

# ARCTIC ADVENTURE

**Five UIC students head north for the trip of a lifetime—and bring back tales of a changing planet**

**By Cindy Kuzma**

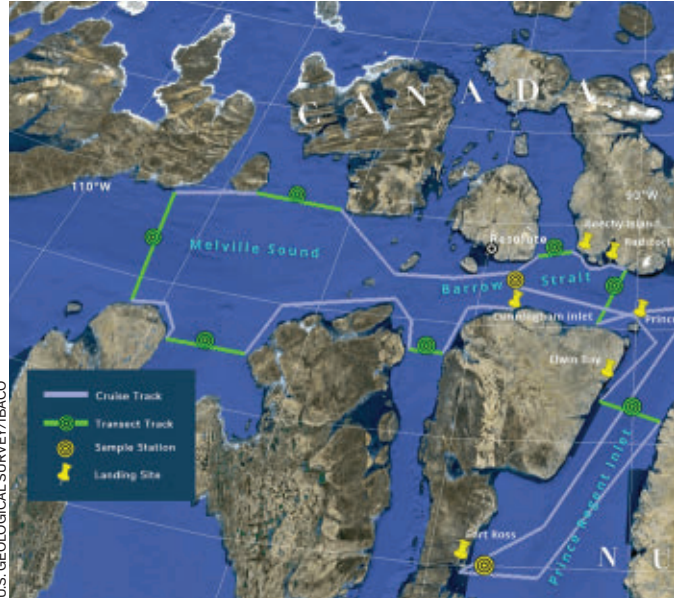






CYNTHIA GARCIA

COURTESY OF NORTHWEST PASSAGE PROJECT/GOOGLE EARTH/LANDSAT COPERNICUS/  
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Sheer white glaciers and icebergs rise up out of crystalline waters. Walrus and seals sun themselves on rocks. Inuit children scamper near the shoreline or tend to their huskies. The images in UIC Ph.D. candidate Cynthia Garcia's phone albums are stunning—like freeze-frames from a nature documentary.

Garcia has spent years studying the Arctic, scrutinizing the circulation of polar ocean water to better comprehend climate change. But until last summer, she'd seen the region mainly as "pixels on a map," sourced from satellite data.

Then last July, she and four other UIC students boarded the Swedish icebreaker *Oden* and set sail through the Northwest Passage, the famed connection between the Atlantic and Pacific Oceans that goes through islands north of Canada.

Over 18 days and 2,000 nautical miles, Garcia's maps and data have transformed into once-in-a-lifetime opportunities and experiences. The aspiring scientists gathered water samples and drilled ice cores, equipped with ice picks lest the surface beneath them cracked. They stood in the rain and sipped fresh meltwater from polar ponds. Between helicopter rides to native villages and historical sites, they scouted for seabirds and polar bears.

It was all part of the Northwest Passage Project, an Arctic expedition led by the University of Rhode Island's Inner Space Center, with funding from the National Science Foundation and additional support from the Heising-Simons Foundation. The other UIC students—Frances Crable, a Ph.D. student in biological sciences; Theresa Ewa, a senior pre-med student in biochemistry; Humair Raziuddin, a fourth-year pre-med student in biological sciences and psychology; and Samira Umar, a junior in chemistry and earth and environmental sciences—joined more than 30 other researchers, students and storytellers on board.

Icebergs and seabirds are a far cry from the skyscrapers and pigeons around campus—and that was the point, says Miquel Gonzalez-Meler, Ph.D., a UIC biological sciences professor who has studied the Arctic and served as a liaison for the project. His past work, combined with UIC's mission to be a minority-serving institution, made the school a perfect fit for sending students on the expedition. "We wanted to take students from Chicago to a remote place that very few people have been, get that experience and then have them share the impact with the rest of the UIC community," Gonzalez-Meler explains.

And share they have—with UIC and

beyond, through blog posts, live broadcasts and a forthcoming two-hour documentary about the journey. Scientists study climate change in extreme regions like the Arctic, but if they can't share their research in a meaningful way, their findings remain data points in jargon, presented at science conferences or locked away behind paid journal paywalls.

Now that Garcia has seen, heard and even tasted the Arctic up close, "I have this holistic view of why this research matters," she says. "I can translate its importance and make it more accessible for people to use in their daily lives." And that's critical, given the broad implications. "Anything that happens in the Arctic doesn't stay in the Arctic," Garcia adds. Climate change contributes to everything from earthquakes and tsunamis in her native Philippines to the polar-vortex conditions that Chicagoans endure.

### THE NEXT PHASE OF HISTORY

For centuries, the Northwest Passage was inaccessible. Massive icebergs crushed or trapped anyone who dared to traverse it. Take the 1845 expedition led by British explorer Sir John Franklin. Despite two ships deemed unstoppable—and loaded with three years' worth of provisions, including 32,000 pounds of beef, 200 gallons of "wine for the sick"

(Below) This map shows the expedition's route through the Northwest Passage, winding through the Canadian Arctic Archipelago, a group of largely unpopulated islands.



(Left) Scientists, education professionals and students sailed through the Northwest Passage aboard the *Oden*, a Swedish icebreaker operated by the Swedish Polar Research Secretariat and the Swedish Maritime Administration.

and a daguerreotype—he couldn't penetrate its pathways. His ships vanished, his crew of nearly 130 men presumed perished.

Finally, in 1906, Norwegian explorer Roald Amundsen successfully traveled the route by ship. Since then, improved technology and a warming planet have made the journey less treacherous. In 2007, the Northwest Passage was temporarily ice-free for the first time in known history, a phenomenon that's recurred in several summers since. That's allowed research vessels, commercial carriers and even cruise ships to navigate its waters, though the route's ownership is disputed. Canada has claimed possession, but the U.S. and China hold different perspectives.

The students were well-aware of their place in history, as well as the current Arctic culture and controversies, before boarding the *Oden*. Many had taken a class on the Arctic that covered not just its science but also the region's history, literature, geopolitics, economics and art. The shipboard team also included an Inuit scientist and community

liaison, an Arctic scholar and a polar guide.

"We're scientists who want to study climate change," Garcia says, "but we can't ignore the economic implications of an opening Arctic, the geopolitical implications and the social component—the human dimensions—when talking about indigenous peoples."

While they fared far better than Franklin's crew, the project team did face its own challenges. The expedition originally had been planned for the summer of 2017 but was canceled. Organizers tried again in August 2018. Six UIC students—including Crable, Raziuddin and Ewa—set out on a vessel called the *Akedemik Ioffe*, only to run aground a day later. "It's been a long journey," Crable says.

This time around, the students flew to a U.S. Air Force base in Thule, Greenland, then boarded the massive *Oden*—one of the world's largest icebreakers, operated by the Swedish Polar Research Secretariat and the Swedish Maritime Administration. Though there wasn't a daguerreotype, the ship did hold more than \$250,000 worth of scientific equipment from UIC alone, not to mention the contributions of the other participating institutions.

### DECODING OCEANIC SECRETS

The expedition's scientific mission was to understand how warming trends in the Arctic affect the waters surrounding the Canadian Arctic Archipelago, the islands through which the Northwest Passage winds. The UIC students comprised what was known as the chemistry team, charged with collecting and analyzing water samples.

Some of their methods were relatively low-tech. A bucket with a funnel—and later, a "MacGyvered" clamp system—collected rainwater during three significant periods of precipitation. Surface-water sampling was done using a bucket with a rope, "like *Pirates of the Caribbean*," albeit in a more frigid climate, Raziuddin jokes.

Four times a day—at 5 a.m. and 11 a.m., and at the same times in the evening—Umar or another student would call the bridge on a shipboard cell phone, asking the boat to halt so they could lower and raise the bucket. With freezing hands—"It was nearly



SAMIRA UMAR

### SHIPBOARD SCIENCE

Water samples from buckets near the surface and deep-plunging bottles were brought back to the ship's atmospheric chemistry lab, overseen in part by Garcia (left). There, she and her team assessed their composition to learn the deeper story of the sea.

The wet lab's tools included laser absorption spectrometers. About the size of desktop computers, they use laser beams to catalogue gases in both the water and its surrounding vapors.

By tracking and noting the proportion and forms of carbon and methane, Garcia—along with (pictured from left to right) Raziuddin, Ewa and Umar, as well as Crable (not pictured)—can chart how and where fresh water is flowing through the Northwest Passage, and learn more about the impact of greenhouse gases there on the overall climate.



Samira Umar (center) holds the drill taking an ice core while Theresa Ewa (right) looks on and chief scientist Brice Loose guides them.



impossible to wear gloves,” Umar says—the assigned student poured water samples into bottles, making sure there were no bubbles. After recording the salinity, temperature and coordinates of the samples, the bottles were sealed in plastic bags and stored in the onboard lab’s refrigerator.

To dive deeper, the team used oceanography instruments called CTDs, which stands for conductivity, temperature and depth. Large cages—about the height of the average scientist—holding water-collection containers called Niskin bottles, arranged in rosette shapes, were deployed at 52 drop sites around the ocean.

The CTD cages plunged, then rose. Meanwhile, Garcia and the other scientists monitored them from a computer in the ship’s lab, controlling where and when the bottles opened and closed to capture water and measurements from different depths.

The properties of the water they collected paint a more complete picture of a changing seascape. Unique configurations of hydrogen and oxygen (called isotopes) act as chemical fingerprints, allowing scientists to better map the flow of fresh water through the ocean. Those same isotopes, along with qualities like the concentration and fluorescence of microscopic

phytoplankton, reveal details about the exchange of greenhouse gases between air and sea.

And then there was the ice coring. As ice sheets and glaciers solidify over the years, they trap gases, chemicals and particles from the atmosphere, preserving a frozen record of climate history. Crable did her first report in the UIC Arctic class on ice cores. So she was thrilled when the ship’s chief scientist, Brice Loose, Ph.D., associate professor of oceanography at the University of Rhode Island, requested her help in obtaining them.

All five UIC students eventually got to put on bright flotation suits, take helicopters to large floes and use a battery-operated drill—or, in case the batteries weren’t charged, a hand-cranked one—to extract thick cylinders of ice. As a reward for their hard labor, they lapped up water from melt ponds, which Umar describes as “the freshest water in the world.” The helicopter rides themselves were like an amusement-park bonus—“Like being on a roller coaster, but with nothing underneath,” Ewa says.

The helicopters also served as transports to several land visits. At Pond Inlet, on Canada’s Baffin Island, the explorers ate barbecue with native residents, learning how the Inuit community survives in harsh conditions and

how climate change has affected their lives. On Beechey Island, they visited four graves; three were those of Franklin’s crew, and one marked a rescuer who came to search for them. “It was very poetic, seeing the tombstones facing northwest,” Garcia says. “We were on the path they were never able to finish.”

Those heavier moments were balanced by lighter ones onboard the *Oden*—and not just because of the 24-hour sunshine that marks the Arctic summer. The ship was equipped with a gym, two saunas and a movie room, which hosted frequent games of GarageBand. Chess was popular too, and then there was the shipwide ping-pong tournament—it lasted a week—and yoga classes led by Garcia. (She’s not typically an instructor, but found fellow passengers seeking to join her practice.)

All of these activities were punctuated by detailed communications, including three broadcasts on Facebook Live and several transmitted to science-center audiences at the Smithsonian National Museum of Natural History, the San Francisco Exploratorium and the Alaska SeaLife Center. The expedition’s website at [northwestpassageproject.org](http://northwestpassageproject.org) offers archives of the broadcasts, as well as many other videos and blog posts that the team produced on board.

(Below) Helicopter pilot Ted Juliussen (far left) shuttled the team to ice floes—and landed his massive craft safely on the shifting surface. From left to right, the students pictured are California State University



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Channel Islands undergrad Nikolas Vankersbilck; and UIC students Frances Crable, Ewa and Umar.

The website also features updated details about the documentary, *Frozen Obsession*, for which a film crew (led by director David Clark) captured many of the students' daily activities. Crable recalls the crew filming her in the lab. After setting up special lighting, they told her to do her work as she normally would. "I would open the fridge, and they'd be like, 'Wait—can you put that back and open the fridge again?'" she laughs.

Even if filming sometimes complicated her daily tasks, Crable can't wait for the production to reach a wider audience. "Watching nature documentaries is how I got interested in science as a kid growing up in Chicago," she says. Now, she'll be the star of her own show, with a chance to share the wide world she's experienced with the next generation of city kids and potential future scientists.

## BEYOND THE PASSAGE

The expedition may have lasted fewer than three weeks, but its influence has been felt in the students' lives and careers. Thanks to connections and inspiration from the journey, Umar decided this spring to pursue her Ph.D. with a focus on ocean circulation. Garcia—

who worked at NASA's Goddard Space Flight Center before coming to UIC—has applied for a NASA grant for a project focused on Arctic water cycles.

Crable, who works in Gonzalez-Meler's lab, is basing her graduate work on the hundreds of samples she brought back, specifically looking at Arctic biogeochemical cycles—the pathways through which chemicals move between organisms and the environment around them. She and Ewa presented some of their data this past February at the annual Ocean Sciences Meeting in San Diego. And this summer at the University of Rhode Island, the expedition's research team will reconvene to explore potential collaborations and publications.

One of the expedition's goals was to shape the thinking of those outside the environmental research field as well, Gonzalez-Meler explains. That's certainly happened for pre-med students Ewa and Raziuddin. Seeing the way climate change has affected the lives of the Inuit people—and discussing it with scientists on the ship and at the conference—spurred Ewa to question what other implications it might have for those in the underserved communities she hopes to serve as a physician.

"It's not going to be us or the people that live in a first-world community" who suffer most immediately from the effects of climate change, according to Raziuddin. Instead, it will be communities like the Inuit, who depend on the land for resources, and live three hours by helicopter from the nearest hospital. Or, those in Pakistan where widespread flooding has exposed many to bacterial infections.

The students' work will have broader implications for climate science, too. Because the Northwest Passage has been so infrequently explored, researchers have lacked context to guide their experiments there—like putting together a puzzle minus the picture on the box. "We don't have a picture, we just have puzzle pieces, and we don't know what shape or where they should go," Gonzalez-Meler says. More work will be required to fine-tune the images the team has generated. But the expedition "has opened the door to that mysterious part of the world," he says. "We begin to know what the questions are now." 📍



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## DRILLING DEEP

Ice cores tell a story about the ocean's past, frozen in place. Student scientists flew on helicopters to reach ice floes. They used a large, battery-operated drill to bore down into the ice until they reached water. After measuring the depth of the hole with a tape, the team examined the core for visible signs of changes in the ocean: for instance, frazil ice—loose, crystalline shapes—formed during times when the sea was more turbulent, and long columnar crystals that take shape underneath existing floes. Then, the students flew the samples back to the ship's lab for more in-depth analysis.