

**Sarah Stewart Johnson**  
from *O-Rings*

Each of us had our own scientific interests: penguins, ciliates, the flapping valves of Antarctic scallops. For me, it was the bacterial cells eking out a living in the bleakness of inland Antarctica. I analyzed samples from the Dry Valleys, just across the sound, where no rain has fallen for two million years. There, iron oxide minerals, which also tint the surface of Mars, stain the blood-red tongue of a glacier that dips down to the ice-covered surface of a salt lake. I studied Bratina Island, which has all the indicators of land but isn't land at all, just a thick layer of dirt and rocks resting on a layer of ice, floating, in turn, upon the sea. Slick mats of green, yellow, and orange cyanobacteria are suspended there, like felt in the meltwater ponds, gashes of color against the barren terrain. I investigated all the microbial colonies I could find, trying to understand how pockets of life could survive in the hostile, Mars-like conditions.

Unexpectedly, though, it wasn't the continent's biology that most moved me, or its tumbling crevasses or poleward storms. Or even the remarkable extent to which my inner world flowed out into the landscape. It was those huts built by Scott and his two polar expedition parties. In contrast to the shimmering ice, the world inside them was dark and awful; there were reverberations from the walls, the abandoned tins and boxes, many of them still full. There were bottles of ketchup, tins of cabbage, a gramophone, test tubes, and glass vials with chemical powders. Ruined reindeer boots, man-hauling sled belts, stacked carcasses of seals, the echoes of death.

There's a small library at McMurdo, located between the laundry room and the weight room at the rear of Building 155. It has no windows and about thirty shelves of books. During the light-washed nights, when I couldn't sleep, I would sometimes find myself there, studying

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the faces of the men who once inhabited those huts. I would curl up on a piece of battered furniture and look through books and photographs archiving the early expeditions. One day I came across the diaries of Edward Wilson, the scientist of the crew. He last saw the Terra Nova hut in late October of 1911, when he joined Scott on his final expedition. All five men in the party reached the South Pole only to discover that the Norwegian flag had been planted there a few weeks earlier, and all five men died on the return journey. Wilson collected thirty-five pounds of geologic fossils proving that Antarctica was once covered by ferns. The consummate scientist, he hauled those fossils to the very end.

On his way back from the Pole, Wilson catalogued the ambient temperatures, which remain to this day among the coldest ever recorded on the South Polar Plateau. So cold that a glass of water thrown into the air would freeze before it hit the ground. A few days later the expedition unearthed a stored cache of supplies at Middle Barrier Depot only to discover that the canisters of fuel had evaporated. It was early March 1912, just a couple of weeks before their death. They needed fuel to melt drinking water and dry out their clothes. Without it, they slowly became encased in a mantle of frozen fabric. There was nothing to treat their frostbitten toes. No heat to draw them from their reindeer-skin sleeping bags in the morning. No warmth to help their shivering bodies to sleep at night.

It was a major turning point in the expedition and, as it turns out, the evaporation of the fuel can be attributed to something very small. The o-rings, the flexing gaskets that acted to seal the fuel inside the canisters, turned brittle and cracked in the extreme cold.

As a space scientist, I know something about o-rings. In 1986, seventy-four years after Scott's party met its end, Caltech professor Richard Feynman sat before an investigative panel and dropped an o-ring into a glass of ice water to demonstrate how circles of rubber lose their

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pliability in freezing conditions. Afterwards, he placed the o-ring down on the wooden podium, looked solemnly ahead and said, “I believe this has some significance for our problem.” And indeed it did; he was part of the committee of scientists reviewing the Challenger shuttle disaster.

I was six years old when the Challenger exploded but I remember it well. Christa McAuliffe was going to be the first schoolteacher in space and, like schoolchildren around the United States, I was peering up at a television watching the liftoff live. After a few moments, Mrs. Schrader walked to the front of the room, her face white, and clicked off the power. It’s one of my earliest memories, and yet it didn’t alter my desire to become an astronaut. Even now, even with two shuttles down and NASA’s human spaceflight program in disarray, I still think about soaring off in a rocket.

A hundred years have passed since Scott’s expedition, and the frontier is now the void of outer space. Like many other young scientists, I have levied my striving upon this great unknown, but I sometimes worry that my convictions about exploration are inaccurate. What if the actuality of this enterprise is horribly different from my romantic ideas?

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