

Voyage to Antarctica

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The words “Peregrine” and “The Spirit of Adventure” sailed past our house. My husband Peter motioned me to the window where he stood, looking through binoculars. Our home perches on a cliff at the entrance to St. John’s Harbour, where we can watch ship traffic come and go. One vessel, the *Akademik Ioffe*, piqued our interest so we walked down to the harbourfront to investigate. *Akademik Ioffe* is a Russian ice-strengthened ship designed for research and leased to the Australian company Peregrine. In our summer, she circumnavigates Newfoundland and Labrador, and in our winter, she heads for Antarctica. We boarded and inquired whether the ship required a physician for the next Antarctic voyage. Several months later, I had landed the job of expedition doctor on an upcoming journey to the Antarctic Peninsula, a horn of land on the north-west side of that vast continent. For Peter and me, it was to be our honeymoon.

Our trip to meet the *Akademik Ioffe* took us through Santiago, Chile, Buenos Aires, then Ushuaia, the southernmost city in South America. There we joined the ship and began our journey through the Beagle Channel and across the Drake Passage to Antarctica. The Drake Passage is known for violent and unpredictable storms. This is where mariners recount stories of the roaring forties, furious fifties, and screaming sixties — all referring to degrees of latitude between Cape Horn and Antarctica. Here, cool Antarctic water flows north to meet the Indian, Atlantic and Pacific oceans. The Antarctic trough, a ring of low pressure around the continent, constantly forms cyclonic valleys, creating the worst seas in the world. I thought of explorers past — from Cook in the 1770s to Scott, Shackleton and Amundsen in the early 1900s — tackling these seas under sail in small vessels, with little to speak of for comfort. Like all the passengers on the *Ioffe*, I was concerned about potential seasickness, but recognized it as insignificant compared to the dangers and discomforts faced

by the early explorers. Some of those early vessels took 180 days to round Cape Horn because the ships could not sail to windward; they could only wait at sea for conditions to change.

Despite the conditions, people have been drawn to Antarctica for centuries. Its remoteness fascinates, and it overwhelms the senses, evoking responses that are both visceral and emotional. Here exists a continent that man cannot conquer. We do not and cannot exist here in any significant way, so it remains pure and inviolate. We must leave Antarctica alone: observe it, respect it and leave no traces of ourselves.

It is a continent of superlatives: the driest, highest, windiest, coldest and fifth-largest continent on earth. Ninety-nine percent ice, it contains 70% of the world’s fresh water in solid form. Yet it is a desert, with only a few centimeters of snow each year, falling in fine particles called diamond dust. Because its brilliant white surface reflects the vast majority of the sun’s rays away, it absorbs almost no thermal energy and is too cold for liquid water to exist. The world’s lowest temperature, minus 86°C, was recorded at the South Pole. In winter, ice forms around Antarctica, effectively doubling its size to a continent about the size of Africa. Ice knits the continent together, covering mountains and hiding crevasses which, if not for the ice, would lie below sea level.

Glaciers flow continuously like frozen rivers from the polar cap to the coast. Some move as fast as 1200 m per year. They form ice shelves as they reach the ocean, hanging over the sea like frozen tongues. This ice is crosshatched with cracks and crevasses and becomes infiltrated with seawater from below. Thus, icebergs are calved in many shapes, as many as 10 000 per year. Tabular icebergs, unique to Antarctica, form when an ice shelf cracks off over the sea. The resulting berg has a typical flat surface and steep sides. Tabular icebergs are vast —

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Penguin highway

up to 100 km long and 200 m high. Huge numbers of them loom in dense fog, threatening unwary ships. In our case, bergs born from the Ronne Ice Shelf, a 400 000 km² area, turned the *Ioffe* back from the Weddell Sea and delayed our arrival.

From a distance, it was unclear whether the huge tabular bergs were part of the continent or floating nearby. As we approached, we were overwhelmed by their size and variety. Smaller, more familiar-looking bergs are multi-coloured, reflecting blue or green depending on the organic material compressed within. Very old ice can be completely blue and indescribably beautiful. Blue and aqua greens are iridescent in the sun and beneath the surface water where four-fifths of the iceberg lives. Each iceberg is unique in size, shape and texture, and surface markings tell their history. On their journey from the glacier's edge to the oceans farther north, they roll and calve and melt, and eventually die, some taking years to do so. All are a stunning part of the Antarctic landscape.

Antarctica is the windiest place on earth. Frigid air flows downhill from the polar cap to the coastal areas. Gravity-fed, these so-called katabatic winds gain momentum as they approach the coast, reaching velocities of 300 km per hour. Colliding with the relatively warmer coastal air, they spawn blizzards and fog. This is compounded by the ring of cyclonic troughs that, uninterrupted by land, circle the continent, producing the most unpredictable and severe weather on earth.

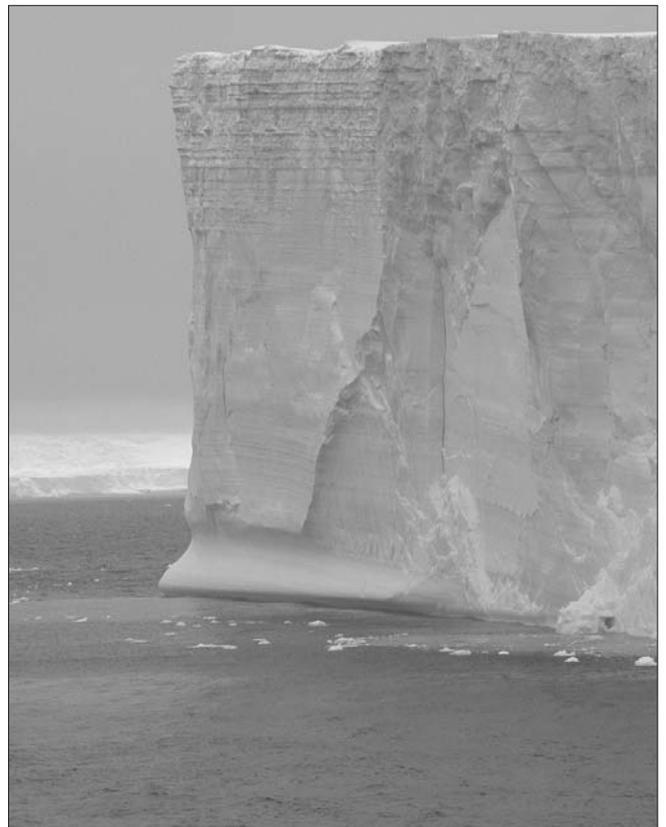
But in these harsh conditions life thrives. The icy waters are dense with krill, a shrimp-like animal that forms the basis of the food chain and supports all Antarctic life. As the cold Antarctic water mixes with warmer water from the north, currents develop, which churn up organic matter, creating excellent feeding grounds to support a profusion

of animals: large numbers of the relatively few species that are adapted to the unique environment.

Antarctica begins at about 60° south, at the convergence, or polar front. Aboard the *Ioffe*, we knew we had reached the convergence when electronics on the bridge indicated a sudden 5° drop in the water and air temperature. Then fog set in, and wildlife appeared. We had arrived on the other side of the looking glass.

Penguins are a common first sighting. They rest on shorter icebergs, having jumped aboard from the ocean where they feed. Penguins are efficient swimmers and have impressive adaptations to the cold, but on land it's hard not to anthropomorphize and see them as "cute." Other ice-dwellers include several species of seal, most notably the leopard seal, which is regarded as the polar bear of Antarctica. Efficient feeders, they consume krill, but also predate penguins and other seals. They are solitary animals, small and serpentine in appearance, and they have no predators. Little is known about leopard seals, and they have never been observed mating or giving birth. We saw several, usually alone on an iceberg, often covered in blood from a fresh kill.

Whales are common, particularly humpback, minke and sei, although we were fortunate to see a pod of orcas and a solitary blue whale. A trusting pod of 25 humpbacks ap-



Tabular iceberg



Map of Antarctica

peared one day and seemed to “play” with our ship. They did not appear to be feeding and we wondered if they were just “having fun.” Humpbacks are slow-moving and easy targets for hunters. Grytviken, where Shackleton is buried, on South Georgia Island, was the largest whaling station in Antarctica, and many marine species were decimated in the region. Now the humpbacks, like many other Antarctic animals, are protected. Whale and seal numbers have recovered somewhat from the days when hunting was allowed.

Once the *Ioffe* arrived on the Antarctic Peninsula we lowered Zodiacs, usually twice daily, and made several landings to experience the terrain and wildlife. We saw four species of penguin: Adélie, Chinstrap, Gentoo and Macaroni. Each had their own personality; some were even inclined to approach humans if they were sitting quietly. The Gentoos seemed curious about my medical kit, picking at its black straps for nesting material, and the Macaronis were extraordinarily cranky.

To reproduce successfully, penguins nest on high land in a rookery, avoiding standing water, which can kill their eggs. The birds must stay pristinely clean to remain waterproof, and they must stay waterproof to swim and to feed themselves and their young. They travel on “penguin highways” — paths from the top of the rookery to the ocean — with dirty penguins on one side, heading down to the sea and clean ones on the other side, walking and hopping laboriously up the steep slopes. Bellies full of krill, they seem barely able to remain upright, let alone navigate the terrain. Yet they unerringly find their own nest, from which

their young noisily demand food. The adult penguins then exchange elaborate vocal greetings and switch over so the dirty hungry one minding the nest can clean themselves and feed. En route to the sea, this parent slides down the hill, walking, stumbling or tobogganing on its belly, over and through other penguins’ territory, taking no end of abuse from trespassed neighbours.

Penguins can be thieves. Their nests are built from small rocks, and home improvements are often accomplished by stealing rocks from their neighbours. Sometimes one penguin will steal a pebble from a nearby nest, only to find upon returning home that its own rocky home has been similarly raided.

As the expedition doctor, I carried a heavy waterproof bag that held any gear I might need urgently: a laryngoscope, airways, endotracheal tubes, IV lines and fluid, splints, cervical collars, drugs and an automatic external defibrillator. I was prepared to respond to any emergency just as I would in my “other life” in the ED; but in the event of an Antarctic emergency, the difficult part would come later in the form of a prolonged stabilization phase while in transport to the nearest facility able to land an aircraft. Transport times in Antarctica range from 3 to 12 hours, depending on the site of an accident. Fortunately, Peregrine has safety foremost in its mind; the Zodiac drivers are extremely skilled in getting people safely from ship onto shore, often under difficult sea conditions, and the expedition leaders have great expertise in conducting their journeys. Thanks to their skills, mine were never put to the test. Nevertheless I remained in constant radio contact with all drivers and the ship while doing on shore excursions.

Numerous Antarctic research stations were built in the 1950s and most have a resident physician, because emergencies do happen. I met two physicians, an Argentinean at



Old blue ice in Lemaire Channel

Esperanza Base and an American at Palmer Station. Esperanza Base is unique in that it is essentially a small Argentinian town for families, complete with a hospital, church and general store. The hospital is as well equipped as any emergency department and the physician in residence is a vascular surgeon and cardiologist, a remarkable combination. He is able to perform a few procedures on site — even stress tests — but patients requiring surgery are flown to Argentina.

Dr. Kristin van Konynenburg, at Palmer Station, had been there several months, having arrived at the end of Antarctic winter. At that point, the station's scientists and staff had endured several months of complete darkness, a hardship to which she was sensitive. The Palmer Station infirmary is very well equipped, with everything she needs to perform rapid sequence intubation, procedural sedation and defibrillation or cardioversion. Dr. van Konynenburg does her own lab tests and x-rays, but to cope with her 24/7 on-call responsibilities, she has trained assistants in first aid and CPR.

Patients requiring evacuation are sent by ship or air, depending on their condition and the stability of the glacier at Palmer. In winter, aircraft can land on the solid ice; at other times, patients are transferred to Rothera Research Station, a British station further south, at Rothera Point on Adelaide Island, with sophisticated air evacuation capabilities, from which they most often fly to Punta Arenas, Chile. It sounds straightforward, but in the event of serious illness, the remote doctor functions as physician, nurse, lab tech, x-ray tech, respiratory therapist and janitor. Serious illness is infrequent — residents undergo comprehensive screening before being stationed at the South Pole — but when it occurs, a great deal of skill is needed. Kristin has some medical back-up via a telemedicine connection to Denver, Colorado, and a digital x-ray imaging system that enables rapid electronic interpretation. However, it is challenging to maintain vital skills that are rarely used.

Memorial University's Faculty of Medicine is addressing this challenge as we develop a unique EM program. The EM year will be complemented by an enhanced skills option for new and experienced graduates who want to perfect skills needed in remote and rural practice. The Family Medicine department, where our EM program is being developed, helped pioneer telemedicine technology that creates real time electronic connections between "front-line" doctors in Newfoundland and Labrador and specialists in urban academic settings.

A special kind of physician is attracted to remote places like Antarctica and Labrador. I asked Kristin about the key qualities required to function in these settings. She believes

that family and emergency doctors are highly suited for work in remote Palmer Station. In order to deal with people who face isolation and long periods of darkness, doctors need to be part physician, part counsellor and part confidante. A narrowly focused physician with poor communication skills would not do well. In addition, remote work demands that physicians know their limitations and have the confidence to know that they have done their best medically, regardless of outcome. This confidence can take years to achieve, and it is a quality we hope to help foster through our EM and enhanced-skills program. Kristin also noted that her medical practice is relatively low volume, so it helps to have a broad interest in wildlife and the outdoors.

The Antarctic trip complete, my thoughts returned to emergency medicine and enhanced skills for remote doctors, although I still find it difficult to focus on anything but Antarctica. This amazing experience adjusted my perspective and reinforced my philosophy of medicine. It reminded me that nature is far more powerful than we are. The creatures of Antarctica have adapted to survive in the world's most unforgiving environment, while we humans can only attempt to adapt the environment to meet our needs, often with disastrous consequences. Antarctica, unapologetically the windiest, highest, driest and coldest place on earth, is too harsh to tame, and this is part of its magic. As a species and as patients seeking good health, we could learn from the way nature endures in Antarctica. Our bodies have wondrous natural processes, which if left alone often will heal us. Knowing when to interfere and when not to is like knowing when we as physicians have done all we can, regardless of outcome. It takes practise and time and reflection ... time to think in this busy world ... something I hope Peregrine's current expedition doctor is able to do in the sanctuary of Antarctica.

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