

# tterra

DISCOVERY | CREATIVITY | INNOVATION • Winter 2019

**TURN DOWN  
THE HEAT**



**Oregon State**  
University



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Climate change is rapidly altering the landscapes of places like the William Finley National Wildlife Refuge in the Pacific Northwest. From reduced snowpack to summer drought and wildfires, the impacts are far-reaching. Four researchers from Oregon State University's College of Earth, Ocean, and Atmospheric Sciences have served as authors on Intergovernmental Panel on Climate Change assessment reports. See The Temperature Puzzle, Page 4. (Photo: George Gentry/U.S. Fish and Wildlife Service)





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Oregon State is Oregon's leading public research university with more than \$382 million in research funding in FY2018. Classified by the Carnegie Foundation for the Advancement of Teaching in its top category (very high research activity), OSU is one of only two American universities to hold the Land-, Sea-, Sun- and Space-Grant designations. OSU comprises 11 academic colleges with strengths in Earth systems, health, entrepreneurship and the arts and sciences.

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**On the cover:**  
Photo illustration by Long Lam



## KEEPING PACE

As a first-generation college student enrolled in a geography class at the University of Port Elizabeth in South Africa in 1987, I learned how the southern tip of Africa is influenced by large anticyclone weather systems, barreling their way up from the Antarctic. Since their effects on everyday life were abundantly clear — gale force easterlies followed by gale force westerlies two or three times a week, the fact became embedded in my psyche.

Throughout the 1990s the information somehow infiltrated every article I wrote — because of the system's prevailing influence on rainfall, biodiversity, seasons and the unique characteristics of life — even to the level of the six biomes in that part of the world. These all contributed to the vocations made possible and pursued, from agriculture to ecotourism to forestry.

My mind swirled when I learned upon the release of the recent Intergovernmental Panel on Climate Change special report — *Global Warming of 1.5 °C* — that those anticyclone systems have been pushed poleward by climate change. Earning special recognition in the report, southern Africa as a global hot spot can expect twice the temperature increase. With that rise, the potential exists for a total collapse of the maize crop, with the livestock industry expected to follow.

Large portions of society are similarly wrestling with the fact that, through fossil fuel combustion, we have altered large atmospheric systems with unexpected consequences. What have we lost because of this? How can we adapt? The sixth Intergovernmental Panel on Climate Change assessment report, scheduled to be published in 2022 is, in part, tasked to answer these questions.

With four Oregon State University researchers previously or currently serving as authors for IPCC assessment reports, this issue of *Terra* offers a glimpse into the planning, procedures and plenary proceedings each group undergoes as it presents the science underlying global warming to the world.

Life, of course, goes on. Keeping pace, this issue of *Terra* also covers research into the spread of flu in cities — on the centenary of the great Spanish influenza pandemic — and the fragmented impacts felt in Oregon due to the current administration's trade war. The magazine also investigates HIV research at OSU and delves into a scholarly summary of judiciary confirmation hearings.

I wonder what that geography class, at what is now known as Nelson Mandela University, is learning about the Antarctic anticyclone systems today. They had been swirling their way eastward, caressing the continent for millennia.



Ian Vorster  
Editor



## SCIENCE FOR THE FUTURE

### Transdisciplinary collaboration opens the door

BY IREM Y. TUMER, OSU INTERIM VICE PRESIDENT FOR RESEARCH

I had no idea that a research project investigating how machining tools fail would launch my career path during my senior year at the University of Texas at Austin. After expressing interest in this project to the lead researcher — who would later become my graduate adviser — I received a National Science Foundation Research Experience for Undergraduates grant and started modeling the reliability of mechanical parts in complex systems.

The long-term, open-ended aspect of this classic engineering problem really appealed to me and made me realize that some problems did not have known solutions. This experience was pivotal in convincing me to pursue my graduate degrees, and I spent the next five years investigating new mathematical tools for analyzing the failure modes of complex engineered systems. Upon receiving my doctorate degree, I moved from Texas to California, where I worked at the NASA Ames Research Center, studying vibration data to determine why helicopter and jet engines fail.

I continue to be passionate about research and am a strong proponent of undergraduate research, which plays a transformative role in students' lives. Since arriving at Oregon State University in 2006, I have been a professor of mechanical engineering and have actively engaged both undergraduate and graduate students in my research projects. For the last five years, my position as the associate dean for research in the College of Engineering has enabled me to collaborate with faculty to address many research-related issues — from intellectual property to commercialization and federal legislation.

My training and research have focused on solving engineering problems by exploring unique approaches in fields like biology and social science. I also believe in the role of social science research in interdisciplinary efforts to improve human health and well-being while providing insights into how science, technology and innovation shape our collective future. As a result, I was pleased to learn that the winter issue of *Terra* magazine — the first issue published since I became OSU's interim vice president for research — would feature stories about Oregon State faculty involved in international climate change reports; how the flu virus spreads in large cities; and the effects of trade wars on Oregon communities.

Oregon State is a place where diverse and powerful research abounds. Our supportive approach in an environment of low walls and transdisciplinary collaboration makes us unique and opens the door to endless possibilities.

In my role as interim vice president of research, I am committed to helping OSU undergraduates, graduate students, post-docs and faculty fulfill their research visions. Together, we will foster an even richer environment where research, discovery and innovation address the world's grand challenges. To that end, I will do all I can to help students and faculty reach their maximum potential in their chosen fields.

Irem Y. Tumer  
Interim Vice President for Research





# The Temperature Puzzle

## Building a picture of climate change

BY IAN VORSTER

“It is worth repeating once again that we are the first generation to fully understand climate change and the last generation to be able to do something about it.”

— World Meteorological Organization Secretary-General Petteri Taalas

It struck hard in the early hours of the morning. Charles Gore, an elderly member of his neighborhood civic league in Norfolk, Virginia, woke to the sound of wind wrestling his waterfront home. The outer edge of Hurricane Isabel had arrived. Glancing outside at Broad Creek, a tributary of Chesapeake Bay, Gore noticed that his pier was covered in seething whitecaps. He knew then it was too late to evacuate.

Considered to be ground zero for sea level rise in North America, Norfolk has hundreds of homes like Gore's that risk flooding during a significant weather event. The water comes bubbling back up the storm drains into the streets to overflow curbs and lawns, driveways and porch steps. Gore, whose garage and crawl space has flooded a number of

times, knows that when his pier is covered with water, the street that accesses his home will be flooded. The pier serves as his exit-gauge.

The city of Norfolk calls it “recurrent flooding.” Elsewhere it is known as “nuisance flooding.” Sea level rise is the cause, regardless of what it is branded.

Research into both the cause and effect of sea level rise, reduced snowpack and other aspects of climate change has earned four scientists in Oregon State University's College of Earth, Ocean, and Atmospheric Sciences authorships on the last two and the upcoming Intergovernmental Panel on Climate Change — or IPCC — assessment reports. They are Distinguished Professors Peter Clark and Alan Mix, Professor Phillip Mote and Assistant Professor David Wrathall.

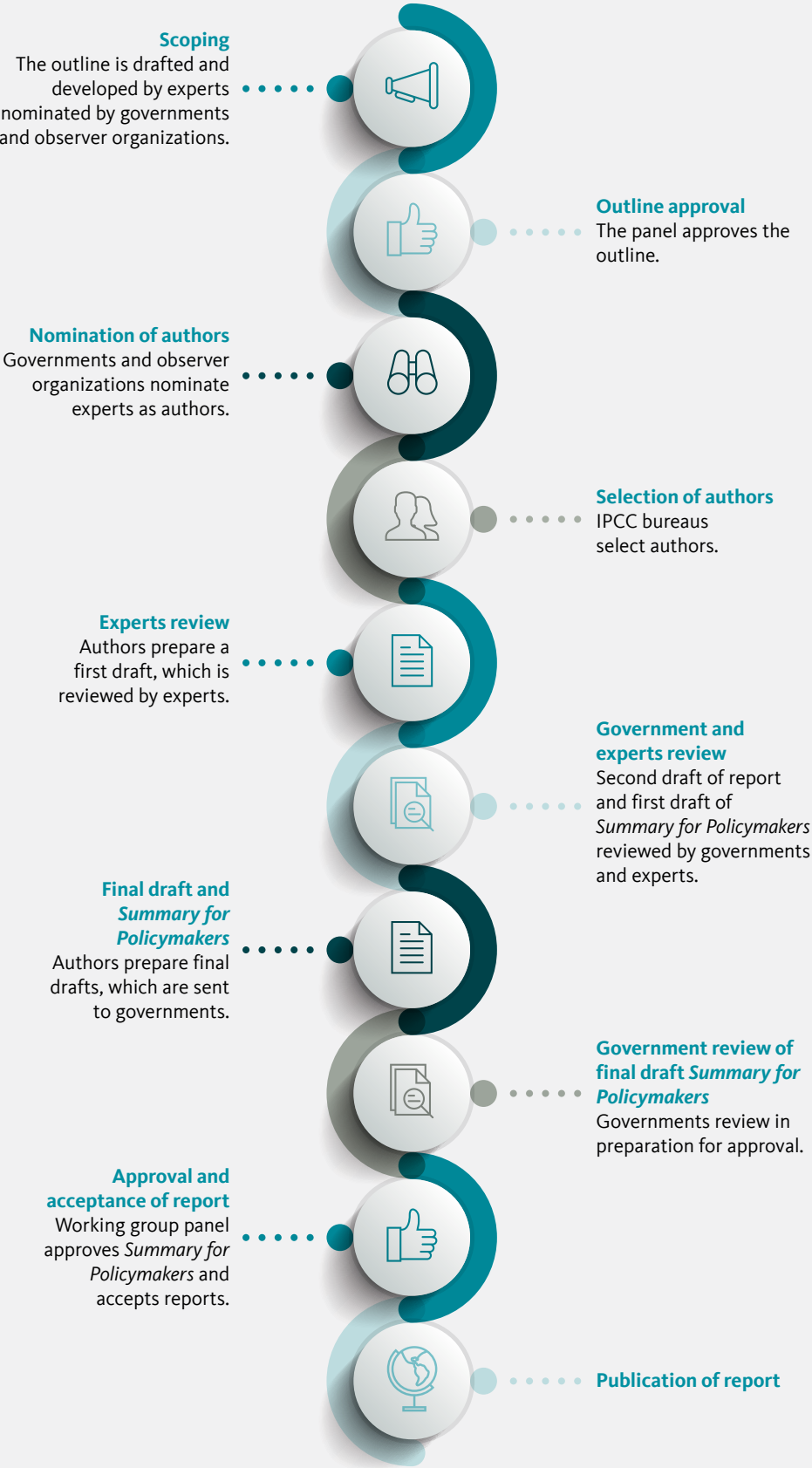
The IPCC has published assessment reports in 1990, 1995, 2001, 2007 and 2013. The sixth will be completed in 2022. Clark was a coordinating lead author of the chapter *Sea Level Change* for the fifth report, and Mote was a lead author on chapters in the fourth and fifth reports, assessing observed changes in the cryosphere. For the sixth report, Mix is a lead author on the chapter *Ocean, Cryosphere and Sea Level Change*, and Wrathall, a geographer, is a lead author on the chapter *Poverty, Livelihoods, and Sustainable Development*.

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**Motorists drive through a flooded section of Llewellyn Avenue near the Lafayette River in Norfolk, Virginia. (Photo: Will Parson/Chesapeake Bay Program)**



Intergovernmental Panel on Climate Change  
Assessment Report Stages



2022 Assessment Report Working Group 1 Timeline: [www.bit.ly/2TC8oG1](http://www.bit.ly/2TC8oG1)  
2022 Assessment Report Working Group 2 Timeline: [www.bit.ly/2CaCQjx](http://www.bit.ly/2CaCQjx)

Although long interested in past climate change, Clark first fully appreciated the effects of current climate change while taking measurements on the Collier Glacier in the Oregon Cascades in the late 1980s. “To see firsthand the dramatic retreat that one of Oregon’s largest glaciers was experiencing was a real eyeopener,” Clark says. “It was clear that something unusual was happening.”

Rapidly receding glaciers are one fingerprint of global warming. Others include melting ice sheets, groundwater draining into oceans and warming of oceans that consequently expand. These all contributed to sea level rise just shy of 8 inches for the 20th century. The next century will witness exponentially more, according to the IPCC.

“One analogy for global warming and sea level rise is this: It’s like putting a pot of water on a burner and turning it on,” Clark says. “The pot of water is your ice sheet or glacier. It doesn’t reach the boiling point immediately. Similarly, putting so much carbon into the atmosphere so quickly is like turning the burner up. And it takes much longer for the glaciers and ice sheets to melt.”

The message behind the pot-on-the-burner metaphor is that the world has turned the carbon burner on and is not doing anything to dial it back. “So, the way in which we are emitting greenhouse gases now will have extremely long-term consequences,” Clark emphasizes.

Aside from the obvious — increased emissions — what has changed the most since the early days of climate change science, and how has it affected the findings? With an “Oh, boy” exclamation, Mix responds, “We’ve had total revolutions in the amount of data we can produce... it’s gone up by factors of hundreds — thousands in some cases. And how we can analyze the data, that’s also changed. Computers are so much better. Nobody had sampled whole swaths of the world, which has now been done.”

He relates early computer power to working on a complex 10,000-piece jigsaw puzzle — with about 90 percent of the pieces laying on the floor. And the cover image defaced. But now, computer-operated machines (like mass

spectrometers) generate data, and a flood of information is gathered from remote sensors, satellites and robotic floats in the ocean to produce more evidence. This makes it possible for researchers to construct a framework to ask the right questions.

Building a Picture of Climate Change

The IPCC is both a scientific and intergovernmental body consisting of 195 nations. It was established under the auspices of the United Nations to review and assess the most current scientific, technical and socio-economic information produced worldwide concerning climate change. Each assessment report cycle equates to a four-year literature survey. The process produces three 1,500-page tomes that summarize the findings of three working groups. The first deals with the physical science underlying climate change; the second with impacts, adaptation and vulnerability; and the third with curbing greenhouse gas emissions, or what is known as mitigation.

Each scientist volunteers a significant amount of his or her professional time — around 10 percent for leads and 25 percent for coordinating leads — for four years.

Mote describes how the groups summarize and assess climate change science for policymakers from the world’s governments as he reflects on the 2013 report.

The process began with IPCC approval of the outline. While the IPCC has high-level oversight of the process, the task of producing the assessment reports falls to the three independent working groups, says Mote. Those groups consist of review editors, coordinating lead authors and lead authors. The timeline for the 2013 assessment was approved in 2009; the authors were selected early in 2010, meeting for the first time later the same year. Each group collates and assesses the

**Right: Children play in recurrent flooding caused by sea level rise along the streets in front of the Chrysler Museum of Art in Norfolk, Virginia. (Photo: Skyler Ballard/ Chesapeake Bay Program) Left: (Credit: IPCC/Oliver Day)**





“To justify policy, the authors need to have an extremely high level of confidence that the planet is in trouble. In terms of the physical dimensions of climate change, the basic facts are abundantly clear.”

— Assistant Professor David J. Wrathall

findings of all published climate change research characterized by specific subjects like observations of the atmosphere, ocean and cryosphere; understanding of biogeochemical cycles, clouds and aerosols; and human-induced climate change. The 2013 report included these along with seven other topical chapters.

Mainly based on the reports prepared for the fourth assessment, the IPCC shared the 2007 Nobel Peace Prize with Al Gore, after which, as Mote somewhat wryly notes, “A bunch of the authors then said to the IPCC, ‘Look, we’ve now produced

four of these. We’ve made comprehensive reports, boiled them down into hard-hitting statements saying humans are changing the climate. It’s going to get worse unless we try to stop it. You know that. Please fix it.”

Mote’s primary research interest is snow in the Northwest. From this perspective, the main climate-related threats the states are dealing with are changes in snowmelt and consequently water flow. A warmer planet means less snowpack in the mountains in the

winter. And the snow that is there melts earlier in the spring. Plants start growing sooner, which dries the ground up, and watersheds consequently end up with lower stream flow and higher fire risk in the summer. Droughts will then start sooner.

OSU’s Wrathall pursued his Ph.D. under another IPCC author, Mark Pelling at King’s College in London. The geographer recalls that his adviser served as a lead author on the urban chapter for the fifth assessment in 2013. The specific impact on cities with large concentrations of poor and vulnerable people is now a key area of concern, with sea level rise driving much of it.

“It’s a pivotal time for the IPCC,” Wrathall says, as both society and the body try to reorient to a new focus on the human costs of climate change. He lists some of the questions the group will try to answer: How much is this going to cost? How much is this going to hurt us, and when? “The human dimensions of climate change were emphasized in the last assessment, and they appear to be the main emphasis for the next one,” Wrathall says. “To justify policy, the authors need to have an extremely high level of confidence that the planet is in trouble. Concerning the

physical dimensions of climate change, the basic facts are abundantly clear.”

The next step, explains Wrathall, is to develop a science-based understanding of what has already been lost, what has been damaged and how people can expect to adapt. He adds, “What we’re starting to see now, is how, when people are prepared, they have the capacity to adapt and can successfully avoid the pain and the suffering and the loss and the damage.”

## Focusing on Key Messages

Coordinating lead authors and a few lead authors from each chapter attended a final five-day plenary in 2013 to present the summary for policymakers to government delegates from around the world. The working group co-chairs and chapter representatives were seated on the stage while almost 400 policymakers comprised the audience. Proceedings were tense.

A review of online videos reveals the mood in the room. Most delegates had open laptops before them, with glowing screens shining on their concentrating faces. A few appeared bored; others were more engaged.

Delegates were given the opportunity to comment on the summary report. The painstaking process worked through the report word by word by word. The goal was to refine 1,500 pages of scientific findings into a hard-hitting, no-holds-barred 25-page report containing the most policy-relevant findings that would be understood by politicians — the proverbial “tip of the iceberg.”

A word count for the summary was posted on a large screen at the front of the auditorium, alongside a chart showing the amount of time that had elapsed. As the week progressed, it became clear that progress was slow, that the pace needed to increase. By Thursday the group was only two-thirds of the way through. It wasn’t unusual to work to 2 a.m. each day. The final session Clark was involved in lasted 24 hours straight, ending with approval of the

summary report and thus the 1,500-page assessment report Friday morning.

Clark, who attended the session and felt an extraordinary sense of responsibility regarding sea level rise, sums it up this way, “It was kind of a negotiation. The delegates raised questions. They disagreed. They wanted things reworded. They wanted things to be deleted. They asked us to replace the word ‘very’ with something else.” The scientists responded, explaining how and why the science supported the word or statement in question.

Mote adds that there is a lot of resistance from the OPEC countries — those who produce the world’s fossil fuels. “It gets kind of frenetic,” he says, describing the proceedings. “They’re gaveling down, and they’re pushing back on the wording. And the scientists are considering suggestions for clarity or accuracy.”

But the reports are all built on evidence and the conclusions are inescapable.

Those conclusions are now a fact of life for the elderly Charles Gore of Norfolk, Virginia, and millions of others who are doing their best to cope with the change — or to use the IPCC working groups’ language, “to adapt.”

Coastal cities like Norfolk are working with business chambers, universities, nonprofits and engineering firms around the world to meet the sea level rise challenges that are now inundating their neighborhoods. The civic league Gore belongs to helped him develop a “rain garden”— a term used to describe a yard engineered to cope with frequent flooding.

Raising houses on stilts, constructing living tidal barriers and buying out neighborhoods to create floodable green spaces are just a few of the schemes currently under investigation as the world waits for its governments to implement the IPCC’s recommendations. As OSU researchers rally to support the next assessment report. As society anticipates the next wave of evidence. As Charles Gore waits for the next storm. **terra**



Less snowpack and receding glaciers are two fingerprints of climate change. (Photo: Garret Sears)





# Advise AND Contend

BY NICK HOUTMAN

Last September, the judicial confirmation hearings for Brett Kavanaugh exploded in citizen protest and bitter partisan debate among politicians. (Photo: Paul Morigi/WireImage)

Last September, hearings on President Trump's Supreme Court nominee exploded in citizen protest and bitter partisan debate among politicians. On one day during a Senate Judiciary Committee hearing, police removed more than 70 protestors who were demanding that senators reject the nomination of Brett Kavanaugh as associate justice. Democrats repeatedly challenged the nominee while Republicans defended him and criticized their colleagues across the aisle for using shameful political tactics.

Elsewhere, in senators' offices and cities across the country, protestors staged sit-ins and took to the streets in support of women who alleged that Kavanaugh had sexually assaulted them as a teenager. Kavanaugh denied the allegations, and with Republicans in control of the Senate, the nomination was approved on nearly a party-line vote.

Rarely have proceedings been so contentious. According to some observers, like former White House counsel Bob Bauer, the stage for bitter conflict had been set two years earlier when Republicans refused to hold a hearing on Judge Merrick Garland, President Obama's nominee to replace Supreme Court Justice Antonin Scalia.

## History of Nominations and Confirmations

Until the 1960s, the Senate often gave its approval by a simple voice vote. That last happened in 1965 when President Johnson nominated Abe Fortas to replace Arthur Goldberg as an associate justice. Despite mounting national turmoil resulting from riots, the war in Vietnam and Johnson's Great Society initiative, it took only two weeks for senators to conduct hearings and to approve Fortas unanimously by shouting "aye!"

Three years later, the tables had turned. When Johnson nominated Fortas to replace Earl Warren as Chief Justice, conservatives objected to the nominee's close ties with the president, challenged Fortas on ethical grounds and mounted a filibuster by which senators can make long speeches to control debate, effectively blocking proceedings. Although the Democrats controlled both the presidency and the Senate, Fortas eventually withdrew, becoming the first unsuccessful nomination to the post since 1795. His tenure on the court lasted only one year more.



“...he [the President] shall nominate, and by and with the Advice and Consent of the Senate, shall appoint Ambassadors, other public Ministers and Consuls, Judges of the supreme Court, and all other Officers of the United States ... ”

— Constitution of the United States, Article II, Section 2

In 1970, President Richard Nixon’s nomination of Harry Blackmun to replace Fortas sailed through the Senate 94-0 (two of Nixon’s previous nominees had been rejected). Blackmun later wrote the majority opinion in the groundbreaking abortion case, *Roe v. Wade*.

Rorie Solberg, an associate professor of political science with a research interest in judicial politics at Oregon State University, counts Fortas as an early milestone in the march toward the persistent conflict that has marked the confirmation process for the last two decades. In the 1980s and 1990s, some nominees faced significant opposition and one, Robert Bork, was rejected. Nevertheless, successful nominees continued to receive overwhelming approval. No senators voted against three of President Ronald Reagan’s nominees: Sandra Day O’Connor, Antonin Scalia and Anthony Kennedy.

In 1991, President George H. W. Bush’s nomination of Clarence Thomas generated allegations of sexual misconduct by

Thomas from University of Oklahoma law professor Anita Hill. Foreshadowing the Kavanaugh proceedings, the charges were the subject of contentious hearings. Thomas was narrowly approved 52-48.

Despite determined Republican opposition to President Bill Clinton’s administration, his two Supreme Court nominees, Ruth Bader Ginsberg and Stephen Breyer, received strong Senate support. It wasn’t until 2005, Solberg says, that presidential nominations to the highest court regularly faced daunting political hurdles.

## Underlying Factors

The increasingly hostile political divide and recent changes in process (no filibuster for judicial nominations) combine with one party’s control of the presidency and the Senate, Solberg explains, to make hearings ironically more contentious and nominees more assured of approval. In her research, she has focused on diversity in the judiciary and how the news media reports on nominees

and confirmation proceedings. Such continued wrangling between the parties over nominees is likely to continue, she says, “until it breaks the system.”

Solberg was interested in the law as an undergraduate and wanted to become a lawyer. However, she realized that what intrigued her were the dynamics of Supreme Court decision-making rather than the mechanics of applying the law to a particular case. As a graduate student at The Ohio State University, she learned how to use statistics to analyze past court cases and the influences on the justices. In one memorable project investigating the influence of *amicus curiae* (friend of the court) briefs, Solberg found evidence reaching back to the 1800s in docket books written in longhand with a quill pen.

In a 2008 paper co-authored with Kevin Scott of the Congressional Research Service and published in the *Southern Illinois University Law Journal*, Solberg cautioned scholars

**Left: President-elect Donald Trump walks to take his seat for the inaugural swearing-in ceremony at the U.S. Capitol in Washington, D.C. (Photo: Shealah Craighead)**

of the courts not to assume that presidents can remake the federal judiciary — from the U.S. Supreme Court to federal judgeships in all 50 states. They noted: The composition of the Senate can change; Judges have lifetime appointments and can retire at will; Senate norms give deference to the opinions of senators representing states in which vacancies exist.

However, she says, a lot has changed in the last 10 years. Most notably, Democrats eliminated the filibuster for executive branch appointments and lower court judges in 2013, and Republicans completed the process in 2017 by canceling the filibuster for Supreme Court nominees. Removing the filibuster has been called the “nuclear option” because it allows the party in control to ignore views from the minority.

We’re now waking up to the situation, says

Solberg, where the lack of process and use of obstruction and delay tactics on both sides has been happening in the lower courts since the Clinton administration. She adds, “It’s to the point where it’s really plaguing the district courts and the courts of appeals, and now we’re seeing it erupt at the Supreme Court level.”

Underlying this contention, says Solberg’s colleague Eric Waltenburg, professor at Purdue University, is the recognition that courts play an important role in policy development. “It’s always been the case,” he says, “that who is on the court has a tremendous impact on the direction that public policy will take in the United States.” Solberg and Waltenburg have collaborated on an analysis of news media coverage of Supreme Court nomination hearings and continue to review the Gorsuch and Kavanaugh proceedings.

Also, says Waltenburg, since judges receive lifetime appointments, their impact on policy can last for decades. With that in mind, presidents have been nominating younger judges whose tenure can extend well past the length of a presidential administration.

## Legacy, Trends, Conflict

As delays in the nomination process have seen retirements leave judgeships vacant, the judiciary has come to rely more heavily on retired judges who work part time. So-called “senior status judges” can retire once they reach age 65 and have at least 15 years of service.



“You sort of give your seat back, and the president can fill it,” says Solberg, “but you’re still doing work. You still hear cases, you still have clerks, and you’re still getting paid, but you’re working quarter or halftime. If those people were to decide to just stop, the judiciary would be in a much bigger crisis than it already is.”

In addition to nine Supreme Court judges, there are another 861 federal judgeships in the district and appeals courts. When President Trump took office in 2016, adds Solberg, there were more than 100 vacancies, including one on the Supreme Court, a result of delays in confirming President Obama’s nominees. Those vacancies plus the normal cycle of retirements created an opportunity for Trump to leave a more significant legacy in the federal courts than many of his predecessors. “Trump may have more

lower court judges appointed than any president in recent history,” she says.

Moreover, Solberg’s research has shown, those appointments are resulting in a judiciary that is becoming whiter and more male. She noted in an op-ed published by *The Conversation* that Trump is reversing a trend toward increasing gender and cultural diversity that began with the Clinton administration.

The pace of approvals has also picked up with hearings expedited to move nominees through the process. Last fall, a hearing on nominees to the lower courts was attended by only two members of the

Senate Judiciary Committee. There were more nominees present than there were senators in the room.

Since the party that controls the presidency and the Senate is getting what it wants, says Solberg, there’s currently little incentive to change the process. Nevertheless, interest groups are offering proposals, including term

limits and educational and age-based criteria for nominees.

The Constitution provides no minimum qualifications for judicial nominees. Law schools did not exist when the document was written, and lawyers learned through apprenticeship. It wasn’t until 1955, when Roosevelt appointee Robert Jackson left the bench, that every member of the Supreme Court had a law school education.

It would take a Constitutional amendment to establish qualifications for the federal bench and a dramatic shift in political winds to calm the waters of judicial nominations. Conflict is likely to affect nominations to the federal judiciary for some time to come. “I don’t know,” says Solberg, “if there’s a way to put that genie back in the bottle.” **terra**





# Helping the Vulnerable and the Marginalized

Understanding the social factors that impact HIV prevention and treatment

BY MICHELLE KLAMPE

In 1981 the Centers for Disease Control and Prevention published an article in its *Morbidity and Mortality Weekly Report*, describing cases of a rare lung infection. It was the first official reporting of what would later become known as the AIDS epidemic.

When the mysterious illness first emerged as a public-health threat, scientists and health officials knew they had work to do. The primary issues to address were: Identify the disease; determine how it was transmitted; produce treatments; halt its spread. By the late 1980s, the first HIV tests and antiretroviral treatments had been developed, but according to the CDC, by 1992 more than 180,000 people had died of AIDS. The current antiretroviral therapies, when used effectively, now allow people living with HIV to lead long and healthy lives. The treatment also helps prevent transmission.

Despite the progress, HIV remains a significant public-health threat. Roughly 37 million people worldwide were living with HIV in 2017, the latest figures available. An estimated 1.8 million people were newly infected with HIV the same year, about 5,000 infections per day, according to the Joint United Nations Programme on HIV and AIDS.

Those at most risk of contracting the disease are often people marginalized in society due to their gender identity, sexual orientation, race or ethnicity, economic status, lack of education or general stigma surrounding the disease.

Taking prevention, diagnosis and treatment programs to these vulnerable populations presents a complicated public-health challenge that isn't easily solved. But it's a challenge that researchers in Oregon State University's

College of Public Health and Human Sciences are confronting head on.

"When I started in this field, getting HIV was a death sentence. We've made huge advances in prevention, diagnosis and treatment," says Peggy Dolcini, a professor in the School of Social and Behavioral Health Sciences. "But this epidemic is very complex. We've come a long way, but there is still quite a lot of work to do."

## Safe Spaces

Today, much of OSU's research around HIV and AIDS focuses on the social and behavioral factors that lead to sexual risk and social vulnerability and the factors that help or hinder testing and treatment in the U.S. and around the world, with particular emphasis on marginalized populations.

"There's a social context that makes people vulnerable to HIV," says Jonathan Garcia, an assistant professor and one of several OSU researchers studying social factors related to sexual health and HIV and AIDS. "All of us are addressing the vulnerabilities of these marginalized populations in some way in our work."

Garcia, a native of Medellin, Colombia, who lived for years in New York City before joining Oregon State in 2015, studies how social experiences influence health. His work explores community-led approaches to social

(Photo: Vitorri Buzzi)

"Having a society that cares for the most vulnerable is valuable to everyone."

— Jonathan Garcia, assistant professor in the School of Biological and Population Health Sciences







# Trade Wars on the Homefront

Protectionism has sector-specific impacts in the Northwest

BY SEAN NEALON



**T**he tit-for-tat trade war being waged by the Trump administration has drawn criticism from business and economists. While the impact in the Pacific Northwest is felt in pockets of the economy, overall, it has not been severe, say experts, including several at Oregon State University. This is, in part, because trade retaliation from major trading partners is usually done in a politically strategic manner: Tariffs are levied against goods produced in states that are politically supportive of the president, says Alison Johnston, an associate professor in the School of Public Policy at Oregon State University.

“The saving grace for Oregon is that it is not a state that is politically sympathetic to Trump and, therefore, is not in the crosshairs of our trading partners,” Johnston says.

In response to the Trump administration’s trade actions, last year Canada counter attacked with a 10 percent hike on U.S. plywood, which touched about \$3.6 million of a Glendale, Oregon-based lumber company’s product. The Swanson Group exports north of the border, but experienced minimal impact. Canadian customers kept buying their engineered wood.

Meanwhile, U.S. tariffs on steel overall haven’t hurt Thompson Metal Fab, a Vancouver, Washington-based company that works throughout the West. It is facing longer lead times to get steel for its projects because importing steel is less economically appealing now, but “there is more work out there than there

are people to make the structures,” says Michael Moore, the company’s vice president of business development.

In Oregon, Washington and Idaho the trade war between the U.S. and China has caused soft white wheat farmers to lose the \$70 million Chinese market for their product.

These three industries and their accounts exemplify the sector-specific impact of President Donald Trump’s trade policies.

Moving forward, with Democrats taking control of the House of Representatives following the midterm election, Johnston says she could see Congress playing a role in future trade decisions. But, she adds, it is still easy for Trump to impose tariffs on a temporary basis.

## Archaic Policy

Jeff Reimer, an applied agricultural economist at Oregon State, says from a historical perspective, Trump adheres

to many of the tenants of mercantilism. This was a national economic policy that was dominant in Europe from the 16th to 18th centuries and was designed to maximize the exports of a nation.

The mercantilist philosophy has long since fallen out of favor, especially with the creation of intergovernmental trade organizations. The primary example is the World Trade Organization, which regulates international trade by providing a framework for trade agreements between nations. It was created in part to protect smaller countries, Reimer says.

“If someone is not treating us fairly we have a way of dealing with them,” he notes. “International institutions, like the WTO, make a lot of sense. And we’re the ones who helped design them.”

Oregon State University President Ed Ray, who is also a professor of economics, compared the administration’s current trade policies to the Smoot-Hawley

Tariff Act, which was passed in 1930 and raised U.S. tariffs on more than 20,000 imported goods.

“The passage of the Smoot-Hawley tariff is credited with beginning a wave of protective tariff increases around the world that deepened and prolonged the Great Depression,” Ray says. “There are no good arguments for protective tariffs.”

He goes on to say that the current and continuing problem in trade relations with China involves the protection of intellectual property rights. The nation’s current actions to undercut NAFTA and trade relations with the European Economic Community are the exact opposite of what the U.S. should be doing to strengthen its hand in negotiations. “Not signing the Trans-Pacific Partnership was a terrible mistake,” Ray adds.

The Port of Portland is a hub for exporting goods from other parts of the U.S., especially the Midwest. (Photo: Tom Gentle)

**“Not signing the Trans-Pacific Partnership was a terrible mistake.”**

— Oregon State University President Ed Ray





## Minimal Statewide Impact

Josh Lehner, an economist with the Oregon Office of Economic Analysis, says Oregon is among the most trade-dependent states in the nation because many Oregon-produced goods are exported. Moreover, the Port of Portland is a hub for exporting products from other parts of the United States, especially the Midwest.

Despite being trade dependent and having a strong manufacturing base, Oregon has been lightly affected by the president's trade policies, Lehner explains. Oregon's economy is also diversified with a lot of what he calls "home-grown industries," such as beer, wine and timber, where the products tend to remain in the United States.

But, adds Lehner, there are some secondary impacts at the Port of Portland. For example, with a drop in Midwest soybeans passing through the port on their way to China, there is less work for longshoremen and truck drivers, and less need for warehouse space.

## Potential Regional Impact

Soft white wheat, which is farmed in Oregon, Washington and Idaho, is not used for American-style bread because it doesn't have the gluten needed to rise well. Almost all soft white wheat is exported and used in Asia for pastries, cookies and some kinds of noodles. So, soft white wheat farmers were impacted when China stopped importing their product in March, says Tom McCoy, a retired wheat farmer from Sherman County, Oregon.

Because most Oregon-made plywood stays domestic, the Canadian tariff has had minimal impact on plywood manufacturers like the family-owned Swanson Group in Springfield, Oregon. (Photo: Ian Vorster)

McCoy, who previously served on the Oregon Wheat Commission and still tracks the industry, says China imports about 6 percent of the soft white wheat grown in the Pacific Northwest. That equates to about \$70 million, he says. "We had a reputation as being a reliable supplier, but the tariffs are casting that in doubt."

## Optimistic About the Future

Unlike the soft white wheat industry, plywood manufacturers have seen a "minimal impact." For example,

the Swanson Group sells less than 10 percent of the firm's plywood to Canada, says Steve Swanson, the company's president and CEO. The Swanson Group employs about 800 people at several wood-product mills and recently opened a plywood mill in Springfield, Oregon.

Canada produces most of its plywood, and the U.S. housing market, particularly in California, remains the dominant destination for Oregon-made plywood. "I believe in the process," Swanson adds, referring to the president's trade policies. "Because I think it creates more jobs in the U.S. eventually."

Like plywood manufacturers, Pacific Northwest steel fabricators have also been impacted by the trade policies. Moore, vice president at Thomson Metal Fab, says that, due to Trump's

steel tariff, his company has to consider other things when bidding on a project. For example, there are now longer lead times to get the steel they need to complete their projects. Domestic steel mills are backlogged because the tariffs have made importing steel less economically appealing to U.S.-based companies. Instead of waiting eight weeks, the norm is now 12 weeks or longer, Moore says. He has worked around this concern by communicating more frequently with his customers.

Another tariff-related impact hit early in 2018. Thomson Metal Fab was in negotiations to secure a large project that would have employed the equivalent of its entire 120-member crew for a year. But the quickly rising price of steel got to be too much for the project owner to take on, so the client suspended the job

Domestic steel mills are backlogged since the tariffs have made importing steel less economical. (Photo: Ian Vorster)

until additional funding could be secured. However, it was easy enough to find other projects to keep them busy, Moore says.

Overall, Moore, who is also president of the Pacific Northwest Steel Fabricators Association, says the recent strong economic growth coupled with the new trade policies make him optimistic about the future.

"We all talk about how good things are right now and how good they have been in the last few years," Moore says. "And we expect it to go on for a few more years. We expect to ride the wave a little while longer." **terra**





# PERSON <sup>TO</sup> PERSON

Congested cities with subways increase flu transmission

BY STEVE LUNDEBERG | ILLUSTRATION BY LONG LAM

As World War I headed into its bloody homestretch a century ago, an even deadlier event was ramping up: A full third of the Earth's population was on its way to contracting influenza. Of the 500 million people who got sick during what was to become known as the Spanish flu pandemic, at least one in 10 perished — making it a medical catastrophe of almost unrivaled proportions.

A century later, research spearheaded by Benjamin Dalziel, an assistant professor in Oregon State University's College of Science, is paving the way toward city planning and management that takes influenza outbreak control into account. The more residents a city has and the more organized their movement patterns, the longer its flu season is apt to last, his work has shown.

The findings are an important step toward predicting outbreak trends for a viral infection that continues to sicken millions of Americans annually, sending hundreds of thousands to the hospital and killing tens of thousands. To put the flu's havoc-wreaking potential in perspective, World War I, one of the deadliest conflicts in human history, needed four years to amass a death toll of approximately 17 million. In just over a year, the Spanish flu pandemic killed at least three times that many.

Some death toll estimates for the pandemic — which earned its name because Spain, neutral in the war, reported freely on the disease, whereas the combatants censored media coverage — range as high as 100 million. By comparison, the top-of-mind epidemic among many people — HIV — has claimed 35 million since the virus's discovery in the early 1980s.

The U.S. was also hard hit by the Spanish flu. "The influenza pandemic killed 675,000 people in the U.S.," says Jeff Bethel, an epidemiology researcher in the College of Public Health and Human

Sciences. "One unusual aspect of that pandemic was that there was not only increased mortality among young and elderly people but also high mortality among healthy 20- to 40-year-olds."

## Key Factors

Dalziel, a population biologist, worked with an international collaboration to analyze weekly flu incidence data from 603 cities of varying size and "structure." They examined the patterns people follow regarding where they live and work, along with the role a key weather metric — specific humidity — played in flu epidemics. Specific humidity is defined as the ratio of the mass of water vapor in air to the total mass of air and water vapor.

Flu is transmitted by virus-bearing moisture droplets that people exhale, cough or sneeze out, creating a "cloud of risk" that emanates from an infected person and is breathed in by those around him or her.

"As specific humidity decreases, the virus remains viable in the air for longer, effectively expanding that cloud," says Dalziel. "However, if an infected person is right beside you, it matters less what the specific humidity is."

Humidity, coincidentally, played a key role in the war, whose end coincided with the Spanish flu pandemic's beginning: The blister-causing terror of mustard gas was at its worst during hot, humid conditions.

As for the flu, if a city has a large population with transportation patterns that frequently draw them together, flu viruses can find new hosts even when climatic conditions aren't at their most favorable. "One thing that distinguishes urban centers from small towns is the presence of localized pockets of high population density that are connected by organized movement patterns," says Dalziel. "We found that makes a difference for how influenza spreads at different times of the year."





The researchers discovered that in metropolises, flu cases are more spread out through the winter months, including early and late in the season, when the weather is not optimal for transmission. By contrast, in smaller cities, more cases will be tightly grouped in a short period, during peak season, when climate conditions are best for transmission.

“We found that as cities become larger and mobility patterns become more highly organized, climatic conditions play a relatively smaller role in influenza transmission,” adds Dalziel.

Flu is an immunizing infection — once a particular strain has infected people, they’re unlikely to become infected again, at least not right away, because their immune system recognizes it and typically can deal with it efficiently. “From the flu’s perspective, it’s facing a limited resource each season — the fraction of the population susceptible to a given strain declines as it spreads,” says Dalziel.

## Always Changing

Counterpunching the response of the immune system, flu viruses are constantly evolving. They switch up the proteins that the immune system responds to, shuffling in new ones that aren’t recognized right away.

“Forecasting and controlling influenza is important for public health,” notes Dalziel. “And there is another reason to study the flu: It’s a classic example of a complex system on Earth. To predict flu outbreaks, you need to look at a variety of processes from urbanization to climate. What’s more, flu spreads and evolves in a range of animal species, and in these senses, it is deeply integrated with the biosphere.”

## Close Contact

There are four genera of influenza viruses, labeled influenza A, B, C and D. Influenza A viruses are the most dangerous for humans, and varieties of it were the

pathogens behind the 1918 — 19 pandemic (H1N1 virus). Lesser but still deadly pandemics in 1957 (H2N2), 1968 (H3N2), 2004 (H5N1) and 2009 (also H1N1) were caused by Type A.

During the Spanish flu pandemic, H1N1 received an assist from the troop movements and close quarters required by the war. Unusually high flu incidence in the U.S. was first detected in military camps, as well as some cities, in spring 1918, as Germany attacked on the Western Front.

In four months of fighting in Europe, 1 million German soldiers were killed. Meanwhile, the pandemic was claiming an estimated 1 million per week for 25 weeks.

“Influenza pandemics have been reported for at least 500 years, and we experience one typically every 30 or 40 years,” Bethel says. “The 1957 ‘Asian flu’ affected nearly half of the world’s population in two waves and resulted in over 1 million deaths. The 1968 pandemic caused an estimated 1 million deaths worldwide and about 100,000 in the U.S., mostly among the elderly.”

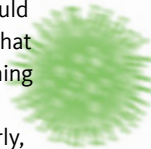
Even in nonpandemic years, the burden of seasonal influenza on the health of the population is “quite large,” Bethel adds. “Many people think the flu is not a big deal, and while it is usually self-limiting, lasting three to five days, they are a very uncomfortable three to five days with extreme fatigue, intense muscle aches and headaches, high fever and runny or stuffy nose,” he says. “It’s not fun.”

Cecile Viboud of the National Institutes of Health, a co-author with Dalziel on the study, says the start of the flu season can vary widely from year to year and place to place. “It can start as early as November or as late as March,” she notes. “We think city-to-city variation in flu timing is linked to differences in the arrival of influenza viruses — a function of connectivity and geography, possibly moderated by humidity and population immunity.”

In nonpandemic seasons, Viboud adds, epidemics tend to have earlier onsets in the South, although not always in the same city, and then move north. “Locales that experience earlier flu activity could be tempted to vaccinate earlier, but that urge has to be balanced with the waning of vaccine-induced immunity within the season — if you vaccinate too early, you lose effectiveness by the end of the season,” she says.

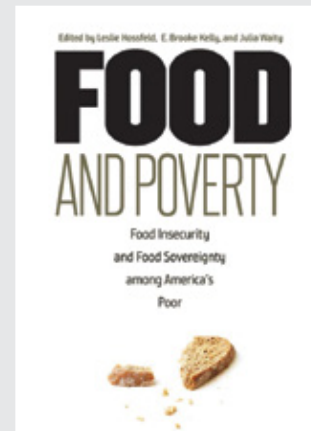
While Dalziel is excited about what he, Viboud and the other collaborators learned about flu outbreaks, he stresses a few caveats. “Our research does not show that some cities are safer than others for flu — rather it shows relative differences in when the cases are likely to occur,” he says. “Also, our model is not designed to predict what will happen with flu epidemics under climate change — there’s still a lot of uncertainty about what will happen to specific humidity as a result of global climate change. And finally, while flu vaccination is an important topic, our analysis was focused on other potentially important factors — city size and structure. Our findings showed that city size and structure could play a role in determining how climate, and other factors such as vaccination coverage, affect influenza epidemics.”

And for people who want to avoid the flu — which means everyone — the recommendations are the same regardless of where someone lives. “Wash your hands often, cover your cough and get a flu shot,” Dalziel adds. “Another way to think about it is that our results on city size and flu spread cut both ways in terms of protective action: If you live in a big city and the thought of more efficient flu transmission in metropolises spurs you to take these protective actions, great. If you live in a small town and the thought of a more explosive flu season spurs you to take these protective actions, also good.”



## BOOK NOTES

### RECENT PUBLICATIONS BY OSU FACULTY



#### FOOD AND POVERTY

**Edited by Leslie Hossfeld, E. Brooke Kelly and Julia Waity**

*Published by Vanderbilt University Press*

Mark Edwards, a sociology professor in Oregon State University’s College of Liberal Arts, co-authored a chapter entitled *Security via Sovereignty: Lessons from the Global South* in this book. Food insecurity rates, which skyrocketed with the Great Recession, have yet to fall to pre-recession levels. Food pantries are stretched thin, and states are imposing new restrictions on initiatives like the Supplemental Nutrition Assistance Program that prevent people from getting crucial government assistance. At the same time, there is an increase in obesity because of a lack of access to healthy foods. The poor face a daily choice between paying their bills and paying for food. *Food and Poverty* explores this subject in three sections: Concepts of food and poverty, problems and solutions.



#### CREATING COMPASSIONATE KIDS

**Shauna Tominey, assistant professor, College of Public Health and Human Sciences**

*Published by W.W. Norton & Company, Inc.*

As parents and caregivers of young children, most people know what children need, but not always how to provide it. Many children are stressed by academic demands, anxious about relationships at school, confused by messages they hear in the media and overwhelmed by challenges at home. Young children look to the adults in their lives for everything. Sometimes the adults are prepared, sometimes they’re not. Shauna Tominey guides parents and caregivers through how to have conversations with young children about a range of topics — from what makes us who we are to tackling challenges to showing compassion.



#### THE ROUTLEDGE HISTORY OF WORLD PEACE SINCE 1750

**Edited by Christian Philip Peterson, William M. Knoblauch and Michael Loadenthal**

*Published by Routledge, Taylor & Francis*

Benita Blessing, an instructor in Oregon State’s College of Liberal Arts, contributed to this book. This work examines the varied and multifaceted scholarship surrounding the topic of peace and engages in a dialogue about the global history of peace since 1750. Interdisciplinary in nature, the book includes contributions from authors working in fields as diverse as history, philosophy, literature, art, sociology and peace studies. It crosses the divide between historical inquiry and peace studies scholarship, with traditional aspects of peace promotion sitting alongside expansive analyses of peace through other lenses, including specific regional investigations of the Middle East, Africa, Latin America and other parts of the world.

#### A NOTE TO NEW AUTHORS

If you have written a book in the past year and work at Oregon State University, the OSU Valley Library would like to add your book to its collection. Please let the library know at [valley.collections@oregonstate.edu](mailto:valley.collections@oregonstate.edu).







# LEARNING TO LISTEN

Hayley Strenke shaped her future through research at Oregon State University. Research that began with her making a call, asking a question and then keeping quiet and taking notes. The graduate student surveyed injuries among fishermen to improve understanding of how to prevent them.

“After I took an introductory environmental health class, I became fascinated with how the world around us — air, water, built environment, products and our work — impacts our health,” says Strenke. In 2018 the Oregon native graduated with a master’s degree in public health, a field she became interested in as an undergraduate.

Strenke’s research grew from her work with Laurel Kincl for the Fisherman Led Injury Prevention Program. Kincl is an associate professor in the College of Public Health and Human Sciences.

Strenke conducted interviews with fishermen along the West Coast regarding their accidents and opinions on safety to develop injury prevention practices.

According to the Centers for Disease Control and Prevention, commercial fishing is one of the most dangerous occupations in the United States. Many commercial fishing operations are characterized by hazardous working conditions, strenuous labor, long work hours and harsh weather, all of which exacerbate each other.

Strenke secured funding to develop short training videos specifically for commercial fishermen. The videos will become part of the First Aid and Safety Training for Commercial Fishermen course presented by the Oregon Occupational Safety and Health division.

She soon learned that she should give attention to what the fishermen were trying to communicate. Listening laid the foundation for her to relate to and interact with industry workers so that she might better understand how to educate them about relevant health and safety issues — in a way that was most meaningful to them. Because every workplace is different, it’s important to work closely with employees to learn how best to communicate health and safety.

“Allowing fishermen to tell us what health and safety issue they most cared about allowed us to create a product that was well-received and appreciated in the fishing communities,” she adds.

Strenke has taken that lesson into her new career as an industrial hygienist for Oregon Occupational Safety and Health, where she now works with a wide variety of industries in the state. Noting the closeness of her small graduate program cohort, she credits much of her success to the supportive environment of the college’s department and learning to listen.



As a graduate student in Oregon State University’s public health program, Hayley Strenke conducted interviews with fishermen along the West Coast regarding their accidents and opinions on safety to develop injury prevention practices.

## THE GREAT IRONY

### Ocean acidification may turn the tables on our children

BY NICK HOUTMAN, SCIENCE WRITER;  
WITH CONTRIBUTIONS FROM  
BURKE HALES, PROFESSOR IN THE  
COLLEGE OF EARTH, OCEAN, AND  
ATMOSPHERIC SCIENCES

Like all life on Earth, we are chemical beings. While this simple fact may not surprise you, it has profound implications for our health and for the environment. We move through an ocean of air that enters and nourishes our bodies as we breathe. We absorb chemicals through the food we eat and water we drink.

But imagine what would happen if our chemical surroundings were altered in ways that weaken not only our bones and tissues, but the very process of growth from the earliest stages of life. This is what marine organisms face with ocean acidification.

By burning fossil fuels and pouring carbon into the atmosphere at increasing rates, humans are disrupting chemical reactions that have sustained corals, mussels, oysters and other shell-forming ocean

organisms for millions of years. That’s because carbon dioxide does not just stay in the atmosphere. Of the nearly 10 billion tons of carbon emitted per year, nearly a quarter enters the ocean. Of the almost 550 billion tons of carbon emissions over the last century, about 150 billion tons has accumulated there. As a result, the oceans are already about 30 percent more acidic than they were at the beginning of the Industrial Revolution.

The rapid rise in ocean carbon dioxide means that the slow natural reactions that support marine life cannot respond quickly enough to buffer the disruption of increasing acidity.

Scientists have shown that this elevated carbon dioxide in the oceans can impact the ability of marine organisms to swim and detect predators. At a chemical level, rising acidity leads to the reduction of a critical component of shell formation: carbonate ions. Less carbonate can interfere with the ability of organisms to make shells and build coral reefs.

Of these impacts, the last is the most immediate, particularly in temperate coastal waters where mussels and oysters anchor food webs. We also stand to lose the valuable ecosystem services they provide, such as water filtration and construction of

underwater structures that protect shorelines from waves and storms.

Much as childhood exposure to lead can result in a lifetime of challenges in human development, low-carbonate conditions experienced by larval shell-forming organisms can have lasting impacts on growth and fitness. The implications of threatening these organisms are staggering — imagine the coastal waters of the Eastern Seaboard and the Gulf of Mexico in the absence of oyster beds and coral reefs. Imagine the iconic rocky shorelines of the Oregon coast without living blankets of mussels and the sea life and birds that depend upon them.

We know that, just as early human exposure to toxins shows up in adulthood, so too does acidified ocean chemistry affect the development of marine life. When it comes to our children, we know enough to remove lead paint from nursery windowsills to protect our children’s ability to learn.

But many of our children are learning another lesson. They understand that they have to protect their environment and Earth’s future. Which is the great irony: We think we are protecting them, but in our failure to reduce carbon emissions and to seriously address climate change, they will have to protect themselves and our precious ocean resources.





## A Milky “Whey” to Make Vodka

### ADDING VALUE TO CREAMERIES, LESSENING ENVIRONMENTAL IMPACT

As much as 90 percent of the milk that pours into a cheese-making facility churns out as whey, which can be expensive to dispose of in landfills and potentially harmful to the environment.

Large companies can show a nice profit by turning some of that whey into protein powders and other nutrition-enhancing products — but the equipment is too expensive for most artisanal creameries, researchers say. However, a new movement is emerging as some of the smaller companies are exploring whey-based spirits — namely, vodka.

Not only are cows now a potential cog in the distilling process, but the environmental impact is far less damaging than dumping whey into a landfill, according to studies at Oregon State University.

“Even though some energy is required to transform whey into vodka, there is still a huge environmental gain by not disposing of it through waste streams,” says Lisbeth Goddik, a professor of food science and technology at OSU. “There is a significant reduction of greenhouse gases and the creameries have the potential to also boost their revenue.”

A handful of companies are already producing vodka from whey products, and Goddik, along with Paul Hughes of OSU's fermentation science program, is researching the flavor characteristics of different wheys and the spirits they produce.

For more on the subject of whey, please visit [bit.ly/2DaFg3P](http://bit.ly/2DaFg3P)

## Adventure Sports to Zumba

### AND EVERYTHING IN BETWEEN

Requiring physical activity classes in college encourages sedentary students to become more active, while elective classes tend to draw those who are already motivated, research from Oregon State University has found.

“When there is no requirement but the courses are available as electives, the students who take the courses tend to be those who are already active and motivated. Those students already have an affinity toward physical activity and the institution supports it,” says Brad Cardinal, a kinesiology professor in the College of Public Health and Human Sciences at OSU. “That neglects a large group of students who are inactive and unmotivated and who could benefit immensely from such coursework.”

Research indicates that physical activity levels tend to decline rapidly as students transition from high school to college and beyond, even though physical activity offers a range of health and other benefits, and habits made or sustained in college tend to follow people into their adult lives.

“Past studies have shown that having a requirement in college is beneficial down the road,” Cardinal says. “Essentially, those studies — including some of our own at OSU — show that students who aren't physically active in college tend to remain inactive later in life.”

Cardinal wanted to better understand the impacts of a physical education requirement policy. He supports a physical activity policy that includes a required academic course that focuses on skill acquisition, development and fun, ranging from adventure sports to Zumba dance and everything in between.

For more information, please visit [bit.ly/2FQkhp2](http://bit.ly/2FQkhp2)

## Birds, Bats and Blades

### DETECTION, DETERRENT SYSTEM HELPS PROTECTED SPECIES

Researchers have taken a critical step toward helping wildlife coexist with wind-power generation. The work is important because while wind power is generally regarded as green energy, danger to birds — particularly federally protected bald eagles and golden eagles — and bats is a concern.

Associate Professor Roberto Albertani and collaborators at Oregon State's College of Engineering; College of Earth, Ocean, and Atmospheric Science's, and the Hatfield Marine Science Center have created an integrated sensor system that can tell if a bird or bat hits a turbine.

On a related project, Albertani is working with Sinisa Todorovic, associate professor of computer science at OSU and Matthew Johnston, assistant professor of electrical and computer engineering, on what they hope will be a breakthrough in the safer-for-wildlife expansion of wind energy worldwide.

The idea is that a computer-connected camera would determine if an approaching bird is an eagle and whether it's flying toward the blades. If the answer to both is yes, the computer will trigger a ground-level kinetic deterrent — randomly moving, brightly colored facsimiles of people, designed to play into eagles' apparent aversion to humans.

Albertani's team has collaborators from the U.S. Geological Survey and an external advisory board that includes wind energy industry representatives.

To read more, please visit [bit.ly/2JTDmWM](http://bit.ly/2JTDmWM)

## THE OREGON STATE UNIVERSITY ADVANTAGE

Connects business with faculty expertise, student talent and world-class facilities, and helps bring ideas to market and launch companies.

## MAXIMIZING INNOVATION

BY JENS ODERGAARD

Every day, approximately 40,000 people in the United States — nearly enough to fill Oregon State University's Reser Stadium to capacity — receive a nuclear medicine imaging procedure using a radioisotope that is in high demand. Known as technetium 99m — or Tc-99m — eight of every 10 nuclear medicine imaging procedures worldwide rely on it.

“Famously, it's used in what is called a ‘stress test,’” says Steven Reese, director of the Oregon State Radiation Center and an associate professor in the College of Engineering's School of Nuclear Science and Engineering. “The idea is that you run on a treadmill and then get injected with Tc-99m, which is attached to a molecule that follows the flow of blood. Radiation detectors are then placed around the body so we can see how the heart moves the blood. It uncovers a lot of vital and accurate information for physicians.”

The brain, bones, kidneys and lungs are also commonly imaged using Tc-99m. But there's a hitch in getting the product to people who need it. The Tc-99m supply is bottlenecked, and the entire U.S. supply is being imported from overseas.

A quick technical lesson: Tc-99m is a decay product of molybdenum-99 (Mo-99). That is to say, Mo-99 turns into Tc-99m as it emits radiation. So to produce Tc-99m, Mo-99 must be made first. Mo-99 is traditionally produced in large nuclear reactors by using the neutrons from the reactor to bombard a uranium-filled container called a target. As the uranium in the target fissions, one of the resulting products is Mo-99. The sole North American producer of Mo-99 shut down in 2018.

It occurred to Reese that Oregon State's 1.1 MW TRIGA reactor could possibly be used to produce Mo-99. It was a wild idea because the TRIGA reactor is much smaller than reactors traditionally used for producing commercial quantities. Additionally, efforts are well underway to stop using high-enriched uranium in research reactors like Oregon State's. This means that low-enriched uranium would need to be used in the target. Together, these challenges meant that it would take a novel target design to make a useful amount of Mo-99.

Reese looped in Todd Palmer, professor of nuclear engineering, who specializes in modeling and simulation. “The original target design is just like a cylindrical can that contains a layer of uranium in it,” Palmer says. “It just seemed to beg for a little innovation, you know?”

Reese and Palmer brainstormed a new target design idea and turned it over to Madicken Munk for simulation. At the time, she was an undergraduate student working for Palmer. After hundreds of simulations and numerous consultations with Todd Keller, Oregon State reactor administrator, to discuss the practical implications of how the target would work in reality, they arrived at the final design.

Because of the huge commercial potential for producing Mo-99 in research reactors in the United States, patents were filed and a company, Northwest Medical Isotopes, was formed to bring the technology to market. Today, NWMI is moving forward with plans to construct a processing and production facility in Missouri, an ideal central location for shipping Mo-99 to medical facilities around the country.

Larry A. Mullins, former president and chief executive officer of Samaritan Health Services and executive chairman of Northwest Medical Isotopes, has been involved with the project since its inception. “We realized the potential early on and were very fortunate to have a partner like Oregon State University, not only for the research and development phase but also for the regulatory and intellectual property rights activity,” he says.

Brian Wall, assistant vice president for Research, Commercialization and Industry Partnerships at OSU, adds that NWMI demonstrates how technology transfer can bring an essential product back to the U.S. “It is a great example of Oregon State's focus on maximizing our innovation and economic impact for the benefit of society.”

For more information, access a podcast at [bit.ly/tech-99m](http://bit.ly/tech-99m).

**View of the core of the Oregon State TRIGA Reactor operating at 1 MW thermal power.**

To discover what the **Oregon State University Advantage** and the **Advantage Accelerator program** can do for your business, contact Brian Wall, assistant vice president for Research, Commercialization, and Industry Partnering, 541-737-9058, [brian.wall@oregonstate.edu](mailto:brian.wall@oregonstate.edu), [oregonstate.edu/advantage](http://oregonstate.edu/advantage).





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Operated by Oregon State University, Taani (pronounced “tahnee” — meaning “offshore” in the language of the Siletz people of the Pacific Northwest) will be the first in a series of Regional Class Research Vessels funded by the National Science Foundation. The ship will advance the scientific understanding of coastal environments by supporting studies of ocean acidification, hypoxia, sea level rise and other topics. Under construction by Gulf Island Shipyards, LLC in Louisiana, the vessel is scheduled for delivery to OSU in the spring of 2021 and will be fully operational after a year of outfitting and testing. (Artistic rendering.)

