

CAREERS

NON-PROFIT WORK Films, science guidelines and emergency medicine all in a day **p.245**

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KYLE LARSON



Kyle Larson and his team trek over a mountain pass in Nepal, one of many adventurous expeditions that have allowed him to take his research outdoors.

FIELDWORK

Extreme research

Cavers, divers and climbers take their science to strange and wonderful places.

BY EMILY SOHN

Marina Elliott never planned to apply her outdoor adventure skills to a career in research and exploration. But in October 2013, she saw an advertisement for a project in South Africa that called for cave explorers with archaeological experience who were also small enough to squeeze through a narrow passageway to excavate an underground chamber. She was startled by how perfectly qualified she was for the job.

Already an avid rock climber and spelunker,

Elliott was then finishing up a PhD in biological anthropology at Simon Fraser University in Vancouver, Canada. She had worked on excavations in remote places, including Siberia and northern Alaska. And she had the flexibility to drop everything to spend a month in Africa.

She joined a team of five other women. One by one, they shimmied through a 12-metre-long chute with an 18-centimetre-wide pinch point, and they emerged with more than 1,500 fossils from 15 skeletons of a previously unknown species of ancient hominin called *Homo naledi*. The discovery helped her to land her current

postdoc position in biological anthropology at the University of the Witwatersrand in Johannesburg, and she now leads a team of six cavers who continue to explore the region.

Although Elliott's path required a dose of serendipity, her experience illustrates one of the many ways that scientists can combine a love for outdoor adventure with their career. Researchers who pursue extreme fieldwork say that the discoveries they make along the way provide a lifetime of adventure tales and shape their careers in positive ways.

Combining an extracurricular passion ►

► for the outdoors with a high-stakes career, however, also brings complications, including the risk that nothing will go as planned. When preparing for fieldwork, ‘adventure’ researchers need to be particularly careful with logistics to ensure success — and their own survival. In addition, they often need to acquire specialized insurance and build a safety net of teammates and strategies to deal with inevitable obstacles. Even with the best-laid plans, disaster can still come in many forms — from violent weather and political strife to crippling injuries. Flexibility and quick thinking can be the difference between a productive trip and a waste of time — or worse.

RISK MANAGEMENT

Stacy Kim, a marine ecologist at Moss Landing Marine Laboratories in California, regularly dives beneath the ice in Antarctica to study how human pollution affects life on the sea floor. On one trip, she spun out on a snowmobile and dislocated her shoulder. The weather was bad, and the remoteness of the location meant that it took several days for medical personnel to reach her by helicopter. For the rest of the trip, she was stuck on top of the ice, doing lab work instead of going underwater. Her teammates did the diving instead. “You try to make sure no single person is completely irreplaceable,” she says.

When injuries and other obstacles occur, they can prematurely end expeditions — but stopping early is not always an option when a research agenda is involved. So, like Kim, many scientists who work in extreme locations try to factor in more time, gear and logistical support than they would for trips done purely for fun.

Ecologist Catherine Cardelús of Colgate University in Hamilton, New York, does most of her field work in the tree canopies, a task that requires climbing up ropes while battling jungle heat and fending off biting insects. On each climb, she lugs a heavy pack filled with sample-collecting tags and bags, tape measures, notebooks, walkie-talkies, water, lunch and other supplies for days of work that can keep her in the trees for up to seven hours at a time.

Cardelús says that her field season lasts two or three times longer than those of scientists whose research occurs on the ground. Some days of work are inevitably lost because of rain or wind, so she always makes sure to hit the trees immediately on good days. But because it is so exhausting, nobody is allowed to do work in the canopy for more than three days in a row. “You have to be incredibly flexible and forgiving,” says Cardelús. “You wake up in the morning and there’s a shut-out rain, so you have to say, ‘Oh well, let’s punch in some data. Let’s do lab work.’ You constantly have to be open to the possibility that you can’t do what you need to do.”

It can help to consider unplanned diversions as opportunities, says Kyle Larson, a structural geologist at the University of British Columbia’s Okanagan campus in Kelowna. In 2014 on a trip to Nepal, Larson and his team were stopped by snow at an elevation of 3,000 metres — only halfway to their planned destination.

“You constantly have to be open to the possibility that you can’t do what you need to do.”

They collected what samples they could, but they were unable to gather data for a project of a student on the trek. She had to abandon the Nepal study and later did fieldwork in Saskatchewan instead, which led to some significant findings. “If you end up going to places you didn’t expect to go,” Larson says, “you can discover things you didn’t expect to discover.”

Safety is also a major concern when working on the edge, and adventurous scientists recommend erring on the side of caution, both to protect team members and to sustain funding. After all, it can take extra effort to persuade a granting agency to give money to support a dangerous, lengthy or team-heavy expedition that may not go as intended.

Early in his career, ecologist Douglas Larson (no relation to Kyle), now an emeritus professor at the University of Guelph, Canada, included climbing ropes in a purchase order so that he could rappel down cliffs in the Niagara Escarpment and study what turned out to be extremely ancient trees living there — a discovery so surprising that forest ecologists in the region disparaged the results before they saw samples.

The university’s director of safety and security told Larson that even one accident would shut his project down. From then on, he committed to extra precautions and redundancies in his equipment, so that even if someone had a heart attack, he or she could be pulled up. Instead of having two or three points of webbing attached to the anchors at a time, as do most recreational climbers, he and his group use four or five.

EXTREME BACK-UP

Strong safety nets become essential in this line of work. Elliott’s dig in South Africa had a medic on standby 24 hours a day. They notified several groups about their plans, including the South African military and a mining-rescue organization, so that they could get help quickly in case of a confined-space emergency. Many adventure-researchers buy specialized insurance that can provide rescue help in remote locations or that can cover accidents related to their work.

But no insurance company can charter a helicopter-rescue mission to a place such as K2, the second-tallest mountain in the world, where geologist Mike Searle of the UK’s University of Oxford has conducted research. He recommends building relationships with the locals in remote regions, and he always gets to know his porters. “If you’re in trouble, those are the guys who are going to carry you down.”

It also helps to be in shape, which is business as usual for many researchers who scale glaciers, climb mountains or dive to the ocean floor in frigid water. To prevent injury and to stay flexible and strong for caving, Elliott runs, hikes and takes exercise classes that combine ballet, Pilates and gymnastics. Kyle Larson lifts weights six days a week when he is not trekking. Kim freedives for fun, often down to

JOYS OF DISCOVERY

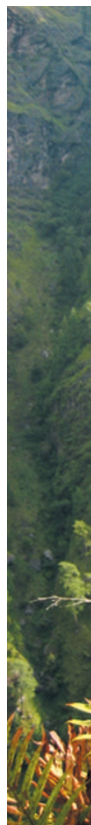
Views from the other side

Ecologist Douglas Larson, emeritus professor at the University of Guelph in Ontario, had just begun to belay a colleague over a cliff in Ontario when some weasels emerged from a nearby hole. As the colleague descended out of sight, a mother ermine and her 13 babies ran over Larson. “All I could do was scream out, ‘I’m being swarmed by ermine!’” he says. “It was one of those exquisite experiences that happens and disappears again.”

Despite its dangers and frustrations, extreme fieldwork can produce incredible, once-in-a-lifetime memories for scientists who put themselves out there. Kyle Larson (no relation to Douglas), a structural geologist at the University of British Columbia in Kelowna, once brought his father along as a field assistant on an expedition to the Himalayas. They hiked ahead of their porters, and after topping a 5,000-metre-tall peak, they stopped in a small settlement. Snow was

falling, and they were getting chilled. Then an elderly Tibetan woman poked her head out of a house and beckoned them inside. She gave them salty yak-butter tea. And although they could not communicate much, they sat around the kitchen’s cooking fire for the next hour, sharing the warmth until the rest of the team appeared. “Those things happen on every trip,” Larson says. “From a cultural perspective, it becomes very enlightening.”

Best of all, say adventurous researchers, are the rewards that come with pushing the limits of discovery. Dangling from cliff faces in Canada and France, Doug Larson has discovered tiny, 1,000-year old trees. Up in the treetops, ecologist Catherine Cardelús, an associate professor at Colgate University in Hamilton, New York, always marvels at the perspective that she gains when she doesn’t have to keep her eyes glued on the trail for snakes. “Oh my gosh,” she says. “Every day I see things most people don’t see.” **E.S.**





Kyle Larson on a research trip to Nepal.

LAURENT GODIN

18 metres or so. And Searle, now aged 61, bikes to work every day. He also climbs, swims and surfs. “You can’t climb mountains,” he says, “if you’re a couch potato.”

One summer day in 1998, Cardelús was dangling from a rope some 24 metres above ground, near the top of a tree in the Costa Rican jungle, when two howler monkeys began to make aggressive motions. Crouched about three metres away, they were shaking branches and baring their teeth with arms outstretched, ready to leap. “I thought, ‘Oh my God, here they come,’” she says. Then she heard “an ancestral guttural sound” — not from the two monkeys, but from her husband, who was working nearby. The monkeys scattered.

Cardelús — who no longer climbs when monkeys are nearby — has experienced many such close calls that include run-ins with snakes, ants, bees and tarantulas (see ‘Views from the other side’). “Each time you climb a tree for the first time, you have to be prepared to evacuate within 15 seconds,” she says. “It’s always exciting getting into the canopy. And it’s just as euphoric to get to the ground.”

Wildlife is not the only source of heart-thumping adventure. One afternoon in the spring of 2011, Kyle Larson crested a mountain pass in Nepal to discover a steep, nearly sheer descent buried in waist-deep snow. The team could see neither the trail nor what they were stepping on. Last year, he arrived in the country’s Makalu region on the heels of a

busy storm season that had dumped metres of snow on the region. Piles of snow reached the rooftops, and trekking was treacherous. “Trying to walk down through that was scary,” he says. “There were lots of bruised knees and falls.”

A certain level of psychological preparation is crucial for working in extreme environments that are, by nature, full of surprises. And that process often starts before the expedition begins. For Elliott, the idea of squeezing through an extremely tiny space presented the first mental obstacle. When Lee Berger, the palaeoanthropologist who recruited Elliott and her fellow cavers for the South Africa excavation, told them that they would need to fit through a small gap, “all of us ran around our houses measuring furniture and stuffing ourselves under it”, she says. She could wedge herself into the space just by expanding her lungs.

As she applied, Elliott worried that she wasn’t qualified enough or that she had screwed up the Skype interview. She continued to doubt herself even after arriving on site. On the first day of reconnaissance, she looked into the 12-metre-long vertical chute that the team was to descend. If someone were to get hurt, medics would have to tend to the injured person until she healed enough to get out on her own. “Psychologically, that was quite trying,” she says. “I remember looking down this shark’s maw of rock, and you can’t see where you’re going because it’s not a straight line, and thinking, ‘Oh, gee, perhaps I’ve miscalculated my own skill set.’”

Because academic courses typically do not cover the ins and outs of survival, Elliott relied instead on years of hands-on experience and prior training that had taught her to remain calm enough to deal with unexpected circumstances. Long before she took on the caving job in South Africa, she had worked as a field guide for an adventure-tour company in the Rocky Mountains and earned a certificate in wilderness first aid. Both equipped her with survival and decision-making skills.

It is impossible to predict every emergency, she says. But one can learn to think quickly and clearly in any situation. “What you can prepare for,” she says, “is the mental stability to say, ‘OK, what do we need to do next? Who needs to do it?’”

Elliott also advises young researchers to pursue all of their life passions, even if they seem completely unrelated. She started out studying veterinary medicine before earning a PhD in anthropology and landing the career-changing excavation post in South Africa. “My take-home message is, don’t fuss if your career or life path appears to be a little bit circuitous,” she says. “You never really know where any given skill set or experience might lead you.” ■

Emily Sohn is a freelance journalist in Minneapolis, Minnesota.

TRADE TALK

Science integrator



Lana Gent is a director of science at the American Heart Association in Dallas, Texas, where she coordinates networks of volunteers, the drafting of science guidelines for emergency medicine

and the production of instructional videos on first aid.

What do you do?

I help to gather input from resuscitation scientists around the world who evaluate the scientific evidence that goes into the creation of our resuscitation guidelines. I’m not usually the one who is giving the talk or is the first author, but it is my team that ensures that those experts are able to do the presentation or create the publication.

How did you learn about this job?

Our lab was in a crunch for money and that made me think about what I wanted to do. Do I continue on this pathway of being a traditional lab scientist? Colleagues were encouraging me to be a medical-science liaison — a professional who teaches physicians how new medicines work — and I was going to interviews. During that process, I was contacted by a recruiter representing the American Heart Association. I didn’t think I was the best fit; I didn’t have a resuscitation-science background or management experience, but the recruiters knew that I had transferable skills. I convinced everyone that if I could learn stereotactic brain surgery in mice, I could learn resuscitation science.

Why is this job right for you?

No one goes to school for the type of position I have. You wear a lot of hats. The hiring manager could see that I took initiative and was passionate. I had shown that I could take on new challenges and bring people together.

What has the job taught you?

I had to learn to be resilient and inquisitive and not walk along just one path. Sometimes as scientists we pride ourselves on being contemplative, and the greatest skill set here is to simplify information and to be quick on your feet. ■

INTERVIEW BY MONYA BAKER

This interview has been edited for length and clarity. For more, see go.nature.com/iysud.