealing with any incidents. The problem is that many such measures are tailored to relatively accessible and historically frequented field locations. As we push the boundaries of science and venture into unknown and extreme environments, our vulnerability in the field increases. Fieldwork can be extremely demanding and often requires skills such as ice climbing, caving, sea kayaking and deep-water diving.

Several studies have found that despite the changing landscape of fieldwork, personal safety is a poorly discussed topic[1,2]. Faculty members, principal investigators, department heads and university administrators — and researchers themselves — need to examine how and why students and junior researchers in particular might neglect their physical safety in the field, and how we might change this. Sadly, I think it is often down to money and the pressure of unspoken expectations.

Early-career geoscientists, whether they are aware of it or not, may be particularly vulnerable to compromising their safety in the field. In my and my colleagues' experiences, this may result from our resolve to successfully conduct our research, and to live up to our own expectations. I have found it challenging to balance safe and responsible research with high-quality and ambitious research. It is easy to become excited about your fieldwork and forget that 'collecting that last rock sample' or dealing with 'just a twisted ankle' can launch a cascade of events that can endanger you and your team.

Having grown up with an outdoorsy background, I found that the transition from 'playing' to working in the field was less challenging for me than for others. The field experiences of early-career geoscientists are often limited to sporadic undergraduate field trips. In the geosciences, requiring previous or relevant field experience from doctoral candidates or postdocs is not essential, at least from what I and my student-colleagues' have seen.

My own academic advisers have always offered exemplary training and guidance. My in-field and theory-based training has always been both appropriate and thorough. When I am preparing for fieldwork in unfamiliar territory, I know how to assess and mitigate risks before I leave, and that, once there, I need to seek advice from experienced locals. I have continuously received the necessary tools and support to conduct fieldwork safely. Any incidents that have occurred in the field in my case are my own responsibility, not that of any institution or other individual.

But for many, budget constraints loom large when it comes to maintaining appropriate field-safety practices[2]. And I understand these concerns. I work as efficiently as possible in the field to ensure that I complete my research objectives. I am frequently guilty of retrieving samples in poor and hazardous conditions, such as blizzards and gale-force winds; using inexpensive and potentially unsuitable equipment; working alone; limiting the number of guides that I hire; and underestimating the amount of medical and food supplies that I can bring. So although I would like to argue that physical safety is the cornerstone of all my research projects, in reality, to meet a budget, I, too, make compromises. And although I may view the risks I take to be calculated, manageable and worthwhile, I know that my superiors would feel differently.

As we push the boundaries of science and venture into extreme environments, our vulnerability increases.

More broadly, the geosciences as a discipline has no formalized approach for developing standardized field-safety measures. This means that risk assessment and field practices are at the discretion of the team or researcher[3] (see 'Fieldwork survival strategies'). Without institutional or federal regulations and enforcement, it becomes easier for all researchers to push safety measures further down the list of priorities.

The geosciences research community must improve its members' access to the support,

services and training that they need to conduct safe and responsible research. I agree with others who have noted that researchers need relevant training or apprenticeships before conducting fieldwork[1]. With multiple Himalayan field seasons behind me, I consider it my responsibility to advise and mentor colleagues who are venturing into similar settings for the first time. The counsel that I have received from my mentors and supervisors should become more prevalent in the scientific community: the better prepared your research teams are for the realities of fieldwork, the more enjoyable and productive your research will be.

Of course, it's also the responsibility of researchers themselves to prepare for the fieldwork ahead. I took some informal fitness and backpacking training courses with colleagues before my first couple of expeditions. This and more-formalized training can prove invaluable, and wilderness first-aid or medical training from non-profit organizations, such as the Red Cross, should be a requirement for at least one member of every research team[4]. There are also field camps and expedition preparation courses offered by companies and institutions worldwide. These courses do cost money, which can reduce participation by early-career geoscientists. I would like to see these costs in the future either subsidized or covered by the research project or associated institution.

Fieldwork should be a positive experience, and should continue to engage and encourage the involvement of young and motivated scientists for generations to come. A more-open conversation about concerns over field safety is necessary for our community.

On that terrifying day, I thrashed below the river's surface, overwhelmed by the water's force. I lost my hiking poles in the confusion. Finally, I fought my way to the surface as a current slammed me into a gravel bar. Gulping in air, I hoisted myself onto the gravel. I was alive.

Had I been alone, or without my equipment, field experience or survival instinct, I am not sure that I would have been so lucky. As I curled up in my sleeping bag that night, I realized that despite everything that had happened that day, there was nothing else that I would rather be doing — and I aim to keep doing it, safely. ■

Elizabeth Orr *is a PhD student in geology at the University of Cincinnati in Ohio.*

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TURNING POINT
Empathetic outreach

Kale Edmiston, a postdoc at the University of Pittsburgh in Pennsylvania, uses neuroimaging to study mood and anxiety disorders. He describes how living as an openly transgender researcher has inspired his outreach endeavours.

UNIVERSITY OF PITTSBURGH MEDICAL CENTER

Has your experience as a transgender scientist informed your outreach?
Yes. I was the only out transgender PhD candidate at Vanderbilt University in Nashville, Tennessee. As word got out, I started getting contacted by members of the transgender community asking for health-care assistance. Few health-care professionals are trained in transgender issues, which contributes to this group's lack of access to health care. And 41% of this population in the United States reports at least one suicide attempt, according to the 2014 National Transgender Discrimination Survey.

What did you do with this information?
I co-founded the Trans Buddy Program, which operates through Vanderbilt and aims to improve health-care outcomes for transgender people. We wanted to create a network of people who can provide support and assistance. Since 2015, we've trained dozens of people and helped at least 450 clients. I also think that institutional investment in transgender leadership for these sorts of programmes, and creating more opportunities for transgender people to lead transgender health advocacy and health-research projects, is important.

How do your insights guide your research?
Being embedded in a community with high rates of anxiety, depression and suicide has given me a sense of urgency and commitment to doing clinically informed mood- and anxiety-disorders research. But I chose to pursue psychiatric neuroscience as a research assistant when I analysed data on individuals who had experienced childhood mistreatment, and found a correlation between the severity of mistreatment and the volume of the fusiform gyrus — the brain region that processes facial recognition. I decided to explore how people who are at risk of developing mood and anxiety disorders process visual information. The visual cortex is overlooked in psychiatric neuroscience. I thought it was a missed opportunity to think about how our perception of the world informs how we engage in and react to environments.

Does academia adequately support diversity?
Certainly not. Many female under-represented scientists have articulated the issues — such as access to mentorship and struggles adjusting to academic culture — that can affect all under-represented individuals in science. Still, things are getting better. I was able to find excellent mentors, peer support and programmes.

What programmes helped to build your career?
First, I received a career-development fellowship — the Summer Program in Neuroscience, Excellence and Success (SPINES) — for under-represented scientists, at the Woods Hole Marine Biological Laboratory in Massachusetts. Meeting both peers and mentors from all over the country was game-changing for me. I also received funding from the Point Foundation in Los Angeles, California, which offers scholarships for LGBTI (lesbian, gay, bisexual, transgender and intersex) students.

Do transgender graduate students face unique academic challenges?
I don't think people realize that transgender prospective graduate students might not get a fair evaluation. Transitioning and coming out typically occurs during crucial young-adult periods when a student is building their grade-point average and undergraduate transcript. Many trans folks take a pause from school during that time. What does that mean in terms of being evaluated in a pool of people who haven't had those challenges? I was an anomaly, as I started my transition during my first semester as a PhD student, which I would not recommend, because it was a lot of stress at once.

How can we level the playing field?
We need to rethink our evaluation systems. Once people are able to access graduate school, we must provide support and mentorship to make sure they are retained. ■

INTERVIEW BY VIRGINIA GEWIN

This interview has been edited for length and clarity.