One Boy’s
Auroral Expedition
Experiential Science Education

Dennis W. Fantone
Imagine the challenge of trying to convince your funding agency to sponsor a photographic expedition to Iceland to photograph the aurora borealis when you have no formal training in photography or auroral sciences. Now also imagine that your funding agency is not some government organization but your parents, and that you need to be taken out of school to go on this trip.

This was the challenge I faced last summer, when the idea of photographing the aurora came to me. I became interested in natural photography during a whitewater rafting trip to Utah. That was my first time in a canyon, and I was so amazed by it that I wanted to share my excitement with everyone. It was then that I became fascinated by the possibilities photography offered for sharing my experiences.

My interest in photographing the natural world has since led to a broad interest in the sciences, one extending beyond a traditional biology, chemistry or physics curriculum to include geology, astronomy, optics and other sciences. I am writing this article in part to show how a hands-on field trip exposes you to a range of scientific principles and activities that would never be encountered in the classroom.

Having succeeded in my first photographic experience during an Outward Bound trip through Desolation, Gray and Labyrinth canyons in Utah, I wanted to find another interesting place to go and take pictures. Although I considered possible destinations in areas ranging

Figure 1. (Facing page) Fisheye view of the aurora, an exposure lasting a few seconds. (Above) Although the weather was warmer than in Boston, Iceland was still very cold at 2 a.m.
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from Africa to Antarctica, I could not decide where to go or what to photograph until I came across a book on the aurora entitled, Northern Lights: The Science, Myth, and Wonder of Aurora Borealis. The thought of seeing colored lights dance across the sky was new and different, and I knew the aurora was what I wanted to understand and photograph. The next problem was to find a suitable location from which to do so.

Preparations
As I learned more from Web searching about viewing the aurora, two destinations emerged as being the most promising for best viewing in November. I had located a Web site which showed the auroral oval* and discovered that the places it could be viewed from were Iceland, Alaska, Greenland, northern Canada and northern Russia. Viewing from some of these places would not have been practical. In northern Canada and northern Russia, there aren’t many cities located under the oval and simply finding places to stay would have been a big challenge. I ruled out Greenland because it is difficult to get to and the late fall weather in Greenland is usually very bad. I was left with Fairbanks, Alaska, and Reykjavik, Iceland. In the end I decided that Iceland would be the best choice because there would be more to do during the day when I was not photographing the aurora, it is easy to reach, and it possesses unique geology and an interesting culture to study. I thought I had a 50-50 chance of seeing the aurora during my visit.

Now all I needed was to get the camera equipment and to convince my funding agency to agree to sponsor me. I soon realized I would have to get approval first because of the cost of equipment and travel. Surprisingly my parents consented rather easily, on condition that my grades would not drop because of the trip and that I would send daily e-mail narratives to my classmates describing my experiences.

Since I was not old enough to go on my own, my father served as driver and porter.

In doing background work on the aurora, I soon realized that I would need to make time exposures and that I would want to take some pictures that covered extremely wide angles. The aurora actually moves quite quickly, so any exposure longer than a fraction of a second includes some motion blur. For the time exposures I would need a tripod and fast film. I was doing a lot of research on the Internet to find the best films to use for these low light levels and the optimal film processing for auroral pictures. I also discovered that I would need a generous measure of luck, given that the weather in Iceland in late November is often cloudy and rainy for extended periods. The www.spacew.com site provides nearly real-time detailed information on auroral activity from satellites and ground observations. From this resource, I was able to learn a great deal about coronal mass ejections, the events that create auroras. I was also able to monitor the auroral oval over Iceland in the months leading up to the trip.

Since I would need to have several cameras available, I went to work trying to beg, borrow and kluge together an assortment of cameras, tripods and optical apparatus. My major achievement was to convince a professional photographer to loan me two special lenses: a Canon 15-mm focal length fisheye, which provided a nearly 180° corner-to-corner field of view, and a Canon 20-mm wide-angle lens. Also, I tried to anticipate all the difficulties I might encounter on the expedition, so I packed spare screws, film, duct tape, Allen wrenches, film and cable releases.

Departure
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\*I eventually settled on Fujicolor Superia 400 and 800 speed.

Figure 3. Auroral image taken with Kodak Ektachrome infrared film. The predominantly blue color indicates green auroral light, the lack of red indicates little near-infrared contribution from the aurora. The lights in the distance are Reykjavik.
porter. We left on the Tuesday evening before Thanksgiving. It was an overnight flight and we sat on the north-facing side of the plane so that we might see any auroral activity. I could not believe my good luck. While the rest of the passengers slept, I was able to see the aurora! I tried to capture it on video but was unable to because the glare in the window was too strong.

While my father and I were in Iceland, we did many science-related things. We visited Geysir, the namesake of all geysers. We visited Thingvellir, a geothermally active area where the mid-Atlantic ridge is spreading across the valley at a rate of 2 in. a year. We swam in geothermally heated springs where the water is bluish, in part from the algae that thrive in the superheated water below the ground. At this time of year in Iceland, the sun rises after 10 a.m. and sets before 4 p.m. Everywhere my father and I went, there was something of scientific significance around us.

On our first night in Iceland, we set out at 9 p.m. to find some dark skies. About 10 miles north of Reykjavik, after only 15 minutes, a huge aurora formed across the sky. It stretched directly overhead, from one horizon to the opposite one. When I had planned the trip, I had never imagined I would see anything so amazing. For about an hour the aurora remained strong, sometimes showing hints of red. I was able to capture it on video as well as with the 35-mm camera. Every night of the trip, I stayed out very late, most nights past 2 a.m., to watch for the aurora. On two other nights, I succeeded in capturing images of the aurora, each time with spectacular displays. On each occasion I took pictures with both color and infrared sensitive film.

The attractions of Iceland

Perhaps one of the most interesting places I visited was the Nesjavellir geothermal power plant. Built in the late 1980s, it is still expanding. The plant draws its power from 300° C steam in the ground and provides electricity and hot water to Reykjavik, about 40 miles away. The steam is essentially superheated groundwater. In the geothermal area at Nesjavellir, a single 8 in. diameter well that is 2000-feet deep can produce sufficient steam to generate 7 MW of electrical power and hot water for thousands of Reykjavik homes. The plant has 21 wells, 14 of which are used for power generation. Some of the wells have actually produced steam that is too hot for power production, over 400°C! Steam at this temperature contains dissolved minerals that will damage the steam turbines, and at room temperature the water has a noticeable odor of hydrogen sulfide. Most of the hydrogen sulfide occurs naturally, but some is added to

Figure 4. The auroral oval for February 23, 2003, at 4:42 p.m. EDT, 21:42 UT (from www.spacew.com).
remove oxygen from the water as a means of preventing the pipes from corroding.

In Reykjavik, we visited deCODE genetics, Inc. (yes, that is how they spell their name). The company studies the genes of Icelanders (who have a very isolated gene pool) to try to determine the genetic component of certain diseases. We also went to the University of Iceland, where we met with physicist Ari Olafsson, the only OSA member in Iceland. He showed us his own laboratory and the teaching laboratory used by his physics students.

On Saturday we had particularly bad weather, with thick clouds and driving rain. To pass the time we took a bus tour of Reykjavik and explored the city. While driving back to the hotel later, I noticed stars in the sky. This was unexpected because it had been cloudy and rainy all day. Back at the hotel, I checked the auroral oval online and saw that soon we would be in the area of highest auroral activity. We started driving to our usual spot for viewing the aurora. On the way, we saw a faint aurora in the sky, but nothing I could photograph. A few miles outside of Reykjavik, we stopped the car. Almost as soon as I stepped out, a huge aurora appeared from horizon to horizon, just as had happened on the first night. I decided to photograph it immediately from where I stood so that I would not miss anything. For about two hours, I took print and infrared photos and even did some recording with the video camera. Then the aurora faded and the clouds came in.

It was about 3 a.m. so we decided to go downtown and check out the wild nightlife we had heard about. We found that more people were going into the clubs than coming out. All the locales were packed. We walked around for a while and then went back to the room, worked on my narrative and went to bed.

**Reflections on a great experience**

I really enjoyed this trip. Space does not allow me to describe all of our activities, which included caving and climbing over lava flows.

In planning, executing and recovering from the expedition, I learned many things that would never be covered in a conventional science curriculum, in a context that could not be created in a classroom. I was able to learn about photography and take amazing photos while learning about another culture and seeing strange landscapes and auroras. I learned about optics, atmospheric physics, geology and astronomy. To me, the experience made science real.

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**References**


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**Figure 5. Mountains, clouds and auroras.**