

UNDERGRADUATE RESEARCH

# CASCADE

FALL 2016

UNIVERSITY OF OREGON COLLEGE OF ARTS + SCIENCES



SOCIAL SCIENCES  
**JUSTICE, INTERRUPTED**  
NATURAL SCIENCES  
**SEA STAR**  
HUMANITIES  
**THE DARK SIDE**

## STELLAR STUDENT

CHARITY WOODRUM  
RIDES A NASA INTERNSHIP  
TO THE FOREFRONT  
OF ASTROPHYSICS



# LAB TESTED

BY STEFANI ALEMAN

*For this year's annual undergraduate research edition of Cascade, we invited senior Stefani Aleman—who is double-majoring in psychology and biology and minoring in chemistry—to write our guest editorial. We asked her, “How has research shaped your career aspirations?”*

I've had some great experiences at the UO that have helped me set my sights on a career in public health. One of my biggest influences was a volunteer opportunity suggested to me by advisors in the biology department. Thanks to their suggestion, I have spent more than a year as a Spanish interpreter at a free clinic in Springfield since the summer of my junior year.

This eye-opening experience helped me start thinking how I might pursue a career of serving low-income individuals, especially undocumented people from Mexico and South America. My aim now is to get a master's degree in public health so that I can assess how well public-health programs are working for these communities.

A different UO experience has given me a huge measure of confidence that I will succeed in this endeavor: I've spent the last year as a research assistant in a psychology lab, where I've been fortunate to actively participate in many inspiring problem-solving sessions.

Each week, researchers from many of the UO psychology labs come together to discuss their projects—professors, graduate students and even undergraduates. Everyone gives really constructive feedback; it's all based on the scientific method—what kinds of questions might be getting missed, what kinds of biases might there be in someone's experiments, different ways to analyze the data. It's amazing to see everyone come together and work



*Stefani Aleman, selected as the student speaker at President Michael Schill's investiture, related her experience as the child of Mexican immigrants and the first in her family to go to college. She has spent the last year as a research assistant in the psychology department, where the collaborative exchange of ideas is helping her envision a career in public health.*

toward trying to make not only their own study better but science as a whole.

I have realized that this is great preparation for my own career goals. I can use that same probing and assessing, that critical analysis, to answer the questions that I have about public-health programs.

As a research assistant in the Brain and Memory Lab, I test how memory works to guide our future decisions. I've run hundreds of subjects through computer exercises that explore two prominent theories of category learning. There are competing theories—exemplar and prototype theory—on how the brain categorizes information, and we run experiments that test these theories. I recruit people, I run them through the exercises, answer any questions they have and then debrief them.


The collaborative spirit of the psychology research labs has left a deep impression on me. It was exciting to be constantly learning from others—and I was encouraged to share my ideas, as well. I will definitely be looking for an employer

who values this kind of teamwork as much as I do.

When I was volunteering at the clinic, I got to see firsthand the disparities in our healthcare system. But I also felt hope because I saw people in need receiving medical care at no cost.

I understand how important the cultivation of opportunity is, and I know something about benefitting from programs for low-income people in part because I wouldn't be at the UO without financial support.

My parents are immigrants from Mexico, and I'm the first in my family to graduate high school and will be the first to graduate college. Thanks to PathwayOregon, the Gates Millennium Scholarship and other funding, my education isn't restricted by my family's limited income.

I never would have guessed what role research would play in my time at the UO. But that's the benefit of this place: You can be so much more than you might imagine. 

# CONTENTS

FALL 2016



## FEATURES

6

### **SEA STAR**

EXPLORING THE OCEAN BOTTOM  
OFF THE COAST OF GREECE

12

### **DANCE OF THE STORYTELLERS**

TRAVELING TO MEXICO, PRESERVING  
A HERITAGE

16

### **STELLAR STUDENT**

CHARITY WOODRUM RIDES A NASA  
INTERNSHIP TO THE FOREFRONT OF  
ASTROPHYSICS

## **INSIDE FRONT COVER**

### **GUEST EDITORIAL**

**2 WHO'S GOT THE EDGE?**

**3 SECRETS OF THE DEAD**

**4 LOUD AND PROUD**

**4 WARRIOR WOMAN**

**9 ENERGY TO BURN**

**10 EXTREME COMPUTING**

**10 THE WRITE STUFF**

**15 DECODING THE CODEX**

**18 COSMIC CONNECTIONS**

**20 IN THE MIND'S EYE**

**22 JUSTICE, INTERRUPTED**

**22 THE DARK SIDE**

**24 RISE OF THE MACHINES**

**25 CRIME AND PUNISHMENT**

**26 LIGHT AS A FEATHER**

**28 AWARD WINNERS**

**29 RESEARCH FUNDING**

**29 ONLINE EXTRAS**

“IN SURVEY AFTER SURVEY, EMPLOYERS SAY THEY WANT GRADUATES WHO CAN DEMONSTRATE THE PROFESSIONAL SKILLS THAT STUDENTS GAIN THROUGH RESEARCH PROJECTS.”

# WHO'S GOT THE EDGE?

NEW ASSOCIATE VICE PROVOST AIMS TO GIVE STUDENTS THE RESEARCH ADVANTAGE

Imagine a recent UO graduate with a degree in environmental studies and an excellent transcript to show for it (mostly A's). He's competing for a job with another environmental studies grad with a not-quite-as-stellar transcript (a few more B's), but who spent her senior year as a member of a small, faculty-led research team. Who's got the edge?

The answer, of course, depends on the job, the employer and a host of other factors that each candidate brings to the table. But in survey after survey, employers say they want graduates who can demonstrate the professional skills—the ability to work collaboratively, show initiative, solve problems, assess and analyze data, present conclusions—that students can readily gain with research experience.

At the UO, more than 25 percent of seniors are involved in research with a faculty member. In addition, at any given time, hundreds more students are engaged in research efforts spanning a diverse range

of disciplines. Some are conducting their own investigations in science labs. Others are doing fieldwork for majors such as sociology or economics. In the humanities, students are pursuing individual research projects that involve a deep dive into library archives.

Any department in the arts and sciences can connect students with faculty mentors to create a meaningful research experience that builds a portfolio of professional skills.

Josh Snodgrass (below) wants many more UO students to make those connections. As the newly appointed associate vice provost for undergraduate studies, he will be increasing the number of research opportunities for UO undergraduates. Under his leadership, the UO


will launch the Center for Undergraduate Research and Engagement (CURE) this fall.

Besides helping students get a job or get into a professional school, “research fosters intellectual independence and gets students to think big,”

said Snodgrass, a professor of anthropology. “It helps them consider, ‘How can I make an original contribution?’”

One of his priorities will be to ensure that all UO students have an inquiry-based experience in their first year, to introduce them to the concept and practice of research. This will include opportunities built into courses and also outside the classroom. These first-year projects will set the stage for more substantive research opportunities as students progress toward graduation.

Snodgrass' goal is that 50 percent of undergrads will have a significant research experience during their time at the UO, which could include working in a lab, doing fieldwork or participating in an intensive study-abroad opportunity. To enhance students' professionalism and sense of accomplishment, he also plans to expand the UO's Undergraduate Research Symposium, an annual showcase of undergraduate research, and develop it into a regional event that gets wider exposure for the work of UO undergraduates.

“Undergraduate research opens the door to so many possibilities—not just career opportunities but personal growth,” Snodgrass said. “There's a world of research going on at the UO and I'm excited to get undergraduates connected to it.” 

*Josh Snodgrass is charged with increasing undergraduate research opportunities at the UO, informed by his own extraordinary experience (See sidebar, Secrets of the Dead).*






# SECRETS OF THE DEAD

**A**s an undergraduate at the University of California at Santa Cruz, Josh Snodgrass was a good student—but not truly engaged. Then an anthropology professor gave him an uncommon opportunity: Did he want to help identify skeletal remains for the local medical examiner?

It was a life-changing introduction to undergraduate research. In the morgue, Snodgrass put into practice what he'd been studying in class—forensic methods to determine, say, the rate at which a body is decomposing or the age of a skeleton.

This extraordinary opportunity triggered a surge of personal, emotional and intellectual growth. It motivated Snodgrass to commit to pursuing a career path as an anthropologist specializing in the study of human evolutionary biology and the application of anthropological techniques to societal issues.

Snodgrass' new job will also be profoundly influenced by this transformative experience: As the newly appointed associate vice provost for undergraduate studies, he will design undergraduate research programs that will be directly informed by his personal knowledge and values.

“Undergraduate research changed my life,” Snodgrass said. “I want to give students the same richness of opportunity.” 

## BY THE NUMBERS: UNDERGRADUATE RESEARCH AT THE UO

# 27%

OF UO SENIORS HAVE DONE OR ARE CURRENTLY DOING RESEARCH WITH A FACULTY MEMBER

# 13%

AN ADDITIONAL OF SENIORS PLAN TO DO RESEARCH WITH A FACULTY MEMBER

# 82%

OF UO STUDENTS HAVE DONE A RESEARCH PROJECT OR PAPER AS PART OF THEIR COURSE WORK

# 46%

HAVE TAKEN AT LEAST ONE STUDENT RESEARCH COURSE

### CAS HONORS PROGRAMS

More than two dozen College of Arts and Sciences departments offer an honors program with an undergraduate research thesis requirement. In these departments, completion of the senior research project confers an honors distinction with the bachelor's degree:

- Anthropology
- Biology
- Chemistry and Biochemistry
- Comparative Literature
- Computer and Information Science
- Economics
- Earth Sciences
- East Asian Languages and Literatures
- English
- Environmental Studies
- General Science
- Geography
- German and Scandinavian
- History
- Human Physiology
- International Studies
- Judaic Studies
- Linguistics
- Mathematics
- Philosophy
- Political Science
- Psychology
- Religious Studies
- Russian, East European and Eurasian Studies
- Romance Languages
- Sociology
- Women's and Gender Studies

### UNDERGRADUATE RESEARCH SYMPOSIUM

This annual event gives UO undergraduates a chance to present their own research work, much as they would at a professional research conference. Students across the full range of CAS disciplines—from geography to folklore to marine biology—share their research via posters or presentations. The sixth annual Undergraduate Research Symposium was held in May and featured:

**186 PRESENTATIONS**

**236 PRESENTERS AND COPRESENTERS (179 PRESENTERS AND 57 COPRESENTERS)**

**213 FACULTY MENTORS**

**29 CORPORATE/INSTITUTIONAL FUNDERS AND SPONSORS**

**39 CAS MAJORS REPRESENTED**

### TOP FIVE CAS MAJORS AT SYMPOSIUM:

**BIOLOGY (38 PRESENTERS)**

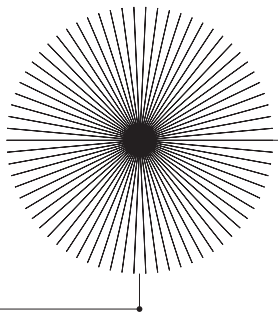
**ENVIRONMENTAL SCIENCE/STUDIES (30)**

**HUMAN PHYSIOLOGY (26)**

**ENGLISH (19)**

**PSYCHOLOGY (18)**

SOURCE: 2015 NATIONAL SURVEY OF STUDENT ENGAGEMENT



# LOUD AND PROUD

PROTESTING RACISM AND IMPERIALISM THROUGH HARD-CORE MUSIC



*The band Los Crudos (above) inspired English major Adam Buchanan to examine punk rock as a vehicle of political expression for Latinos in Los Angeles.*

**L**os Crudos slam danced its way onto the Chicago punk rock scene in the 1990s, brandishing the same mix of loud, fast and angry songs that made household names of groups such as Black Flag and the Sex Pistols.

But there were two key differences: The outfit sang almost entirely in Spanish, and almost always about politics.

In “Asesinos,” for example, Los Crudos—Spanish for “those who are

crude, coarse or raw”—railed against the disappearances of radical youth during military dictatorships in Latin America. In other numbers banded out in three chords or less, the band attacked anti-immigration laws and US imperialism.

As a hard-driving, Spanish-speaking Latino punk band, Los Crudos served English major Adam Buchanan’s investigation of a phenomenon emerging at the same time on the other side of the country: the Latino punk rock scene in Los Angeles.

“Instead of recreating the punk scene they saw from white musicians,” he said, “(the Latino groups) created Latino punk for themselves.”

For his final research project in an English course on race, culture and incarceration, Buchanan examined the growth of Latino punk in East LA in the 1990s. He found the medium to be an effective way for young Latinos to enter the political conversation—with a passionate voice that society couldn’t tune out.

Latino punk was largely overlooked

# WARRIOR WOMAN

A MEDIEVAL STUDIES STUDENT EXAMINES AN ICON IN ICELANDIC LITERATURE

**I**t’s a tale of deceit, deception, mystery—even theft. And it’s nearly as old as time itself.

It’s “Sigurd the Dragonslayer,” a European legend that has been told and retold since the sixth century. (Spoiler alert: Don’t expect to see many dragons slayed.)

What started out as Icelandic folklore was adapted by the Germans. Like a tree that splits into twin branches, the story then diverged substantially in each culture.

But one character is central to each country’s telling of the tale:



Brynhilde, warrior queen and fierce rival of Sigurd’s wife. She is, one expert said, “the most complete psychological portrait, male or female, in Icelandic literature.”

Basil Price (left), a medieval studies and digital arts major at the UO, was fascinated by the complexity

of Brynhilde. He traced the evolution of her character across the two countries for his final paper in medieval Scandinavian and Germanic literature.

Price examined roughly a dozen sources, including classic and contemporary versions of the Sigurd saga in Iceland and

## MANY GROUPS STOPPED THEIR SHOWS BETWEEN SONGS TO HOLD EXTENDED CONVERSATIONS WITH AUDIENCES ABOUT CURRENT EVENTS.

by the mainstream and Latino press, so Buchanan had little in the way of newspaper and magazine articles for gathering basic background on the genre.

Nor were the bands themselves much help. They often self-produced their CDs, so they didn't have a record company chronicling their histories and discographies. Most "official" band documents were simply photocopied flyers that the bands scribbled out to promote shows.

Buchanan had to get creative for his research.

He laid a foundation for his project by reading up on Southern California in the 1980s—the political climate, race relations,

the crackdown on drugs. He studied the history of activism among Los Angeles' Latinos, African Americans and Asians in the 1960s and '70s.

From books and papers that touched on different aspects of Latino punk, Buchanan developed a mosaic of the music—its history in East Los Angeles, the role of other minorities in the genre and the importance that performances played as a means of discourse on political issues.

He got a sense for the culture of the time from a documentary that a band produced about its tour. He collected more context from features on punk music by radio news programs. He interviewed a friend who grew up in East Los Angeles and was a fan of many of the bands.

And he watched a lot of videos. From concerts on YouTube, Buchanan got a real feel for the shows, though they were of little use for deciphering lyrics—the blistering pace of the songs made the words mostly unintelligible. For those, he tracked down copies of lyric sheets that bands often included with their CDs, which he translated through his personal knowledge of Spanish.

Buchanan found that Latino punk—both the music and the high-energy shows—provided a rallying point for a Latino youth population that existed on

society's margins. The music was essentially "a collective voice to protest and air their frustrations," he wrote in his paper.

Nor was there much subtlety to the bands' methods for making a statement. Many groups stopped their shows between songs to hold extended conversations with audiences about current events.

Buchanan traced an evolution in the content and the reach of the music, as well.

Earlier songs focused on drug laws and conflicts with law enforcement, but shifted over time to immigration and citizenship issues. Most surprising for the young researcher, perhaps, was the success of this little-known genre in reaching people—the music and its message spread not just across California and the US West, but into Central America.

What started out as the exclusive domain of young white men—punk rock—became the perfect vehicle for Latinos to express their own anger and frustration. The issues Latino rockers screamed about may have been different, but the underlying emotions were the same.

Said Buchanan, "With any type of music—pop music, rock, hip-hop—you can find smaller groups of people that have been able to take this large form and make it their own." —JM

Germany. He also pored over scholars' commentaries and translations of texts about Iceland's favorite warrior woman (right).

In special collections at Knight Library, Price reviewed a scanned version of "Poetic Edda," an Icelandic tale dating to the 13th century. Although the poem is written in Old Norse, Price had learned enough of the Germanic language in reading groups to interpret the material.

To track points where Brynhilde's character diverged in the literature, Price developed a "textual genealogy"—a family tree of notecards to keep the changes straight. At times, his dorm room was virtually wallpapered with

notes from articles and books.

In the Icelandic tales, Price found Brynhilde portrayed as a fearless fighter with magical powers—think Sigourney Weaver in *Aliens* meets Professor Minerva McGonagall from *Harry Potter*. But she loses her luster in German retellings, becoming little more than a prize for Sigurd to acquire.

His examination of literature dating back centuries gave Price fresh appreciation for the value of the written word.

"I always thought that medieval studies was about cultural history, material culture," Price said. "In actuality, I think I've learned far more about the Middle Ages by reading their stories." —JM





# SEA STAR

AS AN INTEGRAL PART OF A VOLCANOLOGY RESEARCH TEAM, CLAIRE GETZ HOISTED MASSIVE EARTHQUAKE SENSORS, CRANKED COMPUTER CODE AND HAD A CLOSE ENCOUNTER WITH A SQUID

BY JIM MUREZ

**T**he research vessel *Marcus G. Langseth* circled on the Aegean Sea near Greece one day last December, offering stunning views of azure waters, golden sunsets and, in the distance, the majestic island of Santorini.

But Claire Getz (right) scarcely had time to notice.

She was part of a research mission to

learn more about the molten rock deep beneath volcanoes such as Santorini. On this day, she had a big job to complete in a small window of time. Working with crewmates, she assembled massive earthquake-sensor instruments that had to be hoisted and released overboard in specific locations at 20-minute intervals.



Miss a drop zone and the ship would be forced to circle back, delaying the project. Over roughly three days, the team deployed 90 of the ocean bottom sensors, missing none of the time windows.

For Getz, an undergraduate who joined five UO graduate students, it was an exhilarating—if stressful—experience.

“I didn’t think they would let us near (the sensors),” she said. “But we got to be more involved in that than I thought we would.”

## FIRING BEAMS OF SOUND

Getz, who graduated earlier this year with a degree in geological sciences (the department has since been re-

named Earth Sciences), was part of a research team led by UO geologists Emilie Hooft and Doug Toomey. The team is studying the island of Santorini to learn more about the movement of magma beneath volcanoes.

The \$3.5 million project, funded by the National Science Foundation, netted an unprecedented



*Left: Last December, Claire Getz (far right, in black) was the only undergraduate on the Santorini research team headed by geologists Emilie Hooft (center, back to camera) and Doug Toomey (far left, in brown). The team met daily to discuss scientific findings. Right: The research vessel Marcus G. Langseth, owned by the National Science Foundation, was home to an international team investigating the movement of magma beneath the Greek island Santorini. Seismometers, like the one bobbing in the foreground, were used to collect data.*



amount of data and a 3-D view of magma some 12 miles below ground.

There were two pieces to the project—the earthquake sensors and mapping the seafloor around the island—and Getz was integral to both.

Scientists use the sensors, which are called ocean bottom seismometers, to measure vibrations within the earth. That data gives them a profile of the magma moving underneath. Working with these massive instruments, which can weigh hundreds of pounds, was physically demanding, Getz said.

But no less challenging, intellectually, was her responsibility on the mapping project.

A machine on the bow of the ship fired beams of sound at the bottom of the ocean, generating data for a high-tech mapping program.

Months before the trip, Getz logged countless hours in a computer lab, teaching herself how to write code to tell that program how to process the data that would be collected.

Once the trip was underway, Getz and others worked shifts at a computer, pro-

cessing half-hour chunks of data to generate a 3-D map of the seafloor (see p. 8).

“You have to do it all the time,” Getz said, “because the data is always coming in.”

## **EARTHQUAKES, ERUPTIONS, TSUNAMIS**

A spell of rough weather fouled up the process at one point, causing faulty readings. At other times, images of the seafloor appeared fuzzy at the edges. Working with the computer program, Getz was able to remove or correct these errant data feeds.

Through the mapping, the team observed chains of underwater volcanoes near Santorini and saw landslide deposits from earlier eruptions. They also examined the fault that was responsible for a massive temblor in 1956, Greece’s

largest earthquake of the 20th century.

“It was really cool to see what the seafloor looked like,” Getz said, “especially in a place like Santorini, which has a long history of building up large volcanoes and collapsing into a chamber. You get really high-resolution looks at the seafloor.”

Scientists will use the information gleaned from the project to identify the locations of the passageways that magma uses to ooze through the Earth’s crust below Santorini. They’ll learn what factors control the movements of this molten rock, where it collects and what causes it to surge aboveground in an eruption.

With that knowledge, and close monitoring, hazard managers may be able to help predict geologic activity on Santorini, whether it is an eruption, earthquake or a resulting tsunami. Greek

## GETZ TAUGHT HERSELF THE CODE TO TELL THE HIGH-TECH MAPPING PROGRAM HOW TO PROCESS THE DATA THAT WAS COLLECTED.

officials could apply that information toward disaster management planning for the island, which annually provides millions of dollars to the nation's economy.

The look deep below ground will also help reveal how most of the rocks that comprise the foundations of the Earth's continents are formed.

### BE SURE TO TIE IT DOWN

The research team—which also included professors from Greece and the UK—gathered for daily meetings to provide updates and talk about goals for the day. To incorporate an academic element into the expedition, they discussed research papers about Santorini and projects similar to their trip.

But Getz didn't spend every moment in scientific briefings, lugging huge earthquake sensors or hunkering down over a computer screen.

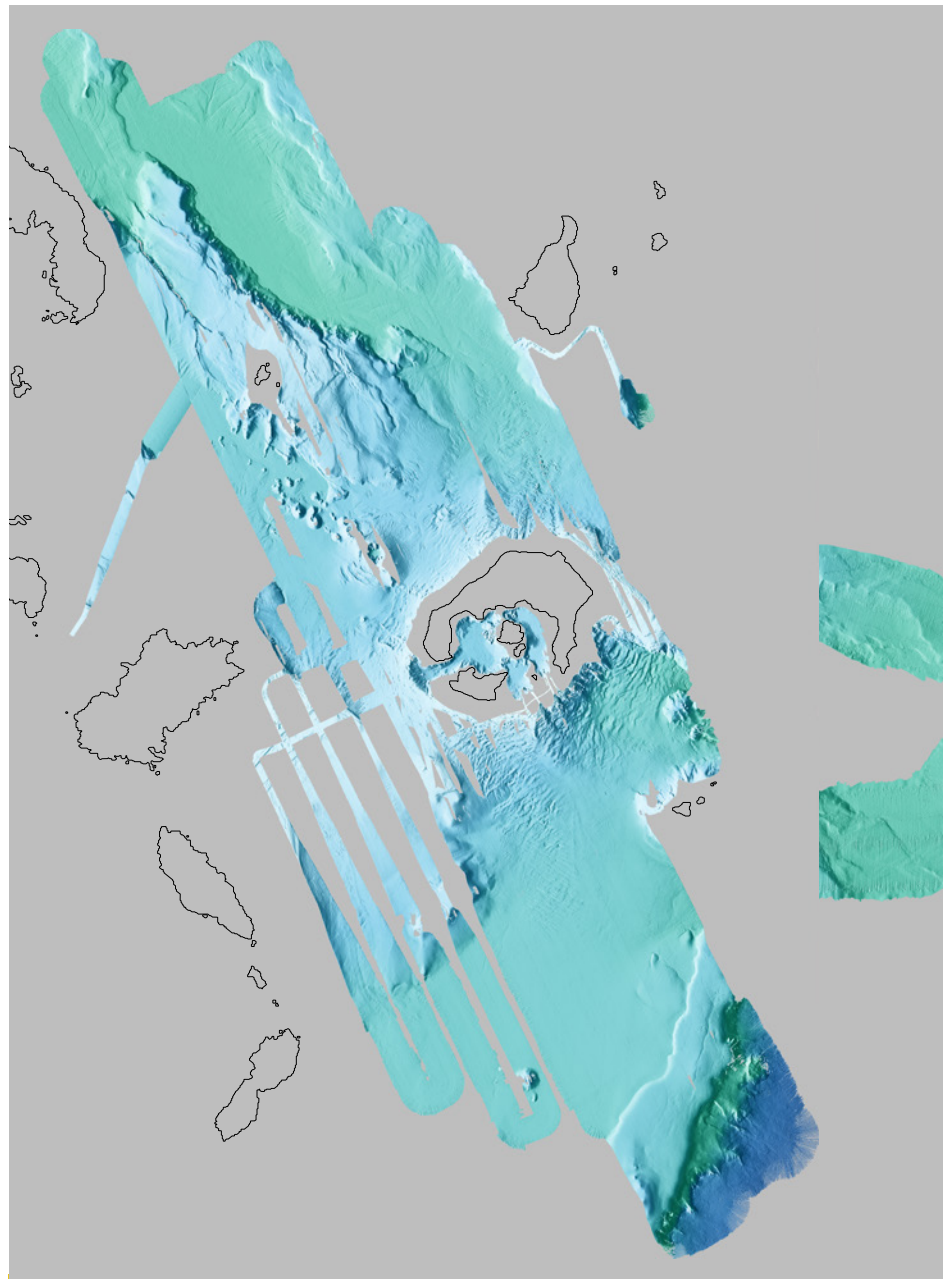
She also was able to pause and enjoy astounding sunrises and sunsets, and even indulge in a leisure activity. Before they set sail, Getz and another researcher stocked up on knitting supplies and a book on how to knit. She taught herself the craft during slow times onboard, finishing one (very long) scarf.

The 235-foot-long ship had all the comforts of home, and then some: a gym, a stocked kitchen and cook, a big-screen TV and a library full of more movies and TV shows than the crew could possibly get through during their expedition.

Getz was told to bring “tie-down materials,” and it didn't take long to understand why. Whenever rough water got the ship rocking, anything on a table or desk rolled off if not tied down or taped.

The crew was fortunate in that they never encountered severe weather. And the gentle rocking of the boat was ideal in helping Getz fall asleep.

As part of her shipboard duties, Getz took shifts on seaman's watches just like everyone else.



Getz helped make this 3-D map of the seafloor around the island of Santorini (visible in the middle). Scientists mapped new regions to reveal the structure of faults and landslides, which may help resolve questions related to a massive earthquake and tsunami in 1956.

### INCOMING!

One time, an unexpected visitor joined them while they were retrieving a seismometer at 3:30 a.m.


It was cold and windy and generally unpleasant to be on the deck of the ship in the middle of the night.

But on this night, Getz caught a flash out of the corner of her eye. Something sailed through the A-frame on the ship—about 30 feet above the water—then landed with a thud.

After some poking around, they found a small squid that “caught mad air,” as

Getz put it, and was flopping on the deck. The crew snapped some obligatory photographic evidence, then returned the overly adventurous cephalopod back to its natural habitat.

For a young scientist, these unexpected interactions with the natural world were a refreshing reminder of the environment beyond her computer screen.

“Sometimes when you are on the boat, you forget you're on the actual ocean,” Getz said. “It's all around you, but you're just sitting in the lab remotely studying the seafloor and the earth below.” 

# ENERGY TO BURN

CLEANING UP NATURAL  
GAS BY BUILDING A  
BETTER MOLECULE

**T**he US has a lot of natural gas and keeps finding more. This resource, which burns cleaner than other fossil fuels, is playing an ever-bigger role in our energy portfolio.

But many natural gas reserves are so impure that they aren't worth tapping.

Nitrogen is a big part of the problem. Natural gas containing more than four percent nitrogen burns poorly, hindering the performance of the machines that run on it.

Ian Rinehart is putting his energy into solving this power problem.

Rinehart, a 2016 chemistry graduate, is part of a team under professor David Tyler that aims to purify natural gas reserves in an efficient and cost-effective way. Their custom-made molecule traps nitrogen, freeing the rest of the fuel for collection; now the goal is making this chemical compound stable over repeated use.

The popular method to remove nitrogen from natural gas is to cool the fuel to extremely cold temperatures—about -259 F. Methane liquefies at that temperature, while nitrogen remains a gas and can be extracted. But this approach is expensive and requires a lot of energy.

Instead of putting natural gas in the big chill, Tyler and his team are creating molecules that essentially suck nitrogen right out of it.

They built a phosphorus and iron molecule to which nitrogen atoms readily bond. When natural gas is exposed to a



CHARLIE LITCHFIELD/UNIVERSITY COMMUNICATIONS

*Ian Rinehart's work requires use of a chemical mixing tank—an airtight metal and Plexiglas box with thick rubber gloves attached. The reactions that occur can be breathtaking, "some of the most beautiful colors I've ever seen," he said.*

solution with these manufactured molecules, the nitrogen atoms stick to them, freeing the methane for collection.

Unfortunately, this nitrogen-trapping molecule works only a few times before it breaks down.

Tyler's team has a solution: They build a "scaffolding" of phosphorus atoms around the iron atom, which gives the molecule durability for the long run.

In practice, the natural gas would be pumped through a solution that contains the iron-phosphorus molecules. The methane would bubble to the surface for collection while the nitrogen remains trapped in the solution.

Now that the team has designed an effective molecule in the lab, they're working to "scale up" so that their creation will work, time after time, in the large volumes of solution that would be needed by industry.

It will take the right mix of iron and phosphorus atoms, and Rinehart spends his days trying to hit that winning combination. He proposes the chemicals and conditions for "trial" molecules, then tests them out himself.

It takes a highly controlled environ-

ment to make the magic happen—an airtight metal and Plexiglas tank about the size of a small sedan, from which all oxygen has been removed.

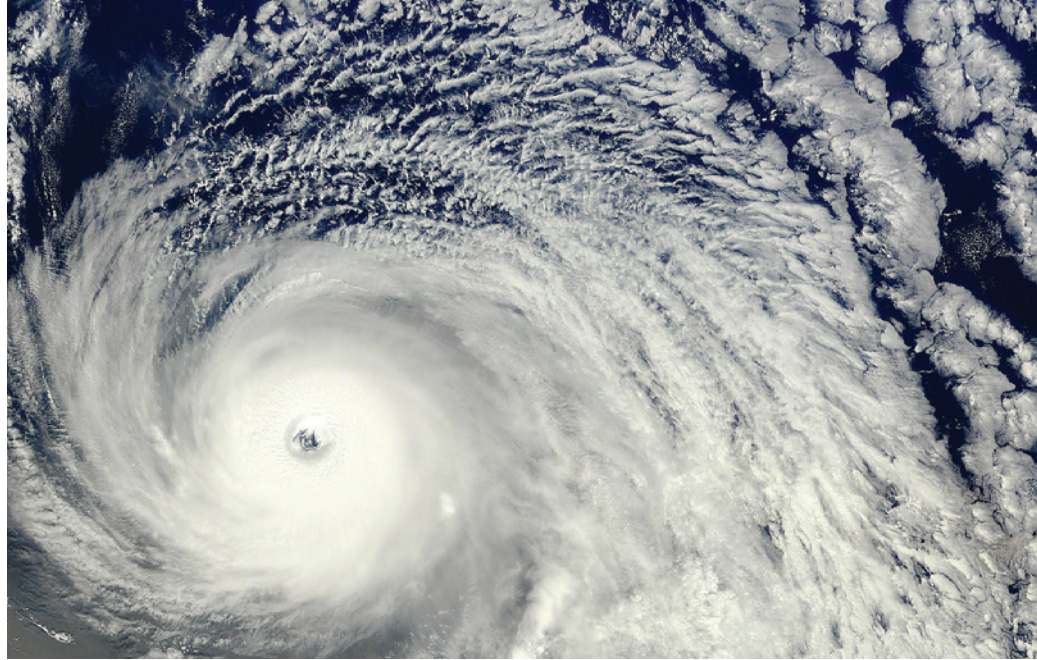
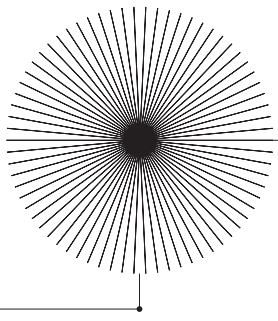
Using thick rubber gloves that reach into the box, Rinehart mixes solutions and powders in vials and flasks. From the start of planning through completion, each run takes several days.

Rinehart works with small quantities of the test materials—fractions of an ounce—that are added to a solution. When his job is complete, the result is small flakes of the finished product, settling on the bottom of a flask.

Those flakes are then added to a solution and natural gas is pumped in, so the team can measure the amount of nitrogen that is collected. They're entering final testing and hope to know soon whether they've got a product to take to industry.

For Rinehart, it's satisfying to take his classroom knowledge about the physical properties of substances and test them in the lab.

"It's been a big challenge," Rinehart said. "I feel like I've learned how to think like a scientist. That doesn't come up in classes." —JM



# EXTREME COMPUTING

UNDERGRADUATES RETOOL SOFTWARE FOR THE NEXT WAVE OF DATA PROCESSING

**T**he human brain can absorb piles of numbers. But it can't easily convert them into an image of, say, wind speed patterns in a hurricane.

It takes powerful computers running complex software to do those conversions. But that presents an ongoing problem: The computer programs that

perform these transformations need to be constantly updated to keep up with ever-evolving technical standards.

At the UO, "keeping up with the pace of change" could be the mantra of a special division in the computer and information science department.

It's a place where undergraduates work alongside graduate students in what is essentially a research-and-development lab.

Undergraduates help design and test programming and other tools that will support the new age of computing—high-performance computing and

the visualization of big data. This is the Computing and Data Understanding at Extreme Scale research group, or CDUX, the brainchild of associate professor Hank Childs.

"Our undergraduate researchers play essential roles in the program," Childs said. "It's a great thing for them to have on their résumés as they look for jobs."



## RINSE AND REPEAT

Although today's computers are faster and smarter than ever before, their speed has essentially peaked. To push through that barrier and get the most out of comput-

# THE WRITE STUFF

HOW TO GET THAT BIG JOB INTERVIEW

**I**t's the classic dilemma: how to get a professional job when you don't have professional experience? Research is a powerful way to build a résumé. And one of the most concrete ways



to demonstrate the skills gained from this experience is to publish a research paper.

Some UO students have the extraor-

inary opportunity to copublish with a professor in a national or international research journal. But any UO student, in any field, has the chance to get their own paper published in the *Oregon Undergraduate Research Journal (OUR Journal)*.

The *OUR Journal* publishes outstanding research by UO undergraduates. Now in its sixth year, it's a career-preparation experience for both the student researchers who submit articles and the student editors who review and publish this work.

When students graduate with a published paper on their résumés, it shows command of the communication skills that employers most want: the ability to acquire, organize and synthesize information, and to present it authoritatively to both experts and lay readers.

The *OUR Journal* is published by the UO

ers’ “brains,” programs need to perform multiple tasks simultaneously rather than sequentially.

Elliott Ewing (left) and Kirsten Dawes—two of four undergraduates on the 15-person CDUX team—learned to rewrite software programming so that a popular tool in the CDUX lab can run efficiently in this new, multitasking environment.

Ewing and Dawes essentially looked under the hood of VisIt, a free visualization and analysis tool created in 2000 by Childs and a team of programmers at the California-based Lawrence Livermore National Laboratory. VisIt processes information-heavy simulation data and produces comprehensible, visual results. It’s been downloaded hundreds of thousands of times, and is used on many of the world’s top computers.

The undergraduates worked with the sections of coding necessary to make the tool compatible with computers running parallel tasks. The work involved scouring VisIt coding for what Ewing called “trouble spots,” then testing new coding in those sections and also on other types of computers. Then doing it over and over again, until all the bugs were gone.



“You rinse and repeat,” Ewing said, “until the process comes out spotless.”

Ewing and Dawes ultimately made changes to the VisIt infrastructure that are now in use by scientists around the globe. It’s an understatement to say the two are proud of their contribution.

“A lot of undergraduates don’t get to work in an industry type of setting,” Ewing said. “There are research opportunities and industry opportunities, and this is a cool mixture of both of them.”

### INSIDE A HURRICANE

For undergraduates, one of the pay-offs of CDUX is the access to graduate students.

Garrett Morrison (above) teamed up with master’s student Vincent Chen to write programming that enables a visualization tool to produce ultrarealistic-looking graphics to work with VisIt.

The duo is working on a collection of software called GraviT, which illustrates big-data challenges such as the movement and speed of hurricane winds. But new coding was needed for GraviT and VisIt to work together.

Morrison and Chen were the code doctors for this painstaking project, working

side by side as they identified and excised faulty sections of programming and replaced it—line by line—with new coding. They met regularly to brainstorm and make sure they were heading in the same direction with solutions.

At the heart of their project was the scientific process of trial and error.

“You try something. It doesn’t work. You try something else. It works a little bit,” Morrison said. “It’s an iterative process.”

The team had to ensure that their programming changes would one day enable GraviT to handle the biggest data sets imaginable—information that captures what transpires when a star explodes, or illustrates the stresses on metals as they’re bent.

Although GraviT is still a work in progress, Morrison and Chen—working with researchers from a handful of other institutions across the country—have written roughly 500 lines of code that gave VisIt its new grip on GraviT’s graphics.

They’ve used GraviT to render what happens inside a tornado and to create images of a hurricane that show the wind speed, precipitation and air temperature throughout the storm.

“When you finally produce something that’s working,” Morrison said, “it’s a moment to be proud of.” —JM

Libraries and accepts work from any major or department—but the submission guidelines make clear that the student editors want to see that their fellow students can explain their work to the average reader. Students must clearly describe the significance of their research for a broad audience—not just specialists who understand the lingo (the acceptance rate is about 50 percent).

The journal is just as enriching for the student editors, all of whom volunteer their time. The current editorial board includes students from general science, biology and marine biology.

Once a submission has been received, members of the student editorial board work with the author in a “double-blind” review, meaning the author doesn’t know who is reviewing the work and the reviewers don’t know who has submitted it. This process is

based on the professional standards established by other research journals.

In their review of submissions, student editors deploy the same communication skills that the authors must master—assessing and polishing content not only for academic merit but also readability for a broad audience.

The current issue features work by undergraduates majoring in fields as diverse as mathematics, history and environmental science:

- “Sexuality, Gender, and US Imperialism after Philippine Independence: An Examination of Gender and Sexual Stereotypes of Pilipina Entertainment Workers and US Servicemen,” by Paulla Santos (history)
- “Xylaria Primers for Phylogenetic


Reconstruction,” by Alicia Ly (environmental science)

- “The Question of Divine Omnibenevolence: What Does the Hebrew Bible Reveal about Yahweh’s Nature?” by Jonathan Faris (biology)
- “Searching for the Nearest Extragalactic Binary Black Hole: A Spectroscopic Study of NGC 4736,” by Annika Gustafsson (physics)
- “Adamov’s Alienation Effect: Showing the Absurdist Slant of the Epic Theatre Aesthetic,” by Nicholas Maurer (mathematics)
- “GPU-Imogen: An Astrophysical Hydrodynamic Code Built for Graphics Processing Units,” by Isaac Brown (physics) and Tom Wolken (physics) —MC

# DANCE OF THE STORY TELLERS

TRAVELING TO  
MEXICO, PRESERVING  
A HERITAGE

BY JIM MUREZ



*The Danza de la Pluma, an annual Zapotec ceremony, has special meaning for UO student Romario Bautista. He is exploring how the ritual crossed the border from Oaxaca, Mexico, to his hometown of East Los Angeles.*

t would have been the experience of a lifetime. Especially for a nine-year-old.

It was East Los Angeles, 2005, and Romario Bautista (below) was asked to participate in his community's annual cultural festival.

The Danza de la Pluma ceremony—"Dance of the Feather"—is a cherished tradition of one of Mexico's indigenous groups, the Zapotec of the state of Oaxaca. The danza reenacts the tribe's fierce battles against invading Spanish conquistadors in the 1500s.

As Mexicans have moved to the United States over the years, the danza ceremony has moved with them, binding migrant communities in the US to their homeland and preserving culture and history.

Alas, joining in a danza is no small task. The dances are exceedingly elaborate, taking months or even years to master. Unfortunately, Bautista's family couldn't commit the time and he couldn't join in the experience.

But any lingering disappointment he may have felt at the lost opportunity has been channeled into a new way of appreciating his heritage. Now in his 20s, Bautista, a UO double-major in anthropology and journalism, has seized on the chance to revisit the danza as a social scientist.

Bautista, along with two other UO students, traveled to Mexico City last spring to explore how indigenous peoples have passed along their history for more than five centuries through traditions such as danzas.

At the heart of the danza is a cultural preservation technique as old as human history: storytelling.

"What my grandparents taught me is, you can tell a story many different

ways, but what's most important is that the message you are trying to tell stays the same," Bautista said. "The dance has evolved physically, but spiritually and emotionally it's still the same exact thing as it was centuries ago."

## A GOD WITHOUT A FOOT

Every year, villagers in one of Mexico's southernmost states hold a festival that recognizes their history. They eat, they dance, they reunite as a community.

Nearly 1,800 miles away, in a neighborhood of East Los Angeles, a group carries out a version of that same ceremony.

Most people at each event have never seen the other one going on in the neighboring country. And yet the two ceremonies are similar; this phenomenon fascinated Bautista, inspiring him to investigate how this came to be.

Bautista is studying how Mexican migrants to the United States use the Danza de la Pluma and other cultural traditions to maintain ties to their history and homeland. With help from anthropology professor Lynn Stephen, he is looking at "transnationalism"—a research area that addresses the growing connections

among peoples across national boundaries, and the diminishing significance of those boundaries.

"Even though there's a border between us," Bautista said, "that culture, that language, that tradition fortunately gets carried over."

Bautista was part of a contingent of three UO students who traveled to Mexico last spring with Ana-Maurine Lara, assistant professor of anthropology. They attended a conference on tribal traditions at the Mexican National Museum of Anthropology in Mexico City, visited historical sites and also met with elders and other experts to bolster their research.

The students gathered material for a yearlong independent study course on the culture of storytelling among Mexico's indigenous people. For this comprehensive project, the trio is producing research and conference papers and a documentary video, while developing curriculum for college-level courses and community-based classes.

In Mexico, Bautista conducted research that built on his personal knowledge of danza ceremonies. He learned that the danzas are as diverse as the many indigenous peoples of Mexico.

Through elaborate rituals, prayers and intricate dances, elders have long relied on danza ceremonies to pass down tribal history to the next generation and preserve cultural identity. Each tells a story—for example, how the sun and earth were created, or the adventures of a god who is missing a foot (dancers hold their own foot at an awkward angle while they perform).

Each movement carries a specific meaning—it can take years to learn all of the intricacies to some of the more complex danzas that extend over days.

Among the Zapotec, current generations perform danzas in the villages where they have been held for more than 500 years. Likewise, tribal descendants who have settled in the US—primarily in California—carry out those same traditions in their communities.

## DOCUMENTING FOR FUTURE GENERATIONS

Most challenging for Bautista has been tracking down what little research is available in written form.

Much of Zapotec history is handed down orally, through the danzas and other means. The desire to document these practices for future generations inspired Bautista to pursue his project.

In Oaxaca, he interviewed villagers across multiple generations, seeking to learn how their participation in this active form of storytelling has shaped them. He visited the museum in Santa Ana del Valle, in the town where his parents were



"THE DANCE HAS EVOLVED PHYSICALLY, BUT SPIRITUALLY AND EMOTIONALLY IT'S STILL THE SAME EXACT THING AS IT WAS CENTURIES AGO."

born, and he interviewed a village elder about the Zapotecs' past.

"There's so much history that even community members don't know," Bautista said.

Back in his hometown of East Los Angeles, Bautista met with migrants and others with family connections to Oaxaca who participate in the local festival. He found that the longstanding tradition they have imported from Mexico provides a cultural link for those who may have never set foot in that country, but have ancestral ties there.

One of them, in fact, is much like that nine-year-old boy who was denied the danza years ago. Bautista's cousin, Jose Garcia, was also nine when he first took part in the ceremony, and he remains active in the tradition today, more than a decade later.

"He doesn't know what Mexico is like," Bautista said. "He's never seen it except through pictures, he's never set foot there. But how he speaks the language and practices the dances . . . I feel like he's been there his whole life."

Bautista is now working with Zapotec communities on both sides of the border, regarding their shared practice of the venerable Danza de la Pluma festival. He's gathering material for a documentary that he'll eventually show to both groups.

"People in Oaxaca don't know how much (the danza) is practiced in the US," Bautista said. "And a lot of those who migrated here don't get to see how it is practiced back in Mexico."

## NO INSTRUCTION MANUAL

There's no instructional manual for danza ceremonies. No video demonstrating the intricate dance steps involved. Don't look for a guidebook on the prayers and rituals. None exists.

So how has this knowledge been handed down to younger generations

over 500 years? That's Perla Alvarez's research question. Alvarez (below) was one of the other UO students who traveled to Mexico City last spring.

Alvarez's ancestors were native to Mexico, although she doesn't know their tribe. The generations before her were taught that being indigenous was shameful and somewhere in her family tree, the knowledge of her ancestral roots was lost.

Alvarez, an ethnic studies major, sees her research as a way of resurrecting traditions and showing pride in her family history. "It's motivated me to explore more about where my grandparents came from, where my parents came from, and to find out more about myself," she said.



**"IT'S MOTIVATED ME TO EXPLORE MORE ABOUT WHERE MY GRANDPARENTS CAME FROM, WHERE MY PARENTS CAME FROM, AND TO FIND OUT MORE ABOUT MYSELF."**

During the trip to Mexico City, Alvarez interviewed tribal elders about the danzas, gleaning bits and pieces of information that would help answer her questions and provide the foundation for a research paper.

The research took persistence and patience. Alvarez worked methodically to build a list of sources, asking each person with whom she spoke to recommend another.

Cultural history is often passed down casually, informally—

and spontaneously. Family members linger after a meal, a question gets asked, a conversation takes a turn and suddenly an elder is opening a door on a legacy that reaches back centuries.

The danzas themselves can be very formal affairs.

The family named by the village elder to organize that year's danza begins working months in advance. They visit the homes of other families whom they ask to participate, and then the parties retreat to a special room with an altar. The

## HOW HAS THIS KNOWLEDGE BEEN HANDED DOWN TO YOUNGER GENERATIONS OVER THE PAST 500 YEARS?

visiting family extends the invitation to join the danza in a very solemn and deliberate fashion, with each family standing on opposite sides of the altar.


Given these types of intimate family and tribal rituals, not everyone is eager to discuss danzas with a complete stranger. Alvarez had to build trust and promise not to publicize sacred prayers, ceremonies and teachings.

Occasionally, though, she enjoyed true moments of discovery.

One evening during her trip to Mexico, she was sitting at a dinner table with elders who casually began discussing "codices"—elaborate visual histories that the tribes have passed down over centuries (see facing page, "Decoding the Codex," for the story of the third UO student who accompanied Alvarez and Bautista to Mexico). The elders went into their meanings, how the documents capture the tribes' history and the stories they tell.

Such conversations, Alvarez said, "are where a lot of learning comes from."

On her trip, she also observed a number of dances that are part of the danza traditions she is studying, called Mexica danza.

"I got really tired, but I enjoyed being tired, and I think that's the spiritual component of danza," Alvarez said. "You are offering the dance, the energies, to the elders. That's what danza and the ceremonies are all about: appreciating yourself, your body and spirituality, and the ability to be present." 



# DECODING THE CODEX

**P**icture a huge scroll—say, 30 feet long—that tells the story of a Mexican tribe.

It might spell out the steps in a certain ceremony, for example, or serve as a calendar or record of activities. The “sentences” are written as a series of images along the edge of a panel or page within the scroll. To read them, you rotate the scroll, reading right to left.

These rich historical records, called codices, capture more than 500 years of history of Mexico’s indigenous peoples, in elaborate and extremely complicated imagery. Ethnic studies major Abel Cerros (right) is decoding one of them, answering questions not just for academic purposes but personal ones.

Assistant professor Ana-Maurine Lara introduced Cerros to codices as a way to learn more about his family history. She and Cerros established an independent study course in anthropology, and he was one of three UO students to travel to Mexico with her recently to conduct field research.

Cerros concentrated on the Borgia Codex, which was created before the 1400s by the Mixtec people who lived around the region of present-day Mexico City.

Each page in a codex has a central, highly detailed, brightly drawn image, usually of a person or an animal, with several symbols in different colors around it, similar to the hieroglyphics inside an Egyptian pyramid. A dozen or so similar but smaller pictures

*The Borgia Codex, from the Mixtec people, captures the annual cycle of weather patterns in symbolic imagery.*

surround that, but show different actions and use different colors and symbols.

“Each page,” Cerros said, “has so much stuff going on.”

There is no key or reference guide that tells the meaning behind the symbols and colors of codices. Instead, scholars have accumulated knowledge over generations and relied on the breakthroughs of other researchers to decode small parts.

For Cerros, a trip to Mexico City last April gave him some special insights.

The Borgia Codex captures the annual cycle of weather patterns in an elaborate fashion. Cerros was able to better understand the mysteries of the codex in interviews with tribal elders. He also attended workshops on the ornate documents, discussing their meaning with experts.

There was also a true “Eureka!” moment. While looking over the codex, he came




“I’M MORE IN CHARGE, CULTURALLY, OF WHO I AM AS A PERSON.”

across an image of a man holding an object that loosely resembled a torch. Then he thought back to a dance he had seen earlier during that same trip to Mexico—a “danza”—during a ceremonial festival hosted by several tribes. He recalled a performer holding a small bundle of plants

above his head and waving it, representing clouds. Then the dancer did a sweeping motion with the greenery, an allusion to rain.

An elder later helped him connect the dots: The drawing and the dance both symbolized an entreaty for rain, either to summon it or keep it away (Cerros wasn’t able to determine which).

Though Cerros was introduced to codices in a high school class, he has gained a much deeper appreciation of them through his research in college. Through the codices he has decoded something of lifelong value—a better understanding of his family’s roots.

“It means a lot to me,” Cerros said. “I’m more in charge, culturally, of who I am as a person.” 



# STELLAR STUDENT

CHARITY WOODRUM RIDES A NASA INTERNSHIP TO THE FOREFRONT OF ASTROPHYSICS

BY JIM MUREZ

It's an understatement to say that, for Charity Woodrum, it was exciting to intern at NASA. Simply put, she was overwhelmed.

"The first week I was holding back tears," the UO physics major said. "You're constantly reminded that you're working with people who have made some of the biggest discoveries in the history of humanity. You think about it on a daily basis."

This summer, Woodrum enjoyed the kind of wide-eyed adventure that most undergraduate astrophysicists-in-training could only dream about: 10 weeks as an intern at NASA's Marshall Space Flight Center in Huntsville, Alabama, where she worked with leading scientists to advance understanding of cosmic phenomena that have only recently come to light.

This wasn't your run-of-the-mill internship built on coffee runs and busy work. Following in the steps of a Duck who landed the same prestigious opportunity a year ago, Woodrum was expected to make significant contributions to evolving research.

For a talented and passionate emerging scientist who came to astrophysics following a career change, the revelation was exhilarating—and perhaps just a bit unsettling.

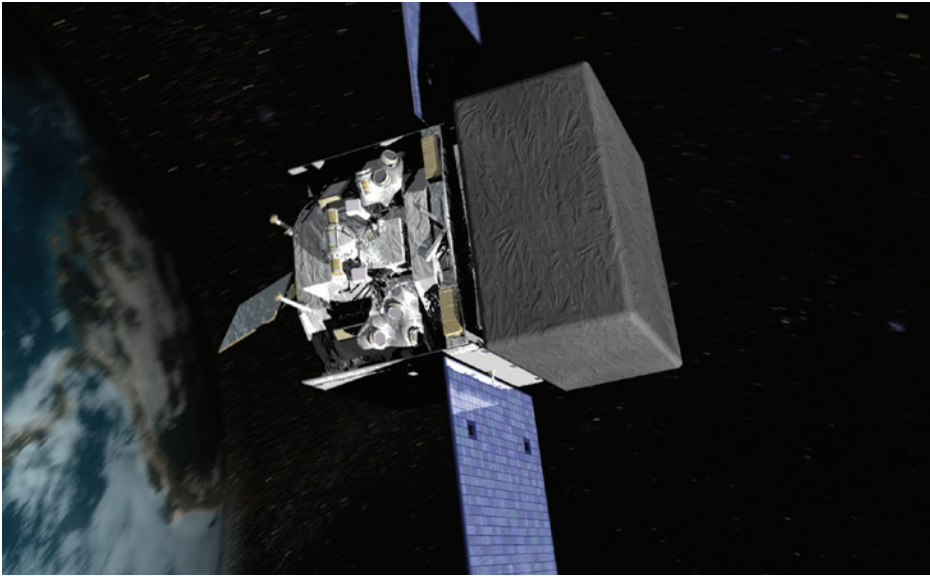
"They're not just making up random jobs for interns to get experience," Woodrum said, halfway through her internship. "We're doing things that are really important for their missions."



*As part of her tour of Marshall Space Flight Center, Charity Woodrum visited a mock-up of the International Space Station, which also serves as a lab. Just like in the movies, when work needs to be done on the actual space station, engineers first head to the mock-up to do dry runs.*

“THEY’RE NOT JUST MAKING UP RANDOM JOBS FOR INTERNS TO GET EXPERIENCE. WE’RE DOING THINGS THAT ARE REALLY IMPORTANT FOR THEIR MISSIONS.”

NASA/GODDARD SPACE FLIGHT CENTER CONCEPTUAL IMAGE LAB



Woodrum, on the hunt for gravitational waves, reviewed images collected by the Fermi telescope (above) and stored as data. She ran calculations that sifted through this information, in a search for previously undetected events. She didn’t find any, which validated NASA’s methods.

## UNDER FERMI’S WATCHFUL EYE

Woodrum worked on a topic that has been called one of the biggest breakthroughs in physics in 100 years: the existence of gravitational waves.

The theory, predicted by Albert Einstein a century ago, postulated that energy ripples move across the cosmos, causing space and time to expand and contract. The waves were detected for the first time last year, with UO physicists playing a key role in verifying them; the proof of gravitational waves validated a fundamental tenet of Einstein’s theory of relativity and triggered speculation that a Nobel Prize is on the way to the lead research team.

Now the hunt is on to see just how many gravitational waves can be found.

The observatories in Washington and Louisiana that detected the first gravitational waves weren’t designed to capture all of them or pinpoint their origin. It’s possible that smaller waves are zipping past the facilities unnoticed.

But they’re not going to escape the attention of NASA’s Fermi Gamma-Ray Space Telescope, which is in a low orbit

around the Earth. The telescope can pick up the gamma rays that are emitted when an explosive event—say, the collision of a black hole and a star—triggers the release of gravitational waves.

Last summer, scientists at the Marshall Space Flight Center made it their top priority to ensure that the telescope is capturing anything that could be a short gamma ray burst, the telltale companion to a gravitational wave. It was Woodrum’s job, essentially, to check the telescope’s work.

The telescope picks up gamma rays using cylindrical sensors that cover about 70 percent of the sky and run almost constantly. Gamma rays from the deepest reaches of space bombard it nonstop.

The frequency and strength of those rays are converted into data that is run through complex calculations to sift out other disturbances. The result is a collection of only the strongest readings—blasts that are most likely the footprint of a high-energy event that could produce gravitational waves.

NASA scientists wanted to comb through the data at an even finer level to

determine if the telescope was picking up gamma ray bursts that hadn’t been previously revealed in the computer readings. Woodrum was assigned to rewrite parts of the programming to make that happen.

“My goal was to find as many short gamma ray bursts as possible,” she said.

## NOT A MILLISECOND TO SPARE

Working with a month’s worth of information from the telescope, Woodrum adjusted computer calculations to bring into view additional data. NASA had been analyzing footage from the telescope at 25-millisecond intervals—Woodrum made this even more precise, dialing in intervals of four and 16 milliseconds.

Nothing new showed up—no additional so-called “candidates” were hiding in the data. Woodrum’s conclusion: Fermi wasn’t missing any gamma-ray events, and therefore, no additional gravitational waves had snuck past.

“I presented (my research) to them, and they decided that it was not useful to go down to the shorter times,” she said. “The 25-millisecond intervals were perfect, which made them happy.”

Imagine being an undergraduate and an intern, and making an astrophysics presentation to a room full of the brightest minds in the country. For Woodrum, that was a reality.

“You have 11 NASA scientists staring at you, and they are all experts in their field and you’ve only been there for a month,” she said. “It’s intimidating and challenging, but it’s really fun, too, and rewarding. It’s a really steep learning curve.”

How important was Woodrum’s research to the Fermi telescope project? When she arrived for the start of her internship, she was shown a checklist of 13 to-do items that NASA scientists had compiled. After her investigation, they crossed an item off the list—analysis of “finer” data for evidence of gravitational waves.

NASA scientists also planned to pull from Woodrum’s work when they write a review of the project.

Michelle Hui, a research astrophysicist at Marshall who was Woodrum’s mentor,

said the intern's computer programming skills made her perfect for the assignment she was given.

Hui was so impressed with Woodrum's dedication and energy that she discussed working with her as a liaison between NASA and the UO research group that helped detect the gravitational waves.

Over 10 weeks at Marshall, she watched Woodrum grow into an independent thinker and valuable contributor.

Said Hui, "She takes things into her own hands."

Woodrum is the second UO student in two years to land an internship at NASA Marshall through an Oregon consortium that promotes education in the sciences. Fellow physics major Manju Bangalore interned at the space flight center in 2015, working with the technology development division to find the best propulsion method for space travel.

Scott Fisher, director of undergraduate studies in the physics department, said Bangalore and Woodrum both went into their internships equipped with the

knowledge and skills that they needed to succeed—and frequently were ahead of their peers in that regard.

"To me, this is a strong validation of the preparation that UO and UO physics instills in our students," Fisher said.

## BUTTERFLIES AND STEPHEN HAWKING

The Marshall Space Flight Center is the US government's rocketry and spacecraft propulsion research center.

As the largest NASA center, Marshall was first tasked with development of the Saturn launch vehicles for the Apollo moon program in the 1960s and 1970s. Marshall is the agency's lead center for Space Shuttle propulsion, related crew training and International Space Station design and assembly.

In tours and presentations, Woodrum and the other interns saw it all, from a mock-up of the International Space Station to the prototype of the ship being designed to take the first humans to Mars. Even better, they heard about these proj-

IMAGINE MAKING AN ASTROPHYSICS PRESENTATION TO THE BRIGHTEST MINDS IN THE COUNTRY. FOR WOODRUM, THAT WAS A REALITY.

ects from the scientists running them.

"You get chills and butterflies," Woodrum said, "as you are walking around hearing what everybody does for their work."

For her, astrophysics begins with Stephen Hawking.

Woodrum was a community health nurse in southern Oregon's Douglas County, and the emotional strain of an otherwise satisfying job was beginning to

# COSMIC CONNECTIONS

**Y**ou don't have to go to NASA to have an otherworldly experience in UO physics research.

So says undergraduate Charity Woodrum, who, in fact, did go to NASA—she was at the space agency's Marshall Space Flight Center in Alabama last summer for a 10-week research internship (see "Stellar Student," p. 16).

But students fascinated by physics have scores of research opportunities at Oregon. Almost all of the department's faculty manage or participate in large research programs, and most welcome undergraduates for their projects.

Those projects include working on and installing seismographs that monitor the Cascadia subduction zone, building and commissioning a robotic telescope at Pine Mountain Observatory and helping an international team of scientists obtain data at the Large Hadron Collider in Geneva, said Scott Fisher, the department's director of undergraduate studies and public outreach coordinator.

UO physics majors "are deeply engaged in research at large and small facilities around the state, country and globe," he added.

Woodrum is one of the students making waves in research here at the UO, working with similarly motivated and talented physics undergraduates.

Over Memorial Day weekend, Woodrum and other undergraduate members of the astrophysics research group spotted an exploding, dying star in a galaxy 35 million light years away while on duty at the UO's Pine Mountain Observatory near Bend. The observation helped the global scientific community confirm the supernova, which had been detected by astronomers in Australia just a few hours earlier.

The dying star was some eight to 50 times the mass of the sun.

"When we saw the picture come up on the monitor and saw the supernova clearly visible, it was extremely exciting," physics major Lindsey Oberhelman said. "None of us students had done any observing before."

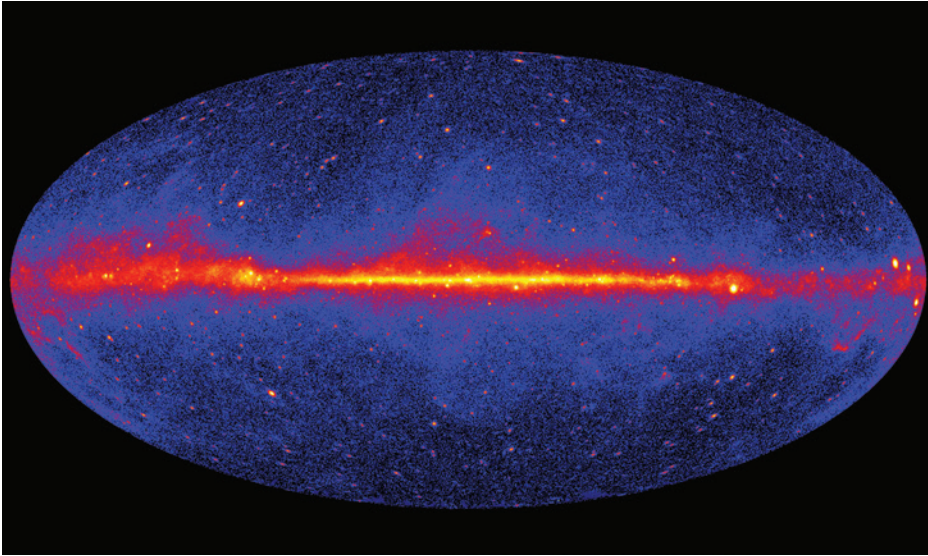
Woodrum's role was pivotal. Scientists had just learned of the possible supernova in a distant galaxy, so she encouraged the team to train the telescope there, just in case.

## A SUPERNOVA ON THE FIRST RUN

Their instrument was the most modern telescope at the observatory: the state-of-the-art Robbins telescope, built with mostly off-the-shelf components and customized with UO staff- and student-designed hardware and software. The scope will eventually be operated from a control room on campus, said group leader Fisher.

"It was a goal of mine to image at least one supernova within the two years I have with the Robbins telescope, but I thought it was an improbable goal," Woodrum said. "I definitely didn't expect to see one in our first run."

Fisher is committed to transforming the observatory into an instrument for undergraduate research. But his undergraduates are also probing a topic that has nothing to



*The Fermi Gamma-ray Space Telescope gave Woodrum new “eyes” into space. This image is a map of the sky at gamma-ray wavelengths, accumulated over six years of operation by the telescope.*

take its toll. So to clear her head, she read whatever she could find by the famed theoretical physicist.

It wasn't exactly light reading, but Woodrum devoured it. What she thought

was a distraction was actually a passion, she discovered—she wanted to become an astrophysicist.

“Because life experiences are determined by what perspective you have, I

thought, ‘What’s the most interesting perspective I can have in my life?’” Woodrum said. “I decided I wanted to experience life through the eyes of an astrophysicist.”

The learning curve for astrophysics is steep. On the first day of class, students are learning Newton’s laws—and by graduation, they’re tackling quantum mechanics. Think of it as 300 years of human discovery squeezed into the four years it takes to earn a physics degree, Woodrum said.

Even so, she has distinguished herself in this reinvention as a college undergraduate, not just with her course work but with her contributions to the department’s research (see below).

Woodrum is on her way to a new career that will be focused on gazing at the stars. Her experience at NASA was—dare we say it?—one small step closer.

“I’m a bolder scientist and learner now,” Woodrum said. “One of the skills I’ve brought back is to not be afraid to try something that’s really hard that you’ve never done before.” **EAS**

do with telescopes—understanding the evolution of galaxies.

Scientists trying to learn more about how galaxies are formed often concentrate on two types: “galaxy clusters,” which refers to a big group of them bound together by gravity, and “field galaxies,” which essentially have no neighbors. Comparing the two groups can lend insight into how they have evolved, Woodrum said.

The team, which works with images of galaxies taken by the Hubble Space Telescope, is collaborating with institutions from around the world. Those images show points of light that have traveled a mind-boggling distance to reach the Hubble—six billion light years, or roughly half the age of the universe.

After an initial analysis of the images was performed, Woodrum and the rest of the UO team inherited the results as a large and complex database of numbers. They have been responsible for plotting, visualizing and, most important, interpreting the data obtained with Hubble, the Gemini Observatory in Hawaii and other large telescopes.

Woodrum’s team found that at a given point in time, solitary galaxies tend to be younger than cluster galaxies. The latter evolve more quickly because the presence of neighbors cre-

ates a strong gravitational pull that accelerates activity—star formation, for example.

“When galaxies collide, a lot of stuff happens,” Woodrum said. “When one is alone and minding its own business (growth occurs) more slowly.”

It’s a simple, compelling scientific observation—but there’s nothing simple about the skills it takes to get there. To convert images from space into a verifiable find such as this, Woodrum relies heavily on mathematics and a command of multiple programming languages.

Woodrum has received an undergraduate research fellowship of \$8,000 from the Oregon NASA Space Grant Consortium for the work. The consortium, a statewide network of universities, museums, researchers and more, promotes education in science, technology, engineering and math. Astrophysics work is demanding, Woodrum said, but the payoffs—unlike those galaxies she studies—are never far away.

“Every physics student gets to be in awe every day—and in research, even more so,” Woodrum said. “Most physics students love learning something new every day. But when you’re doing research on the evolution of a galaxy, you get to learn something new for humanity. That’s a whole new level.” —MC



*In May, a team of UO undergraduates was among the first to spot an exploding, dying star in a galaxy 35 million light years away. Their observation helped the global scientific community confirm the supernova—circled in red—which had been initially detected just hours earlier.*

# IN THE MIND'S EYE

A BIOLOGY STUDENT'S EXPERIMENTS WITH SIGHT PRODUCE AN UNEXPECTED RESULT—A VISION OF HIS FUTURE

BY MATT COOPER

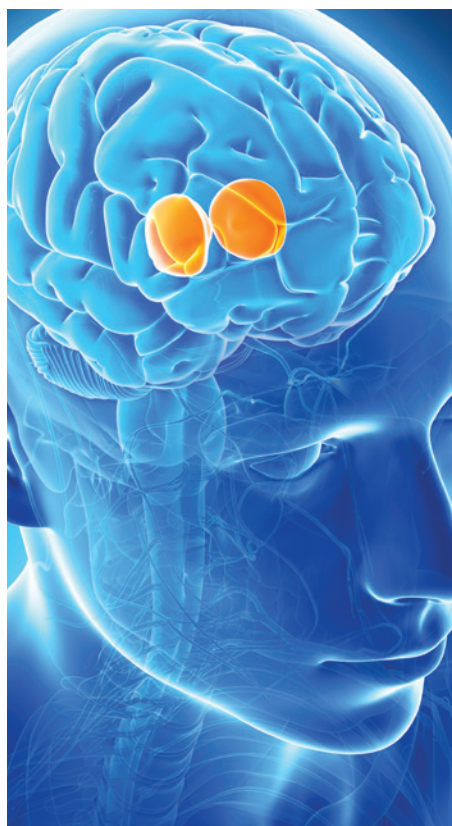
**T**here's a lot we still don't know about how vision works. For example, if we're running or at rest, how does the brain adjust to help us see?

Neuroscientists are exploring this question.

They're looking at the thalamus, a structure in the middle of our brains composed of two bulb-shaped masses, each about the size and shape of a walnut (right). The thalamus is a relay stop for sensory information on its way to the part of the brain that controls vision.

Researchers at the UO are making exciting advances in this area, and they're recruiting undergraduates such as Ian Etherington to play critical roles in labs where experiments are conducted.

Laboratory research has proven to be a defining experience in Etherington's life. In the lab, working with faculty mentors and a team of scientists, he's been able to build not only skills and confidence but also clarity about what comes next: a path toward helping others who suffer from neurological conditions like the one he has experienced himself.



## RUNNING OR RESTING

It's only recently been discovered that a person's active or passive behavior—running or resting—influences how the thalamus processes visual information.

Thanks to work by a team that includes UO neuroscientists Cris Niell and Denise Piscopo, we know that within the thalamus there are specific cellular routes for specific visual information. One set of these cells—called neurons—might handle an object moving left-to-right across our vision, for example, while another covers objects moving right-to-left. But

these cells respond differently depending on whether or not the body is in motion.

Etherington (right), a biology major working in the Niell lab under former UO researcher Wayne Tschetter (now at Concordia University), conducted tests to determine whether running or resting affected the performance of neural channels. The team found that during running, cells that deal with the direction or orientation of a passing object respond more strongly; likewise, there is a stronger response by a special group of cells that help us see bland or low-contrast stimuli—a gray sky, for example.

For months, Etherington tested individual cells within the thalamus, observing the results on a monitor similar to an EEG. When a particular cell “fired” more strongly, for example, it showed up as more spikes in the wave moving across the screen.

Etherington's running of experiments was integral to the project, according to Niell. “These are the things that make the lab go,” he said. “I'm in my office writing papers and grants. It's people like Ian who are the ones in there doing the experiments. Ian kept the project moving forward—it's like having an extra engine on board.”

The payoffs of research are significant for undergraduates such as Etherington.

For one, it enables students to take what they learn in class to the next level.

Although courses such as organic chemistry include time in the lab, experiments are often carefully designed to reinforce what is being taught. In a research lab, by comparison, the only goal of the experiment is to test a hypoth-

esis. It's up to the researcher to call on ideas and theories from the classroom in service to the project.

Projects in a research lab offer opportunities "to reach for classroom concepts that you need," Etherington said. "It's a very effective way to learn."

There are the résumé-building benefits of research, as well. Etherington's hands-on work with fundamental neuroscience—recording and listening to the activity of cells—would be a rare strength even among graduate students interviewing for lab positions, Niell said.

Perhaps most important, though, is a skill Etherington is developing that will serve him regardless of his career path—learning to think like a scientist.

"How do you think about analyzing data? How do you troubleshoot things? How do you research a question?" Niell said. "Ian has developed a lot of ingenuity, a lot of creativity."

He recalled, for example, Etherington's solution for a tedious lab task. The needle-like probes used for recording cell activity must be repeatedly dipped in solution for cleaning. Etherington, who had been scouring old literature on similar projects, found that sewing machines had been retooled to function as automatic dunkers.

"He's a problem solver," Niell said. "He's learning those general research skills that you just can't get in a course. These are highly sought-after skills, regardless of the kind of work you do."

## DON'T BREAK ANYTHING

When Etherington first joined the project, one of his first thoughts was *don't break anything*.

As an undergraduate making a first foray into research, Etherington found it easy to feel overwhelmed. There is a steep learning curve in grasping both the scientific questions in play and the complicated techniques that will be used to try to answer them.

"It's like starting any new job—there is so much to read and understand



and so many questions to ask people in the lab,"

Etherington said. "One of my first days in the lab, I was given a stack of papers to read—it was like drinking from a fire hose, just trying to absorb the background."

As he found his footing, though, Etherington became increasingly invested in the project and its importance. He was thrilled by the team's breakthroughs and amazed by the insight into the inner workings of the brain.

"It's like spying on something that you're never supposed to know is happening," Etherington said. "Pulling back the curtain on how the brain works—it's mind-boggling to me, and extremely compelling."

The project has given Etherington the

**"IAN KEPT THE PROJECT  
MOVING FORWARD—IT'S  
LIKE HAVING AN EXTRA  
ENGINE ON BOARD."  
—UO NEUROSCIENTIST  
CRIS NIELL**

confidence that he can be "more than just a bystander to science"—he can get involved, he can be a part of creating knowledge.

"For a long time, I was pretty squeamish about neuroscience," Etherington said. "But at some point, I started to wonder if it might actually be freeing and empowering to understand what is going on in the brain as we experience life."

Etherington's interest in the workings of the brain is, on one level, personal: He has struggled with obsessive-compulsive disorder, a deeply frustrating experience, he said, and in many ways, a hindrance to academic life.

But the disorder has also served Etherington to some extent. It makes him "pathologically tenacious," he said—an excellent attribute in a scientist—and it has helped him define a career trajectory.

Etherington is on a track to wear three hats in neuroscience, as a physician-scientist-professor. He wants not only to find solutions in the lab, but also to present them to patients and pass along this knowledge to the next generation of doctors and researchers. He plans to focus on neurological disorders such as OCD, autism and schizophrenia.

## DRIVING CURIOSITY


To that end, Etherington has shaped his education and research at the UO to give him solid foundational knowledge of neuroscience and its underpinnings, biology and chemistry.

"I want to be on the frontlines and working with patients, but I also want to be able to say to them, 'I'm working on something to make our treatment options better,'" he said. "Straddling that rift between medicine and science has long been something that has compelled me. The only question is whether I can handle the workload to get there."

Niell has seen indications that Etherington has the makeup to do it.

He still remembers his first encounter with the student. Then just a freshman, Etherington buttonholed Niell on an obscure paper from the scientist's distant past, but one that Etherington had found fascinating and had studied closely: Was Niell aware of any additional developments? Had anyone else looked into the intriguing questions that had been left unanswered?

It showed to Niell the kind of driving curiosity that successful scientists must bring to this demanding work. Then, in the researcher's lab, Etherington put that passion for knowledge to work, establishing himself as an independent thinker who can also make contributions to the team.

"Ian set the example for undergraduates working in the lab—he has the creativity, the ideas, and he can self-motivate," Niell said. "He showed me what undergraduates can do." 



# JUSTICE, INTERRUPTED

HOW POLITICS COMPROMISED THE PURSUIT OF A SUSPECTED NAZI WAR CRIMINAL

BY JIM MUREZ

John Demjanjuk was a Ukrainian autoworker living in the suburbs of Cleveland in 1977 when investigators showed up at his door.

A tip alerted them to the fact that he was actually Ivan Demjanjuk, a former guard at a Nazi concentration camp during

World War II who had lied on an immigration form to take up a new life in the United States.

That was the beginning of an international judicial process for a man who became perhaps the most famous face of the Nazi war crimes trials.

It was a process that was not just long and convoluted, but deeply flawed, according to Claire Aubin (above), who received her degree earlier this year. Her investigation of the Demjanjuk case led her to conclude that it had been compromised by

competing national interests, global politics and circumstances of the moment.

Aubin, a double major in international studies and Russian, East European and Eurasian studies, was looking for a topic for her senior thesis early this year when a trip to Washington, DC, proved fortuitous.

During a research seminar at the United States Holocaust Memorial Museum, she learned of major gaps in the coverage of the Demjanjuk case.

Demjanjuk was sentenced to death in a highly publicized trial in Jerusalem in 1988. But it was a case of mistaken identity—he was wrongly believed to be Ivan the Terrible, a notoriously cruel guard at the Treblinka concentration camp. The revelation came to light only after the Soviet Union released identification paperwork that vindicated Demjanjuk; the conviction was overturned and he was released.

Then in 2011, German courts found Demjanjuk guilty of being an acces-

sory to more than 27,000 deaths at the Sobibór concentration camp. And that's where Aubin saw an opportunity.

While there was extensive analysis of Demjanjuk's trial in Israel, global interest waned once it was determined that he wasn't Ivan the Terrible. For her thesis, Aubin decided to examine international law, procedures and the pervasive role of politics throughout Demjanjuk's case.

She was clearly onto something. Just after she began her work, the first comprehensive book on Demjanjuk came out.

Aubin used dozens of records on Demjanjuk, from the start of the investigation in 1977 through his death while appealing his case in Germany. She used the case as an assessment of the effectiveness of the international judicial system in the prosecution of suspected Nazi war criminals.

Working in the Holocaust museum, Aubin collected everything she could relating to Demjanjuk—historical docu-

## THE DARK SIDE

EXPLORATION OF OUR "SHADOW" SELVES BLURS THE LINE BETWEEN RELIGION AND PSYCHOLOGY

If you go to the official *Star Wars* website, you can read how the theories of psychiatrist Carl Jung have influenced the blockbuster film series. "Carl Jung is essentially the great-grandfather of *Star Wars*," states the *Star Wars* in Mythology blog.

Among the many Jungian themes to manifest in *Star Wars*, the most dominant is "the shadow."

The shadow, according to Jung, is the hidden side of our psyches, aspects of ourselves that are too violent, sexual, greedy or grandiose to acknowledge consciously. *Star Wars* explicitly sets up juxtaposition between the shadow or "dark side" and the good, and plays it out through characters such as Darth Vader.

Intrigued by the concept of the shadow, Michelle Maujean, who graduated in 2016, delved into it for a research paper for religious studies. She examined not just the shadow itself, but also Jung's theory of how we can come to terms with disturbing parts of ourselves.

According to Jung, becoming a wholly in-





*Defendant John Demjanjuk, moments after hearing an Israeli court sentence him to death in 1988 for Nazi war crimes. Of her research into his trials, Claire Aubin said, “there’s a level of sensitivity that you need to have. Some would say, ‘This is a sad thing that we shouldn’t talk about,’ whereas others would say, ‘No, we need to talk about it all the time. We need to shout it from the rooftops.’”*

ments, publications, photographs and audio and video recordings.

Last spring, she expanded her research with a visit to the Mazal Holocaust Collection, the world’s largest privately owned Holocaust archive, which was donated to the University of Colorado at Boulder in 2014.

It was thrilling—but challenging—to be one of the first researchers to see those records. “They hadn’t even finished archiving them yet,” Aubin said, “which made it much harder because they hadn’t cataloged everything.”

Aubin spent months sifting through piles of legal documents, courtroom transcripts, pamphlets and literature, including limited-edition and rare books.

Her conclusion: The political pressure on international trials intensifies when nations’ reputations and legacies are at stake—and that can lead to mistakes in administering justice.

Review of the records revealed to Aubin a story of three countries with their own motives for pursuing Demjanjuk with an almost blind zeal.

In prosecuting a Nazi war criminal, Israeli officials saw the opportunity to provide a sense of reparation to Holocaust survivors and to validate Israel’s power as a still-fledgling nation. In the US, the Department of Justice’s newly created Office of Special Investigations saw the capture and prosecution of a man believed to be Ivan the Terrible as a triumph that would justify its existence.

And in Germany, the Demjanjuk trial was seen as a way to atone for sins and reassert the country’s standing in the international legal system.

Aubin tracked instances where investigators lowered standards or ignored discrepancies in the evidence against Demjanjuk. Some so strongly wanted

to convict the man that they thought was Ivan the Terrible that they ignored warning signs and claims by US agents that suggested it was a case of mistaken identity, she said.

In photographic lineups, Demjanjuk’s picture was the largest, subconsciously suggesting to witnesses that he was the primary suspect, Aubin said.

She read witness statements that had been handwritten by interviewers—but based on the interviewers’ memories, rather than a recording. Records indicated that prosecutors had given more weight to eyewitness testimony than physical evidence, although the former is less reliable.

In the end, Aubin was forced to re-think what had been an idealistic view of international law.

She set out to assess how three nations handled legal proceedings for an important figure from an international tragedy. She found that they were unable to keep politics and personal agendas out of the process.

“I still believe in the legal system,” Aubin said. “But my perceptions of it are different now that I see how dependent it is upon politics.” **CAS**

tegrated, mature human being (he calls this process “individuation”) means becoming consciously aware of these darker aspects of the self and finding appropriate expressions for them.

How does a psychological theory qualify for a research topic in religious studies? Mark Unno, an associate professor in religious studies, said the shadow theory “addresses both a psychological process and the possible religious dimensions of human experience.”

Maujean—who crosses over those boundaries herself, with degrees in religious studies and psychology—focused on case studies from a book by psychotherapist Robert

Akeret, *Tales from a Traveling Couch*.

She analyzed two of Akeret’s former patients: Charles Embree, a young man who was “in love” with a circus polar bear, and Naomi Goldberg, an introverted and insecure college student who came to believe she was the reincarnation of a Spanish countess.

Embree eventually resolved his shadow self by becoming a professor who lectured on the circus; Goldberg ran away to Mexico and lived flamboyantly as a flamenco dancer named Isabella.

Maujean’s conclusion: Both found their place in society only through resolving their external and hidden personalities.

Throughout her research, Maujean demonstrated an exceptional ability to grasp theoretical concepts and relate them to the lives of real people, Unno said.

“She was able to take an outside theory, adapt it to a concrete example and give a critical analysis of the psychological process,” he added.

She received the religious studies department’s 2016 Jack T. Sanders Memorial Award for research projects that also spanned religion in war, terrorism and end-of-the-world beliefs. —AT

# RISE OF THE MACHINES

USING ARTIFICIAL INTELLIGENCE TO PREDICT RECESSIONS— IS IT BETTER THAN THE CLASSIC METHODS?

If you've ever gone to the Amazon.com website and viewed something you might like to buy—say, a backpack—you've probably seen the familiar prompt: "Customers who bought this item also bought . . ."

Click on an Under Armour backpack, for instance, and Amazon will present you with a full description of that product—plus a lineup of dozens of backpacks from other companies that you might like better.

This is how Amazon uses its massive stores of data on previous customer purchases to nudge you closer to your own purchase—or, ideally, to buy even more stuff. The company's sophisticated modeling software "knows" that customers like you, who have looked at that Under Armour backpack, often ended up buying something in a similar vein. It is using data on past behavior to predict what you might be most inspired to buy today.

This phenomenon—predictive modeling using computers that "learn"—applies across a huge array of fields. Jeremy Garbellano (right), a recent UO graduate, was especially intrigued with how the concept applies to economic predictions.

Now, thanks to his deep research and analysis as a student, he has landed a job at Amazon as a financial analyst.

For Garbellano, it all started in the late 2000s, as he watched with dismay as friends struggled to find jobs following the collapse of the housing market. It was the beginning of his fascination with boom-and-bust cycles in the economy.

"Many were underemployed or unemployed. Those who did find work were the first to be laid off," said Garbellano, who got his degree in economics in 2016. "It was amazing to me that your job prospects could really depend on whether there's a recession when you graduate."

Garbellano majored in economics because he wanted to understand the 2008–9 financial crisis. Now he's distinguished himself for his analysis of the tools available to experts for predicting the next one.

In identifying or predicting periods of recession and growth, economists have long relied on mathematics and statistics. But Garbellano believes these approaches can be improved with an assist from some of the latest advances in computer science.

Computer scientists are adding new tools to the economic forecasting toolkit. They're writing computer programs that run on artificial intelligence—the idea that a machine can "learn" to produce better and better results for you. It's all based on sophisticated calculations called algorithms that the computer performs to make predictions.

For his honors thesis, Garbellano tested eight of these "machine learning" programs and also compared them to traditional methods such as "logit-probit regressions" and "Markov switching models." He measured the performance of each in

"nowcasting" a recession—that is, determining whether one is happening in a given time window, based on real-time data.

Using the period from 1980 to 2014 for his project, Garbellano assessed how well the various methods identified ups and downs in the economy. For historically relevant data, he used statistics from that period, including payrolls, industrial production metrics and personal income data.

Garbellano found that a machine-learning method called "k-nearest neighbors" was the best for predicting recessions. It's based on charting a number of known data points, such as recent monthly economic upturns and downturns; by add-

ONE THING GARBELLANO DIDN'T PREDICT, HOWEVER, WAS GETTING A JOB AT AMAZON.

ing another data point—say, the current month's economic activity to date—one can predict whether the month will end as one of growth or decline based on the data point, or points, closest to the one added.

Although he didn't compare the new and old approaches head-to-head, Garbellano found merit in a traditional method called "logistic regression." In fact, he concluded that taking into consideration the results from numerous forecasting approaches—old and new—could be best for trying to predict something as complicated as the next recession.

One thing he didn't predict, however, was getting a job at Amazon.

"Amazon is a company that is awash in data and, in finance, I interact with different data every day," he said. "I have a great set of tools to use data more rigorously than many people who are trained in traditional business programs." —MD





# CRIME AND PUNISHMENT

## EXAMINING THE INTERSECTION OF RACE AND PROSECUTIONS

**D**aniel Silberman has long been a proponent of criminal justice reform.

On debate teams in high school and at the UO, he has argued for an end to mandatory minimum sentences and even prison abolition. He has been particularly interested in whether the prosecutorial process can result in different outcomes, depending on a defendant's race.

From this, Silberman (right) formulated a pressing question: How do changes in a community's racial demographics correlate to changes in prosecutions?

For his final research paper in sociology, which earned him an honors distinction, he explored that very question.

Silberman—who graduated earlier this year and begins at UCLA School of Law this fall—collected data for all 36 Oregon counties from the US Census, American Community Survey and the Oregon Department of Corrections. He established each county's felony conviction rate over two five-year periods, 1998–2002 and 2008–12; for racial and economic demographics, he collected county data for 2000 and 2010.

Then, with the help of complicated statistical analysis, he compared each county's racial composition and econom-

ic demographics with felony conviction rates for drug and violent crimes.

In counties across Oregon, Silberman's statistical model correlated a rise in black or Hispanic populations with an even higher rise in felony convictions for drug and violent crimes—despite the fact that there was no significant surge in those offenses in the FBI reported crime rate for the periods under review.

The model predicted that, over the 10 years, if the number of Hispanics in an Oregon county increased by 1 percent, there would be an average increase of 3.5 percent in felony drug conviction rates.

Just to be safe, Silberman tried to eliminate the argument that the predicted rise in prosecutions could have been due to increased crime that the FBI didn't capture. He did this by accounting for factors that are sometimes correlated with increased crime and, therefore, more convictions—poverty and unemployment, for example. The predictions held even after adjusting for such factors.

Silberman's conclusion: For the 10-year period, increases in minority populations were strongly associated with increased prosecutorial harshness.

Though quick to stress that his work doesn't show that authorities are intentionally targeting blacks and Hispanics,

Silberman suggested his findings warrant additional review of the issue.

Associate professor Aaron Gullickson, Silberman's thesis advisor, introduced Silberman to a powerful statistical tool that made the analysis possible: computing software called, simply, "R," which is, Gullickson said, "the best software of its kind."

"But it has the steepest learning curve," he added. "It's not a point-and-click kind of thing. It's almost like learning a real programming language."

Silberman was a quick study. A few weeks after being introduced to the software, Silberman not only had figured out how to use it, Gullickson said, "but he had been downloading soccer stats and was doing analysis on those as well."

By the time Silberman was done with the criminal justice project, he was an expert with complicated statistical tools such as "fixed-effects linear regression models." He created graphs that plotted conviction rates against minority populations. He also produced recommendations for the criminal justice system, including uniform charging standards to ensure consistency among prosecutors.

This from a student who initially was taken aback when he realized that his research question would require him to dig deep into quantitative statistical analysis.

Said Silberman: "I hadn't taken a statistics class since high school." —MC



# LIGHT AS A FEATHER

## TRANSLATING A DARKLY POLITICAL GRAPHIC NOVEL

BY JIM MUREZ

It is an apocalyptic take on modern-day Mexico: Conquering angels rule the nation, indigenous groups stage a vicious revolt, widespread bloodshed ensues and no clear victor emerges.

This is Edgar Clément's *Operación Bolívar*, a graphic novel with themes of conquest and foreign influence that resonate just as well now as when the book was published in 1990.

Amy Poeschl first came across Clément's highly political project in a class on Latin American comic books last year. Long a fan of graphic novels, she instantly fell for *Bolívar*.

So for her, it was a no-brainer to use the book as the basis for a research project in senior lecturer Amanda Powell's class on literary translation. Students were assigned to translate a Spanish text, such as a poem or part of a book, into English.

Never mind that none of Powell's students had ever tried to translate a graphic novel before. Or that *Bolívar* is filled with complicated subtexts referring to the Spanish conquest of Mexico and the United States' presence in Latin America. Or that Poeschl was committing not just to the translation of text, but making her new English-language version align with the original book's visually lavish and often pointedly satirical images.

"I knew it was a big challenge because I had to deal with graphics as well as the words," said Poeschl, who graduated

from the UO earlier this year with a degree in Spanish. "But I adored the graphic novel so much that it was worth it."

In Latin America, authors have used graphic novels to tackle serious subjects for decades. Through sharp writing and detailed imagery, they've pushed for economic and cultural reform, provided alternate views of the region's history and pointedly criticized authoritarianism in government.

In Mexico, officials have distributed graphic novels widely to promote literacy among the nation's citizens, particularly the poor, and to teach the country's history.

she loves most about Spanish. "If I could do nothing but this for the rest of my life," she said, "I'd do it in a heartbeat."

First, Poeschl did a rough translation of a section, then she refined it over and over. She researched each word's meaning in English and Spanish, referring to translation dictionaries and then repeating the process panel by panel. She spent days analyzing even a single image of an angel's body before she began writing an interpretation.

"Researching words and their etymologies was fascinating," Poeschl said.

“PART OF THE MOTIVATION FOR ME TO DO THIS WAS I HAD SO MANY FRIENDS WHOSE SPANISH WASN'T GREAT. I WANTED TO MAKE IT AVAILABLE TO THEM.”

These trends laid the groundwork for the medium's acceptance as a legitimate form of literature by a large swath of young people; they have carried that respect and love of graphic novels into adulthood and broadened the appeal of the medium.

### PUTTING A PUZZLE TOGETHER

Poeschl translated 20 pages of the 164-page novel. She started her project with comparatively strong chops in Spanish—she's been studying the language since middle school and her family hails from Puerto Rico.

She pored over the 20 pages she translated roughly 100 times. It was like putting a puzzle together—one that helped Poeschl realize that translation is what

Given Clément's penchant for playing with words, Poeschl felt an obligation to be meticulous even with seemingly obvious translations.

Consider the phrase "la recuperación de la conciencia." It could be interpreted as "coming to awareness" or "reawakening," but Poeschl ultimately translated it as "the recovery of the conscience." That might seem to be the most logical, literal choice, but it was one that Poeschl arrived at only after revisiting the important phrase repeatedly with her classmates and Powell.

Poeschl's solution, Powell said, subtly drew attention to how Clément skewers the corporate commercialization of basic human activities like making art, healing the sick and seeking spiritual consolation.

In *Operación Bolívar*, indigenous people in Mexico wage an all-out war against a ruling class of angels. The book is filled with subtexts referring to the Spanish conquest of Mexico and the United States' presence in Latin America.

Thus the need for a recovered conscience.

Along with weighing possible word choices, Poeschl sought to craft each English sentence to match the author's tone—which presented another layer of challenge. In *Bolívar*, Clément switches freely between a colloquial voice and a professorial style of the kind you'd find in a history book.

Poeschl also decoded and translated metaphors and puns that have no English equivalent, while ensuring that the translation accurately reflected the accompanying illustrations.

In one passage, Clément, in describing angels, uses a word—"ligeros"—that means both feathery and light, but also trivial or frivolous. There is no single word in English that even comes close to all these shades of meaning, Poeschl said—but the metaphor "light as a feather" fit perfectly.

"That was one that I worked on for weeks before I finally went, 'Oh, that's so obvious,'" she said. "You want so much to find that perfect word and you know it's out there."

## SHADES OF MEANING

Powell praised Poeschl for skillfully navigating an exceedingly complex and multifaceted novel. *Bolívar* interweaves allusions to indigenous, Mexican, American and European cultures with Biblical references and political satire.

Translation is more than pulling out a dictionary and plugging in a word that fits, Powell said. For Poeschl's project, it required looking at the translation within the theme of the novel, while taking into account the particularities of the Spanish language.



"Even within a language, we have instances where no two synonyms denote or connote exactly the same thing," Powell said. "Each has a shade of meaning, and the history of usage implies a certain thing. That's all the more true between languages."

For her part, Poeschl hopes her research will resonate with a larger audience than simply her teacher and classmates. She wants to reach US Latinos and Hispanics who are losing their Spanish fluency, which includes some of her friends.

She chose to translate *Bolívar* in part because it is filled with important ideas about Mexican history and politics that, she hopes, her friends will more easily grasp in English than Spanish.


"Part of the motivation for me to do this was I had so many friends whose Spanish wasn't great," Poeschl said. "I wanted to make it available to them because I knew it was going to be right up their alley."

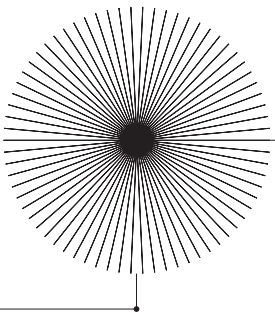
Literary translation is valuable as more than just a research exercise, Powell said. It can serve as ideal training for a wide range of careers, including the legal, medical and diplomatic professions.

"It is one of best preparations for any field where the language is nuanced," Powell said.

Beyond translation, undergraduates in Romance languages have pursued many other avenues of research. Some have studied French- and Spanish-speaking communities in the US, looking at questions such as bilingualism; they have investigated how language shapes communities and how communities that share a language change over time. They have delved into topics as diverse as medieval romance and postmodern performance.

Research in Romance languages also exposes students to often-overlooked parts of the French-speaking world such as Africa, areas of the Caribbean and the Middle East and regions of Africa and South Asia that speak Portuguese.

"When you learn about Africa in high school, you may learn about French-speaking Africa, but rarely do you learn about Portuguese-speaking Africa," said Amalia Gladhart, department head. "Undergraduate research in Romance languages exposes you to new worlds you never knew existed." 

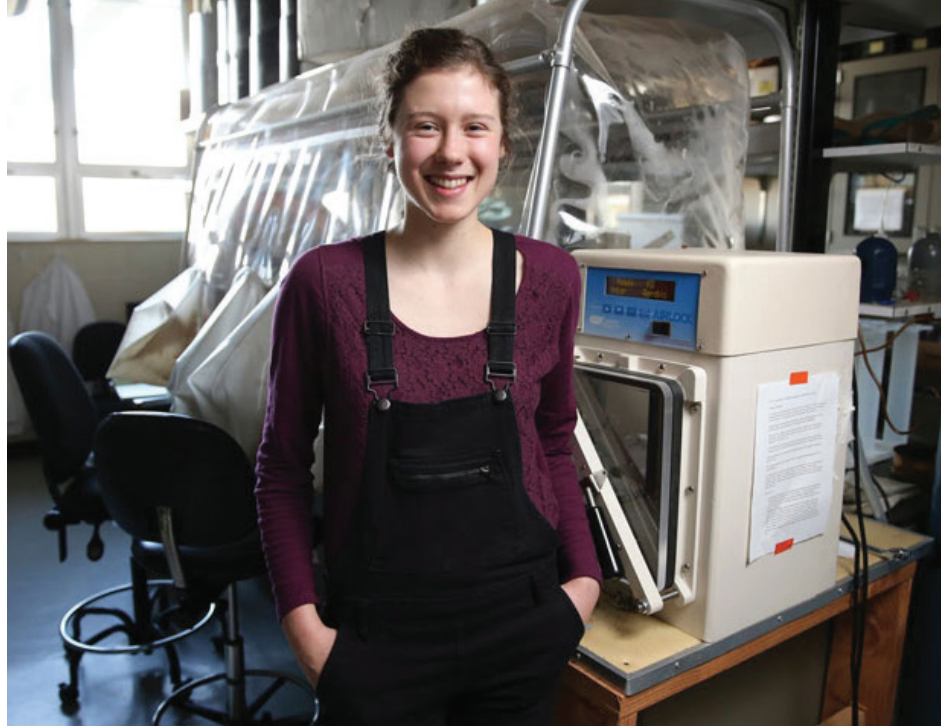


## NATIONAL AWARD WINNERS

**Y**ou never know where research will take you. **Amelia Fitch** (right), a biology major and Clark Honors College student, was a stellar environmental scientist at the UO. For her research on marine and freshwater wetlands, she pioneered new techniques for analyzing soil enzymes.

Fitch thought that, with graduation earlier this year, she would be off on a tour of Europe. She was only half-right—she’s spending the 2016–17 academic year in Great Britain, the first Duck ever to win one of the most prestigious postgraduate scholarships in the world.

Fitch received a **Gates Cambridge Scholarship**, awarded through the Bill and Melinda Gates Foundation, which covers all university and travel costs for a one-



year master’s program at the University of Cambridge. Just 35 Americans among more than 800 applicants received the scholarship this year.

Fitch’s research was essential to her application for the scholarship. And she’s not the only Duck who earned a national-level award in 2015–16 for the pursuit of original knowledge.

Under the **2016 Fulbright US Student Program**, **Kyla Martichuski** (biology) will conduct research in New Zealand. Fulbright is the government’s flagship international educational exchange program.

Martichuski will conduct breast cancer research for a year at the Auckland Cancer Society Research Centre at the University of Auckland, New Zealand. Her work is part of a master’s program in biomedical science.

After finishing her studies in New Zealand, she plans to pursue a doctorate at the OHSU Knight Cancer Institute.

“I am so honored to receive a Fulbright,” Martichuski said. “I am appreciative of the knowledge and skills I have gained from my professors and peers during my time at the UO.”



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## FUNDING AND AWARDS FOR UNDERGRADUATE RESEARCH

**F**aculty researchers get funding for their projects from agencies such as the National Science Foundation and the National Endowment for the Humanities. But you don't have to be a professor to get financial support for research efforts.

Undergraduates have funding opportunities, too. There are tens of thousands of dollars available to students conducting research in the humanities, natural sciences and social sciences at the UO. This support helps pay for tuition, materials, living expenses and even travel to conferences where research work can be presented.

Among the wide range of options:

- **Center for Undergraduate Research and Engagement (CURE):** eight \$500 grants, open to all undergraduates in a competitive review process. These are conference travel awards that will support undergraduates who want to present and showcase their research at regional and national conferences.
- **Humanities Undergraduate Research Fellowship (HURF) grants:** \$2,500 research stipend to students over two terms of work with a faculty mentor in the humanities; the fellowship funds as many as eight UO students for 16 weeks during the winter and spring terms.
- **Presidential Undergraduate Research Scholars:** \$5,000 research stipend for the academic year for students in chemistry, physics, earth sciences and mathematics.
- **Vice President for Research and Innovation Undergraduate Fellowship:** \$5,000 research stipend for the summer.
- **Undergraduate Research Opportunity Program (UROP) mini-grants:** up to \$1,000 in research funds awarded during fall and winter term.



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- **Oregon Undergraduate Researchers in the Summer Program for Undergraduate Research:** approximate \$4,200 research stipend for the summer.
- **Foreign Language and Area Studies Fellowships:** \$5,000 living stipend, plus tuition and fees up to \$10,000 for the academic year; \$2,500 living stipend, plus tuition and mandatory fees for the summer.
- **Center on Teaching and Learning Undergraduate Research Fellowship Program:** full tuition waiver for the academic year.
- **Center for Sustainable Materials Chemistry Summer Research Program:** \$4,000 research stipend for the summer.
- **Science, Mathematics, and Research for Transformation (SMART) Scholarship-for-Service Program:** cash stipend of up to \$38,000 a year, full tuition, required fees, health insurance contribution and book allowance.
- **McNair Scholars Program:** tuition support plus a \$2,800 summer research stipend for low-income and first-generation students or those from a group that is underrepresented in graduate education.
- **UO R25 Summer Research Program:** approximate \$3,800 summer stipends and professional training for undergraduates to participate in research projects funded by the National Institute of Child Health and Human Development.

Still looking for more? Visit **Online Extras** to read, view and hear more about some of the features in this issue:

**TURN IT UP.** The band Los Crudos (p. 4) paved the way for a generation of Latino punk rockers to not only play hard-driving songs, but also sing about the social issues their communities were experiencing. Hear Los Crudos in an NPR report at [cascade.uoregon.edu](http://cascade.uoregon.edu).

**LISTEN TO THE EARTH.** Undergraduate Claire Getz was on board for a research trip to examine magma beneath an island off the coast of Greece (p. 6); the \$3.5 million project, funded by the National Science Foundation, netted a 3-D view of molten rock 12 miles below ground. Visit [cascade.uoregon.edu](http://cascade.uoregon.edu) to read blog posts made during the expedition.

**THE STORYTELLERS.** The Danza de la Pluma ceremony—"Dance of the Feather"—is a cherished tradition of one of Mexico's indigenous groups, the Zapotec of Oaxaca (p. 12). Three UO undergraduates traveled to Mexico City last spring to explore how indigenous peoples have long told their story through danzas—see video of the dance at [cascade.uoregon.edu](http://cascade.uoregon.edu).

**PUBLISHED AND PROUD.** The *Oregon Undergraduate Research Journal* publishes exceptional research by undergraduates from any discipline (p. 10). Now in its sixth year, the journal is rewarding for both the undergraduate researchers who submit articles and the student editors who review and approve submissions. Check out the latest issue at [cascade.uoregon.edu](http://cascade.uoregon.edu).



# CASCADE

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