

tterra

A world of research & creativity at Oregon State University · Winter 2014



A Primeval Marvel

The Pacific lamprey's vital role in Northwest ecosystems

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Oregon's leading public research university



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Carrying on a centuries-old tradition, Northwest tribal members harvest Pacific lampreys by hand in the churning waters of Willamette Falls near Oregon City. (Photo: Dave Herasimtschuk, Freshwaters Illustrated)

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Oregon State is Oregon's leading public research university with more than \$263 million in research funding in FY2013. Classified by the Carnegie Foundation for the Advancement of Teaching in its top category (very high research activity), Oregon State 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: The mouth of a Pacific lamprey (Photo: Jeremy Monroe, Freshwaters Illustrated)

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Language Matters

If there's a single message in this issue of *Terra*, it's this: Language matters. It frames our relationships and defines our culture. It affirms common interests and ways of seeing the world. If you want to get something done, using the right language can make all the difference.

I learned that lesson early. At the dinner table, my parents would occasionally shift from English to their native Dutch. It often seemed to happen close to Christmas. My sisters and I, who spoke only English, knew the conversation was not meant for our ears.

As an ethnographer in Guatemala in the 1980s, Oregon State professor Cheri Pancake learned that understanding Mayan culture required extraordinary care in how she spoke during interviews and meetings. Later, when she became a computer engineer, she applied that skill to the world of software. She and her team in the Northwest Alliance for Computational Science and Engineering interview people who use computer algorithms (the steps programmers create to accomplish a task) to make decisions about everything from forest fires to crop insurance. The language of software — vocabulary, structure, logic — matters to them.

For Kayla García, who grew up in Wisconsin, learning Spanish felt more like an act of remembering than encountering something new. The professor in the OSU School of Language, Culture and Society has her feet in English- and Spanish-speaking worlds. Her work acts like a prism for culture. It reveals peoples' lives in colors that speakers of other languages might otherwise never see.

Language is also at the heart of Gregg Walker's research on international negotiations. The Law of the Sea Treaty talks were complicated enough, he says, but they pale in comparison to the United Nations Framework Convention on Climate Change. In Warsaw last fall, he listened and advised as delegates parsed words to underscore what's at stake in the climate change debate: our survival and the world as we know it.

Their stories show Oregon State's commitment to solving problems and enriching lives.

Editor





International Imperative in Science

Research builds trust, mutual respect

BY RICK SPINRAD, VICE PRESIDENT FOR RESEARCH

My research career took me to the waters off Africa, South America and Central America. I found the experience of working with colleagues from many nations to be exciting, and I learned a lot about the scientific challenges we were addressing. In retrospect, I realize I learned a lot more about being a good citizen of the world. I developed a deep respect for cultural differences and varying national perspectives.

How, then, in this faster-paced, more networked world should we approach the global nature of our research enterprise? What are the challenges and opportunities we should prepare for as our research efforts continue to expand across the world?

First, we, as researchers, must realize that our work goes well beyond the boundaries of the hypotheses we are testing. As I was negotiating a collaborative research program between the U.S. federal government and the government of Indonesia several years ago, an American ambassador shared with me that this project was viewed as an important vehicle for building trust between our two nations. In short, the research had become a tool of diplomacy, as well as a forum for advancing knowledge. On more than one occasion, the international partners with whom I initiated a dialog about a research project ultimately became trusted collaborators on larger efforts with broader policy implications. We would never have gotten to the policy issues without a foundation of cooperation predicated on our mutual passion for research.

Global Economy

On perhaps a more pragmatic basis, the global economy (which is, itself, dependent on robust research) has become highly transnational. Many corporations' executive activities transcend geopolitical borders. Those industries, which are supporting more and more of our research activities, are less interested in the mailing address of the researchers they support than in the ability of those researchers to collaborate globally and provide meaningful advances in understanding that can contribute to the bottom line. However, managing intellectual property across varying legal systems may also present another significant challenge.

Finally, the world is recognizing that the major research imperatives we face do not have a national identity. Poverty is not an Indian problem alone. Food security is not unique to China. Climate change is not owned exclusively by the Republic of the Maldives. Sure, some issues, like protection of specific species, might correspond to the research priorities of a particular nation, but for the most part, big research problems lend themselves best to multinational solutions. The abundance of international research-dependent organizations (World Health Organization, Food and Agricultural Organization, World Meteorological Organization) testifies to the importance of international cooperation in research.

All of this points to the need to position Oregon State to best respond to the call for international research cooperation. We do a lot of that now. This issue of *Terra* showcases Gregg Walker's work with the United Nations Framework Convention on Climate Change. But we need to continue to think about the best policies and practices for our research community. We don't simply want to allow this kind of collaboration — we want to nurture it!





Engineers with Soul

Humanitarian Engineering combines technical knowledge with social skills

BY KENDRA SHARP, COLLEGE OF ENGINEERING

Engineers excel at solving problems. They can design systems that provide clean drinking water, generate electricity from sunlight and improve personal health. While the design of these systems demands technical skill, success or failure ultimately resides with the people who use and maintain them and whose lives depend on them — that is, with a social network.

Our students want to understand that meaningful context. They come to us with a desire to make an impact with their lives, and Oregon State is embracing the challenge. We have launched a Humanitarian Engineering program (HE@OSU) to offer a transformational education focused on problem-solving and a deep understanding of culture and social relationships.

Nationally, engineering education may not be living up to this vision. In fact, Erin Cech, a sociologist at Rice University, recently noted that engineering education may foster a “culture of disengagement.” In a survey of more than 300 engineering students at four universities in the Northeast, she tracked students’ perceptions of cultural factors, such as public welfare, social consciousness and understanding the consequences of technology. Cech found that after four years of college, the students were less concerned about public welfare than when they entered.

This provocative result challenges us as educators. Indeed, as we endeavor to ensure students’ competence in fundamental engineering concepts, it’s all too easy to lose sight of what it means to be an engineer: to create solutions for difficult problems, to be aware of the context within which these problems arise and to anticipate the potential consequences of our solutions.

As engineering educators, we find ourselves at a crossroads. We need to engage the millennial generation, open up opportunities to connect engineering to community service and encourage creative problem-solvers to understand the importance of community engagement. These skills are as important for a corporate client as they are for a village halfway around the world.

Humanitarian engineering means developing solutions in partnership with communities. Examples include designing easy-to-maintain water filters, composting toilets, renewable energy systems, wastewater systems, communication systems, vulnerability assessments of local infrastructure and more. Our curriculum will include ethics, social science methodologies, engineering design for low-resource environments and multi-disciplinary case studies of development projects.

We’re well-positioned to succeed. Oregon State has tremendous strengths in engineering for global development and strong connections to public, nonprofit and business organizations around the world. We have an award-winning student chapter of Engineers Without Borders. Our HE@OSU team consists of committed faculty from across campus: engineering, public health, social sciences, humanities and natural resources.

The timing is right for HE@OSU. Our emphasis on engagement is a great fit for the university’s ethos of service and commitment to a healthy planet. We are poised to be a leader in this field. Our students expect nothing less.

In Africa, students in Oregon State’s Engineers Without Borders chapter share cultural and social skills as well as engineering expertise. (Photo: Justin Smith)





Breed to Feed

Crop scientists create the plants that keep Oregon farmers in business

BY DANIEL ROBISON | ILLUSTRATION BY LONG LAM

Oregon's \$5 billion-a-year agriculture industry needs new breeds of grains, nuts, fruits and vegetables. Some food crops become vulnerable to disease and pests. Others must evolve to match the changing needs of farmers and consumers.

Oregon State University plant breeders have a long legacy of creating new food crops with better yields, healthier nutritional content and enhanced flavors. Breeders emphasize sustainable farming practices that help the environment and boost growers' bottom line.

This doesn't happen overnight: Designing new varieties of wheat, raspberries and other crops can take a decade to go from the back of an envelope to your dinner plate. But OSU sees 5 billion reasons to keep new crops coming to a field near you.

NUTS

When Eastern Filbert Blight crippled Oregon's hazelnut trees in the 1990s, OSU rescued the industry. Among the newly resistant varieties is **Wepster**, a high-yielding tree that produces a petite nut, perfect for the chocolate industry.

TOMATOES

The **Indigo Rose tomato** has a striking purple pigment — and that's no accident. OSU bred its skin to contain high levels of anthocyanins, compounds with potential antioxidant health benefits.

GRAINS

Grain growers must stay a step ahead of pests and diseases to keep yields high and meet market demands. In 2013, farmers had their first crack at **Kaseberg** and **Ladd**, two new soft white winter wheats. Meanwhile, OSU is testing more than 10,000 experimental varieties of barley. A new variety, known as **Verdant**, recently hit seed catalogs.

SMALL FRUITS

OSU and research partners have bred small fruits for nearly 100 years. New varieties of **raspberry**, **strawberry** and **blackberry** continue to emerge at Experiment Stations across the state. The results have been fruitful: Together these sweet treats add \$140 million to Oregon communities annually.

POTATOES

OSU has a storied history spawning new spuds, including the **Crimson Red**, **Purple Pelisse** and **Sage Russet**. Bred to resist fungi, insects, viruses and weeds, OSU tubers reduce chemical, fertilizer and water use.



SURVIVORS from the Depths of Time

Scientists and tribes work urgently to save the ancient Pacific lamprey

BY LEE SHERMAN



“Lampreys are delightfully bizarre fish — and vastly underappreciated for the role they play ... in ecosystems.”

Center for Biological Diversity



A

sk a random sample of Oregonians what they know about Pacific lamprey, and you'll likely get one of the following responses:

“Um, not much. Aren't they some kind of eel?”

“Ooo, yuck! They're parasites, right?”

“Oh, yeah, I saw those on *River Monsters*.”

These answers ordinarily come with a wrinkled nose or a shudder of disgust. To most people, lamprey seem icky or scary or both. It doesn't help their image that one of the world's 40 lamprey species, the sea lamprey (*Petromyzon marinus*), is invading and imperiling the Great Lakes. Nor does it help that Animal Planet's “extreme angler” Jeremy Wade recently did an episode of *River Monsters* titled “Vampires of the Deep.” During his hunt for lampreys in Oregon's thunderous Willamette Falls, he cranked up the drama with a script worthy of a low-budget horror movie. Amidst the churning, roaring waters, he shouted about the “slimy, serpent-like vampires!” and “primordial bloodsuckers!” he was soon to bag.

Wade did get one thing right when he said, “Lampreys are survivors from the depths of time.” For eons, Pacific lamprey (*Lampetra tridentata*) by the millions have scaled Willamette Falls — a 40-foot-high natural waterfall between Oregon City and West Linn — to reach their spawning grounds in the Santiam, the Pudding, the Long Tom, the Marys and the other tributaries of the Willamette River. A black-and-white photo taken at the falls in 1913 shows a Medusa-like tangle of lampreys — thousands of shiny, serpentine creatures packed together on a rocky ledge — as they thrust upward against the torrent.

For millennia, Northwest tribes harvested lampreys from those very same watery ledges, plucking them

In the Smith River in Oregon's Douglas County, a Pacific lamprey holds onto a rock with its sucker mouth to rest as it swims upstream to spawn. (Photo: Jeremy Monroe, Freshwaters Illustrated)

from the rocks by hand. Then, early in the last century, pioneer families began dining on lamprey, and European-American fishermen joined in the harvest, collecting the three-foot-long jawless fish at Willamette Falls by the boatload for processing into fishmeal, vitamin oil and livestock feed. The yearly catch hit a high of 185 tons — a half-million lampreys — in the 1940s, according to a 1999 report of the Columbia Basin Fish and Wildlife Authority.

Once upon a time, before European settlement, the tribes had bountiful places to catch Pacific lamprey, a sacred staple in native diets. Back then, lampreys dwelled throughout the Columbia River Basin. But in a few short

decades, the ancient fish have disappeared across most of the watershed. Today, the Willamette River is the last stronghold of an animal that biologists describe as an evolutionary marvel. Having survived at least four of Earth's major extinction events, the Pacific lamprey is collapsing, defeated by dams, pollution, habitat loss, dwindling host fish and factors yet unknown to scientists.

"It's death by a thousand cuts," says Oregon State University fisheries biologist Carl Schreck.

The English term "lamprey" derives from the Medieval Latin word *lampreda*. Translation: "stone licker." The weird name comes from the fishes' curious ability to climb vertical rock faces with their mouths — suck on, wriggle up, suck on, wriggle up. The amazing functions of their suction-cup mouth, which scientists call an "oral disc," also include latching on to other fish. Certain websites have dubbed adult lamprey "aquatic hitchhikers" for riding along with salmon, cod, flounder and even whales while feeding on their body fluids.

Their mouths play a key role, too, in building spawning nests ("redds"). By sucking onto large river rocks, lamprey can scoot the stones along the riverbed and arrange them in a circle on the gravelly substrate. The rocks form a protective barrier against currents that might wash away the eggs — as many as 100,000 per female fish.

Sucking Up

One morning in May, two Oregon State fisheries biologists wearing Polarized sunglasses quickly spot at least a dozen such redds in the Luckiamute River, a Willamette River tributary northwest of Corvallis. Velcroed into their Simms "Pro" stocking-foot waders, researchers Luke Schultz and Mariah Mayfield are standing in an alder-shaded pool. Sunlight flickers through the leaves and glints off the riffles. Trees leaning lazily over the water catch the reflection on the underside of their trunks.

"See that speckled dace?" Schultz says, pointing down at the pebbled riverbed. "It's hovering right inside a redd." The finger-sized fish rests over a rounded depression the size of a pizza. Schultz points out another depression and another, noting the large stones rimming each hollow. As the female lamprey deposits her eggs by fanning her body across the nest, she grips a rock with her mouth for



This young lamprey captured in the Marys River in Benton County is being measured as part of a study by Oregon State researchers with funding from local tribes. (Photo: Chris Becerra)

stability. “A month ago, we saw a lot of adults here,” Mayfield reports. “We saw a lot of carcasses, too.” Like salmon, lampreys die soon after egg laying. Their bodies nourish other riverine species.

Schultz and Mayfield, who work in Carl Schreck’s lab in OSU’s Department of Fisheries and Wildlife, are documenting Pacific lamprey spawning grounds as part of a three-year study funded by the Columbia River Inter-Tribal Fish Commission. “The goal of our research is to first ensure the persistence of lamprey in the Willamette Basin and, second, to restore population levels sufficient to meet historic human use,” says Schreck. “To do this, we need to have some understanding of the reproductive capacity of the Willamette population, and bottlenecks to reproduction need to be identified.”

For at least two decades, the tribes have been leading the charge on behalf of lamprey, which the Grand Ronde Indians call *skakwal* and the Umatillas call *ksuyas*. As one of the “first foods” of Northwest Indians (along with salmon, elk, huckleberries and camas bulbs) lamprey hold a



Electrofishing for young lampreys, OSU fisheries researchers Luke Schultz, Gabe Sheoships and Mariah Mayfield cross the river side-by-side in a formation they call the “Lamprey Shuffle.” (Photo: Chris Becerra)

place of high honor in tribal culture. The fish’s seven gill slits have religious and cultural significance that echoes through many native traditions (see Gabe Sheoships’ post on the *Terra* blog).

But outside Indian culture, Pacific lampreys have a PR problem. “The Euro-American perception (is) that lampreys are pests,” David Close,

a fisheries biologist and member of the Cayuse Nation, wrote in a 2002 report for the Confederated Tribes of the Umatilla. “We suggest that cultural biases (have) affected management policies.”

Close, who now leads the Aboriginal Fisheries Research Unit at the University of British Columbia, offered some staggering statistics

Lamprey Brain Trust

Northwest scientists confer at research center

“The situation for Pacific lamprey is bad and getting worse,” says OSU fisheries biologist David Noakes, director of the Oregon Hatchery Research Center. “We have enormous gaps in our knowledge of even the most basic aspects of life history, ecology and behavior of our native lamprey.”

To jumpstart the filling of those gaps, experts from around the Pacific Northwest and Canada gathered at the center in October for a Lamprey Research Workshop. Resolving uncertainties about lamprey, focusing research

questions and raising awareness of conservation and restoration needs were the key goals for the 50 attendees. The scientists shared emerging findings in ocean ecology, molecular genetics and barriers to passage, as well as cultural implications for Northwest tribes, which are funding much of the Pacific lamprey research at Oregon State and elsewhere.

“We need to share the concerns of tribal peoples for the Pacific lamprey,” emphasizes Noakes.

to bolster his critique of lamprey management. In 1966, nearly 47,000 lampreys were counted in the Umpqua River at Winchester Dam. By 2001, the count was 34. In 1963, more than 49,000 lampreys were counted in the Snake River at Ice Harbor Dam. In 2001, the number was 203.

“If you had to identify one smoking gun,” says Schreck, “it would be dams.” The stair-step fish ladders in the Columbia Basin’s vast network of hydroelectric dams were designed for salmon, which are powerful jumpers. But lampreys, whose suction-cup mouths are not adapted to right angles, are stymied. According to Schreck, it wasn’t an oversight. “The fish passages were built deliberately to exclude lamprey,” he says. “Back then, people thought lampreys were outcompeting salmon.”

Deliberate poisoning also decimated Pacific lamprey in the last century. “From the late 1940s through the 1980s, the Oregon Fish Commission used rotenone in basins throughout the state to eliminate non-game species including Pacific lamprey,” reports a 2004 Northwest Power and Planning Council document. “This practice no longer occurs today, but with up to seven year-classes of Pacific lamprey present in freshwater at any one time, the intentional fish kills of the mid-1900s likely severely impacted Pacific lamprey populations.”

The Oregon Hatchery Research Center in the Alsea River Watershed recently built one of the Northwest’s first lamprey-friendly fish ladders. And a standing-room only crowd at

the OSU-sponsored International Conference on Engineering and Ecohydrology for Fish Passage in June heard from Northwest scientists who are studying new designs for lamprey passage.

Bacon Cheeseburger

Even as wildlife conservation groups make herculean efforts on behalf of charismatic species — the majestic Chinook salmon, the adorable panda bear, the mysterious blue whale — the Pacific lamprey has drifted ever closer to the endangered species list practically unnoticed — except by the tribes and a few OSU fisheries biologists. David Close, who was a researcher at Oregon State in the 1990s, was one of the first scientists to sound the alarm in the fisheries community. Ever since, researchers have been scrambling to learn as much as possible about the primordial survivor before it’s too late.

For the Pacific lamprey, the “pest” perception couldn’t be further from the truth, these scientists stress. Unlike the invasive sea lamprey, which is overtaking native trout in the Great Lakes, the Pacific lamprey is exquisitely adapted to the Northwest river ecosystems it has shared with salmon, steelhead and rainbow trout for thousands of years. In fact, compared to lamprey, the more charismatic aquatic species are planetary newcomers. Modern fish — the jawed kind — don’t show up in the geologic record until the Devonian Period late in the Paleozoic Era (“Paleozoic” derives from the Greek, meaning “ancient life”) — about 400 million years ago.



Lamprey, on the other hand, made their appearance 100 million years earlier, during the Cambrian Period at the very dawn of prehistory. And dinosaurs? Next to lamprey, the fearsome reptiles seem positively modern, not lumbering onto the scene until the Jurassic Period, 250 million years after lamprey first plied the primordial seas.

Schreck notes that lamprey parasitism may not be fatal to the host. And there’s another side to the story, one that actually makes lamprey



beneficial to salmon: Lampreys are a sought-after delicacy for sea lions, seabirds, otters and other animals that eat salmon.

“Lampreys are a buffer against salmon predation,” says Schreck. “They’re the most energy-laden fish, very, very rich in oil, which makes them the preferred food of salmon predators. They’re sort of like the cheeseburger — the bacon cheeseburger — of the food web.”

A hungry sea lion will eat 30 lampreys to every salmon, studies

have found. Caspian terns, which have been gobbling up juvenile salmon on the Lower Columbia, also prefer to feed on lampreys — when they’re available. “As the lampreys disappear, predators eat whatever’s around, and that happens to be salmon,” says Schreck.

Buffering salmon predation, however, is only one ecosystem talent of the Pacific lamprey. After hatching, young lampreys dwell unseen in river-bottom muck up to eight years or more. Blind and

With her net, researcher Mariah Mayfield lunges for a tiny lamprey that has emerged from the sediment during a sampling study in a tributary of the Willamette River. (Photo: Chris Becerra)

nocturnal, about half the size of a No. 2 pencil, these lamprey larvae play an important role in stream ecology — a role that has earned them another nickname, the “river worm.”

“They churn up the soil in the river, just like an earthworm would in your garden,” says Schreck. “This allows

for cycling of nutrients up through the food chain.”

“Right, they burrow in fine sediments,” adds fish biologist Lance Wyss, a former researcher in Schreck’s lab who now works for the Calapooia, North Santiam and South Santiam watershed councils. “They feed on fine organic material, adding to the transfer of nutrients between the water column and the substrate. It’s good for the entire riverine food network.”

But within those fine sediments, pollutants lurk. In urban corridors, especially, contaminants from cars and industry — manmade chemicals that run off freeways and parking lots into the watershed — create a toxic brew for streambed-burrowing organisms. In one study, baby lampreys were introduced to sediments from the Environmental Protection Agency’s Super Fund cleanup site at the Port of Portland. The larvae quickly burrowed in. Even more quickly, they burst back out, coughing up the sediment, Schreck says. They refused to burrow again.

Tickling Baby Lampreys

A trio of OSU researchers line up shoulder-to-shoulder on the edge of a quiet pool in the Marys River, which tumbles eastward out of the Coast Range. It’s early summer 2013. The guy in the center, grad student Gabe Sheoships, looks like a character from *Ghostbusters* strapped into a battery-powered electrofishing backpack the size of a small suitcase. In each hand, he holds a long metal pole with an electrode at the end. Lowering the probes into the stream, he delivers a mild zap near the river bottom, where fine sediments provide nourishment and hiding places for lamprey larvae. “To the fish, it just feels like a tickle,” says Sheoships, whose Cayuse and Walla Walla ancestors fished the Columbia long before white settlers came across the Oregon Trail. That tickle is enough to startle the fish into popping up from the mud.

His two companions, Luke Schultz and Mariah Mayfield, flank him, gripping dip nets. Then they begin the “lamprey shuffle,” a sideways scoot across the pool that looks a lot like a country-western line dance.

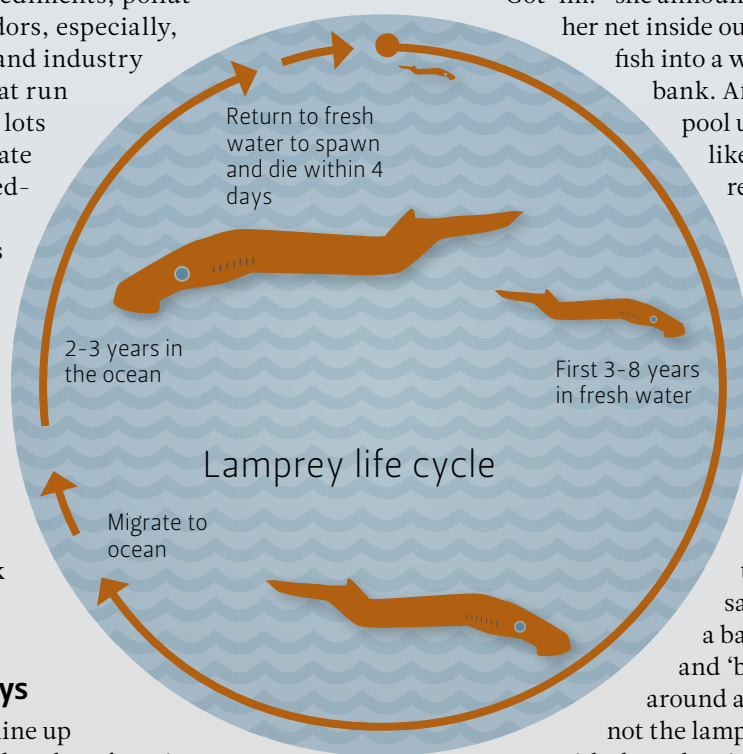
“There’s one!” calls out Schultz. Mayfield lunges, thrusting her net into the stream and scooping up a four-inch brown baby lamprey, the larval form that scientists call an “ammocoete.”

“Got ‘im!” she announces triumphantly. Turning her net inside out, she releases the tiny fish into a water-filled bucket on the bank. After zigzagging across the pool until they’ve sampled every likely hiding place, the three researchers — who call themselves the “Lamprey Posse” — weigh and measure each of the 100-plus larvae they’ve caught and return them to the stream.

As a tribal member, Sheoships has a personal stake in the research. “The lamprey is a cultural keystone for the tribes of the Columbia Plateau,” he says. “Lampreys have gotten a bad rap. The terms ‘parasite’ and ‘bloodsucker’ get thrown around a lot.” Then he jokes, “It’s not the lampreys’ fault that they got hit with the ugly stick.”

Schultz, who hails from the Midwest where invasive sea lampreys are decimating sports fisheries, hears similar terms of disparagement when he tells the folks back home that he’s trying to save the Pacific lamprey. “They think I’m a maniac,” he says. “They don’t understand that the situation is completely different here. Our lampreys are native. They play an important role in ecological functioning and also in cultural preservation.”

The researchers’ data on Pacific lamprey populations in the Marys, the Luckiamute and several other Willamette River tributaries will give scientists and tribes a better picture of the fishes’ status to inform conservation efforts. The findings also will fill in data gaps needed for a possible listing under the federal Endangered Species Act.



“We don’t want another snail darter or Devils Hole pupfish — a species nobody’s ever heard of until it’s endangered,” says Corvallis filmmaker Jeremy Monroe of Freshwaters Illustrated, whose recent short documentary, *The Lost Fish*, portrays the Pacific lamprey’s plight. Pacific lamprey will play a leading role, too, in Monroe’s upcoming feature-length film *Willamette Futures* about “the fate of Oregon’s big river.”

After years foraging in the muck, the little lampreys in quiet tributaries will emerge to undergo a metamorphosis. Schreck likens the transformation to the better-known tadpole-to-frog changeover. The larvae will acquire eyes (beautiful blue eyes the color of tropical seas). They’ll grow razor-sharp teeth and a rasping tongue and ride the river currents out to sea. By the time they return to

freshwater to spawn, they’ll be 500 times bigger, having ballooned from pencil-length to yardstick-length in two or three years.

Scientists like Schreck hope research can help these emissaries of the Paleozoic survive the Anthropocene.

“Thirty-five years ago when I started my career, there were zero papers on lamprey presented at meetings of the American Fisheries Society,” he says. “These days, there are whole symposiums on lamprey,” (see “Lamprey Brain Trust,” Page 9).

All the attention just might be making a difference. “So far this year, 908 lamprey have passed Winchester Dam on the Umpqua, where only 34 passed a dozen years ago,” Schreck reports. “Maybe something good is happening for lamprey.” **terra**



Friending a Fish

New curriculum brings lamprey to the classroom

One of Earth’s most ancient animals has inhabited some of the modern world’s hottest locations: Facebook and Twitter.

Thanks to the U.S. Fish and Wildlife Service (USFWS), the Pacific lamprey last year had a virtual life on social media in the character of “Luna,” an imaginary fish that kids could follow online as she migrated through the Columbia River Basin.

Now, Oregon State has joined USFWS to create a multimedia lamprey curriculum for students in grades four through six.

“The curriculum helps students meet core standards in science and social science,” says Maureen Hosty, the Portland-based OSU Extension 4-H specialist who is leading development of the Pacific Lamprey in the Classroom Project along with Sean Connolly and Donna Allard of USFWS. “Students are able to move through the six learning modules at their own pace and in an order that is intuitive to them.”

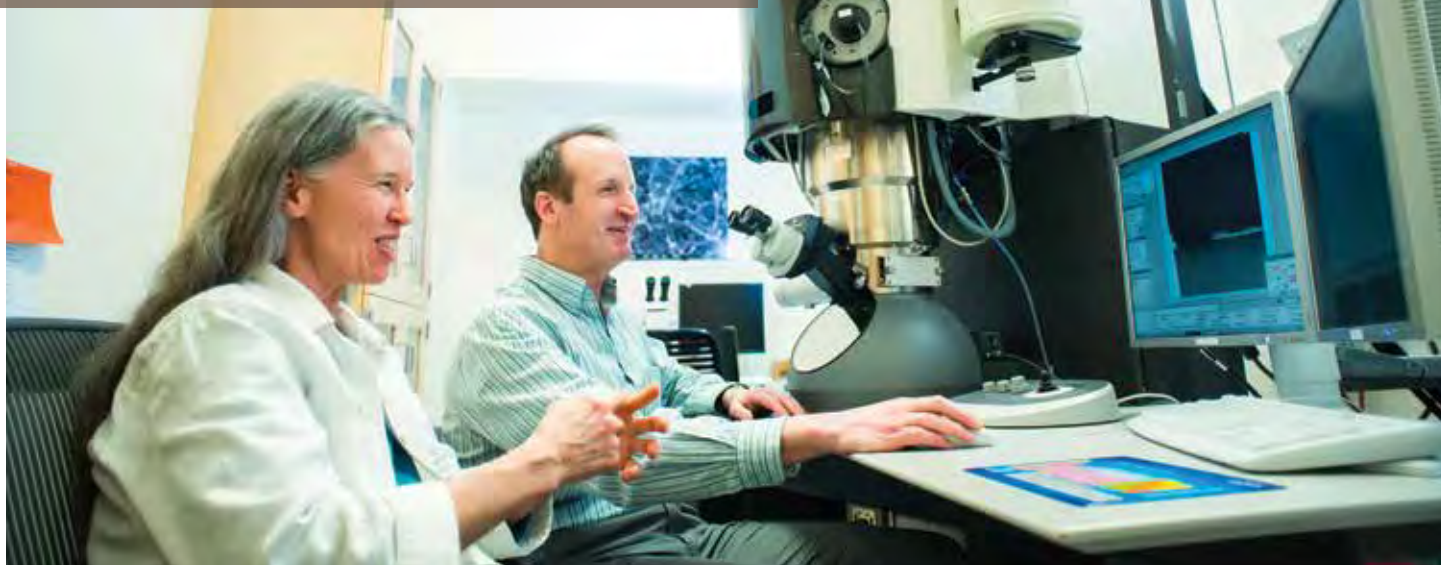
Contact Hosty at maureen.hosty@oregonstate.edu for details.

A child peers into a tank of lampreys during an educational outreach sponsored by the U.S. Fish and Wildlife Service. (Photo: Dave Herasimtschuk)

HIGH BEAMS

Electrons light up the world of the small

By Nick Houtman



For a place that takes pictures with what amounts to controlled bursts of lightning, the lab is quiet, almost hushed. Standing in the entrance to Oregon State University's Electron Microscopy Facility (EMF), you might hear researchers' soft voices as they discuss the best way to see pollen on a bee's tongue or to look at a layer of molecules on a silicon wafer. You might be struck by the images on the walls and display screens — disc-shaped blood cells, elegant ocean plankton, flower-shaped nanocrystals.

The EMF is home to machines with names like Titan, Nova and Quanta, all built by FEI, a global scientific instrument company headquartered in Hillsboro, Oregon. In essence, this lab is the Hubble Telescope of the nanorealm. It reveals microorganisms associated with disease, biodiversity and pollination. It demonstrates human innovation at the molecular scale, the architecture of materials designed for industries that are just a gleam in a researcher's eye.

The technology is a far cry from what you might have used in your high school biology lab. Researchers don't just peer at a sample through a microscope lens. They place it in a sealed chamber and sit at a computer. They direct the machine to shoot an electron beam at the sample through a tube that guides and focuses the beam with magnetic "lenses." As the subatomic particles strike the sample, they knock other electrons off its surface. A detector captures these "secondary electrons," and an image appears on a display screen in front of the scientist.

The EMF's two staff members — Pete Eschbach, director, and Teresa Sawyer, instrument manager — assist scientists and train students to prepare their samples. During the last four years, Eschbach says, the EMF has provided direct support for more than

Teresa Sawyer (left) and Pete Eschbach direct operations in Oregon State's Electron Microscopy Facility. (Photo: Hannah O'Leary)

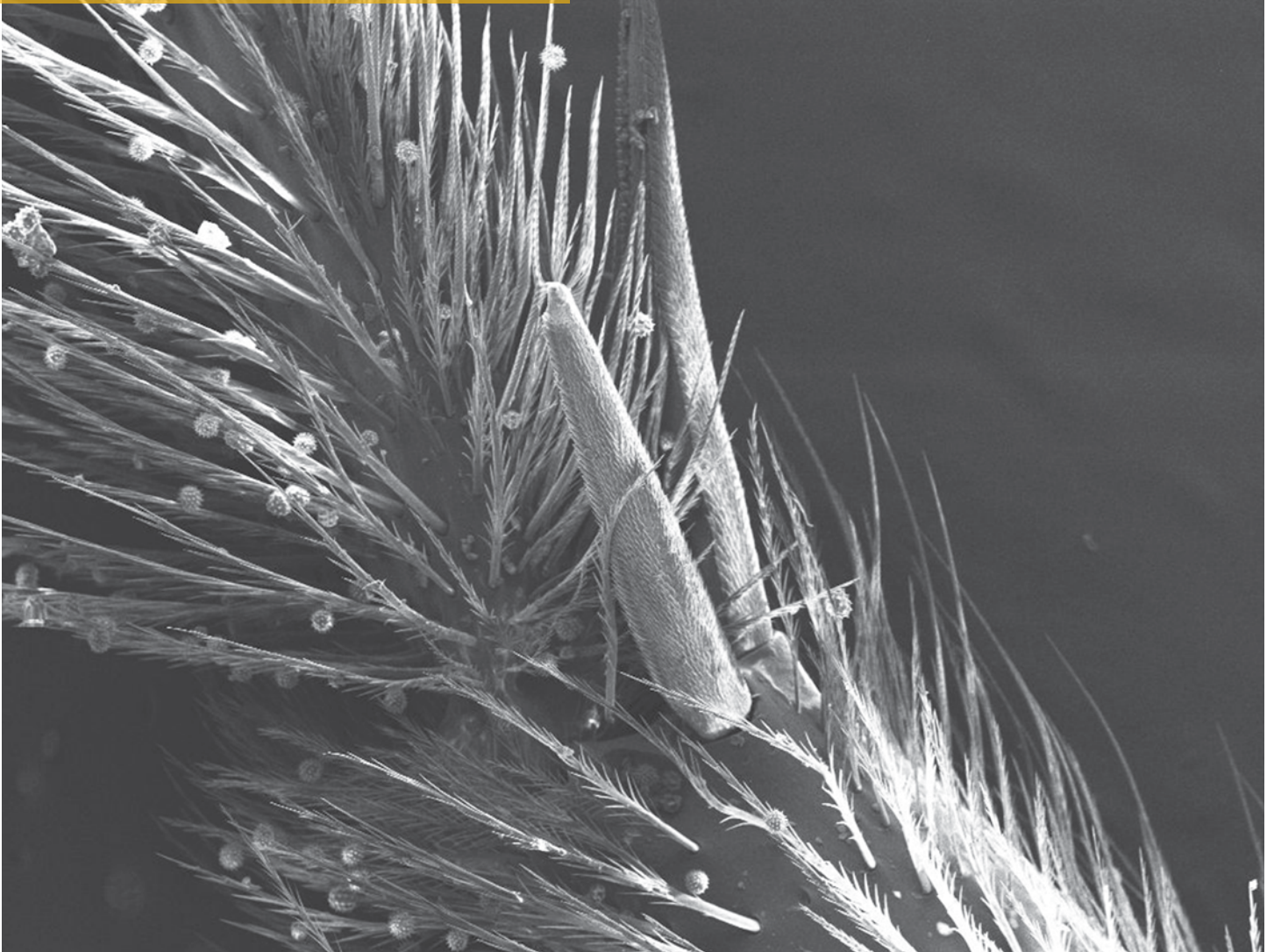
\$100 million in Oregon State research projects. Its images and data underlie advances in solar energy, crop science, archaeology and human and animal health. Businesses use the facility to assure the quality of their products, and lawyers use it in disputes over pollution and patent rights.

Engineers bring in fiberglass strands, semiconductors layered with titanium-coated diatoms and piezoelectric materials, substances that change shape under the influence of an electric current. A researcher in OSU's J.L. Fryer Salmon Disease Lab brings in a Willamette River carp that is covered in tumors, from skin to gills to throat. (The lab's images identified the cause: an infectious parasite.)

The EMF's two workhorses — the scanning electron microscope (SEM) and the transmission electron microscope (TEM) — differ in the power of their sample penetration. Both record the interaction of electrons with molecules, but the SEM looks at the surface, capturing images of shape and structure. The TEM dives deep for a look inside. Working with the TEM takes longer, says Eschbach, but can generate more information about composition and chemistry.

For Sawyer, the ability to generate an intimate view of materials and living things still inspires her. "It's pretty amazing that you can get a picture with electrons," she says. "When you hit something with electrons, they excite other electrons and you get an image. I think that's absolutely cool."

PROOF OF POLLINATION



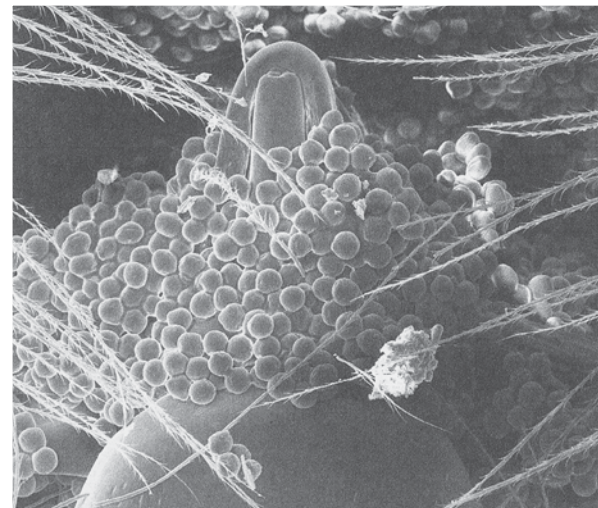
As honeybees pick up pollen and nectar, they pollinate about one-third of the plants in the human diet. “Growers rent honeybees to pollinate their crops, and we are taking a close look to see what kinds of pollen the bees are actually collecting,” says Sujaya Rao, entomologist in Crop and Soil Science.

Using a scanning electron microscope, Rao, graduate student Sarah Maxfield-Taylor and emeritus entomologist Bill Stephen have studied pollen collected by honeybees and bumblebees in and near blueberry and red-clover fields. They have focused on pollen caught in hair on body

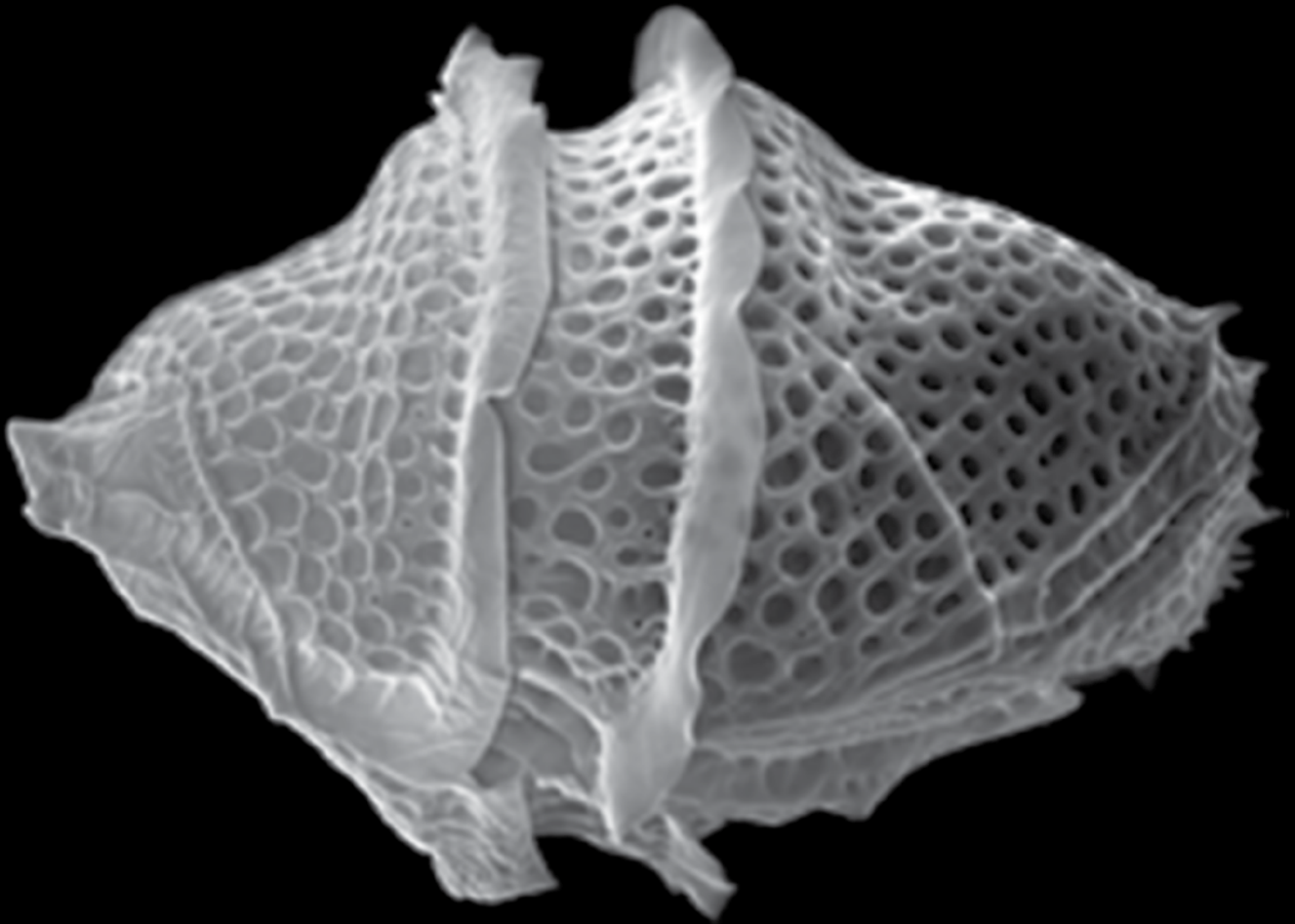
parts such as the leg and head, rather than on the “pollen load,” a ball made of nectar and pollen that bees take back to the hive.

Even the tongue accumulates pollen grains, which rub off the plant as the insects work their way into flowers and use their tongues to collect nectar. Bumblebees tend to have longer tongues, says Stephen, which are well adapted to specific types of flowers.

Their images show how pollen picked up by the bees can vary, depending on which plants are in bloom. These show pollen on a bee’s leg (top) and tongue.



ILLUMINATING PLANKTON



Consuelo Carbonell-Moore has made it her life's work to document the diversity of one of the ocean's most abundant life forms: dinoflagellates, a type of plankton. These organisms are no mere bystanders in marine ecosystems. Some produce life-giving oxygen. Others influence the formation of coral reefs. In coastal waters, they can bloom as "red tides" and turn filter-feeding organisms, such as shellfish, toxic.

With a courtesy appointment in Botany and Plant Pathology, the oceanographer uses a scanning electron microscope to capture images of dinoflagellate cells that she and her colleagues have collected in the oceans. She has already described several

genera and dozens of new species previously unknown to science. Among her samples currently in process, she says, are up to 100 new species. The one above is among the hundreds of dinoflagellate cells that are still undescribed in scientific literature.

"This is a tremendous amount of new cells that nobody has seen before," she says. "It will add to our knowledge of biodiversity."

Carbonell-Moore has used scanning electron microscopes in North America and Europe. "Oregon State's facility is amazing," she adds. "For ease of use and the quality of the images, it's the best."

NANOCRYSTALS FOR SOLAR



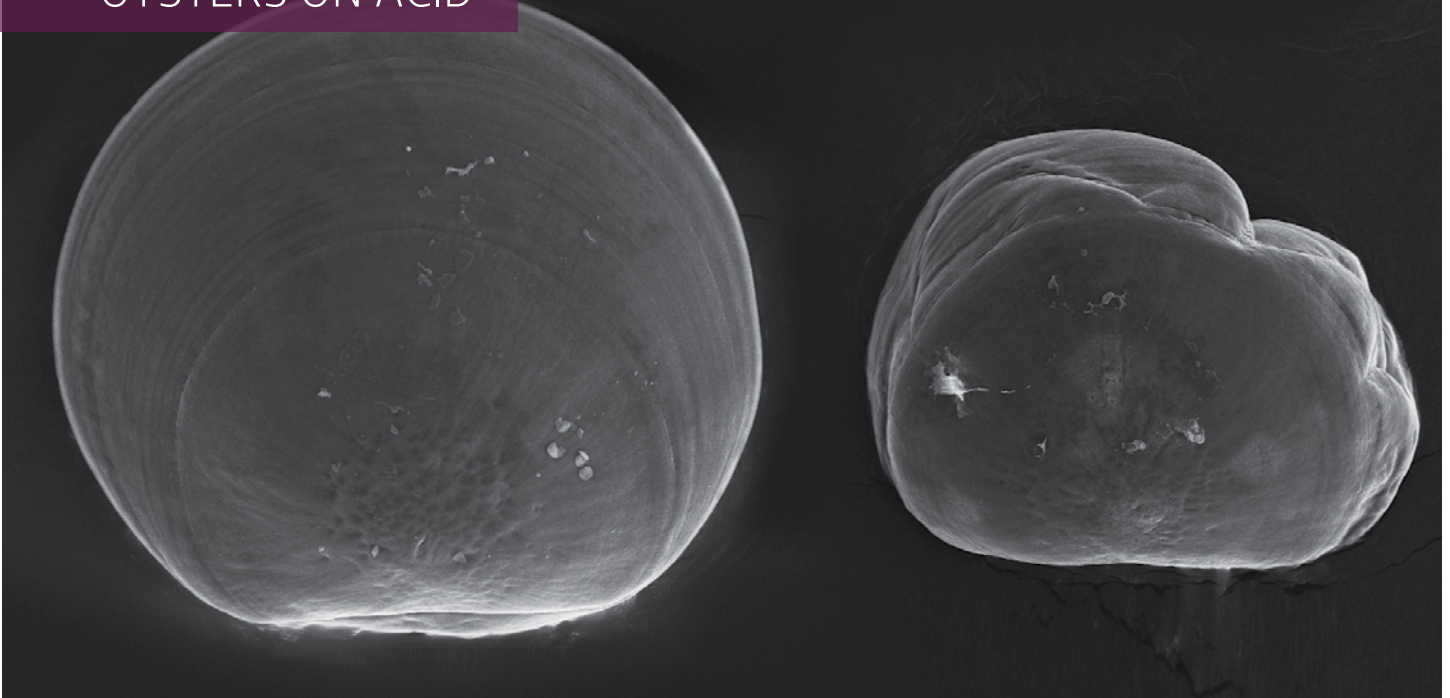
In Alex Chang's lab in the School of Chemical, Biological and Environmental Engineering, researchers arrange atoms in precise patterns to create materials with novel electrical and heat-transfer properties. Chang and his colleagues use electron microscopy to visualize and analyze structures that are often only a few atoms thick.

"The EM facility is very important for our work," says Chang. "It allows us to look at the structures in high resolution."

These flower-like particles are among a variety of curious shapes created by zinc-oxide nanoparticles. Others appear as

needles or spheres. After mixing a solution in a continuous-flow microreactor (a device in which chemical reactions occur in tiny channels), Chang and his team deposit particles as a film on a heated surface and then slowly cool the film. They have used this relatively simple technique to make transistors as well as materials with high heat-transfer characteristics. Motor and window manufacturers are among the companies that have expressed interest in Chang's work.

OYSTERS ON ACID



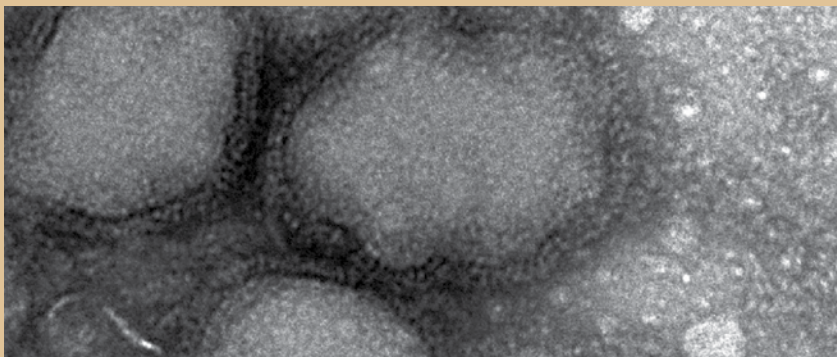
The oceans are about 30 percent more acidic than they were a century ago, and scientists are beginning to understand the consequences for marine ecosystems. Oysters may provide an early warning of what's to come.

George Waldbusser, a biogeochemist in the College of Earth, Ocean, and Atmospheric Sciences, and Elizabeth Brunner, a master's student, conducted an experiment with oyster larvae, which are about the width of a human hair. One group of larvae was grown in water from deep in Puget Sound. Its level of acidity was equivalent to that forecast for the global ocean in the next 100 years. Another was grown in surface water under current

conditions. The researchers used scanning electron microscopy to compare larval development after four days in the Taylors shellfish hatchery in Washington state.

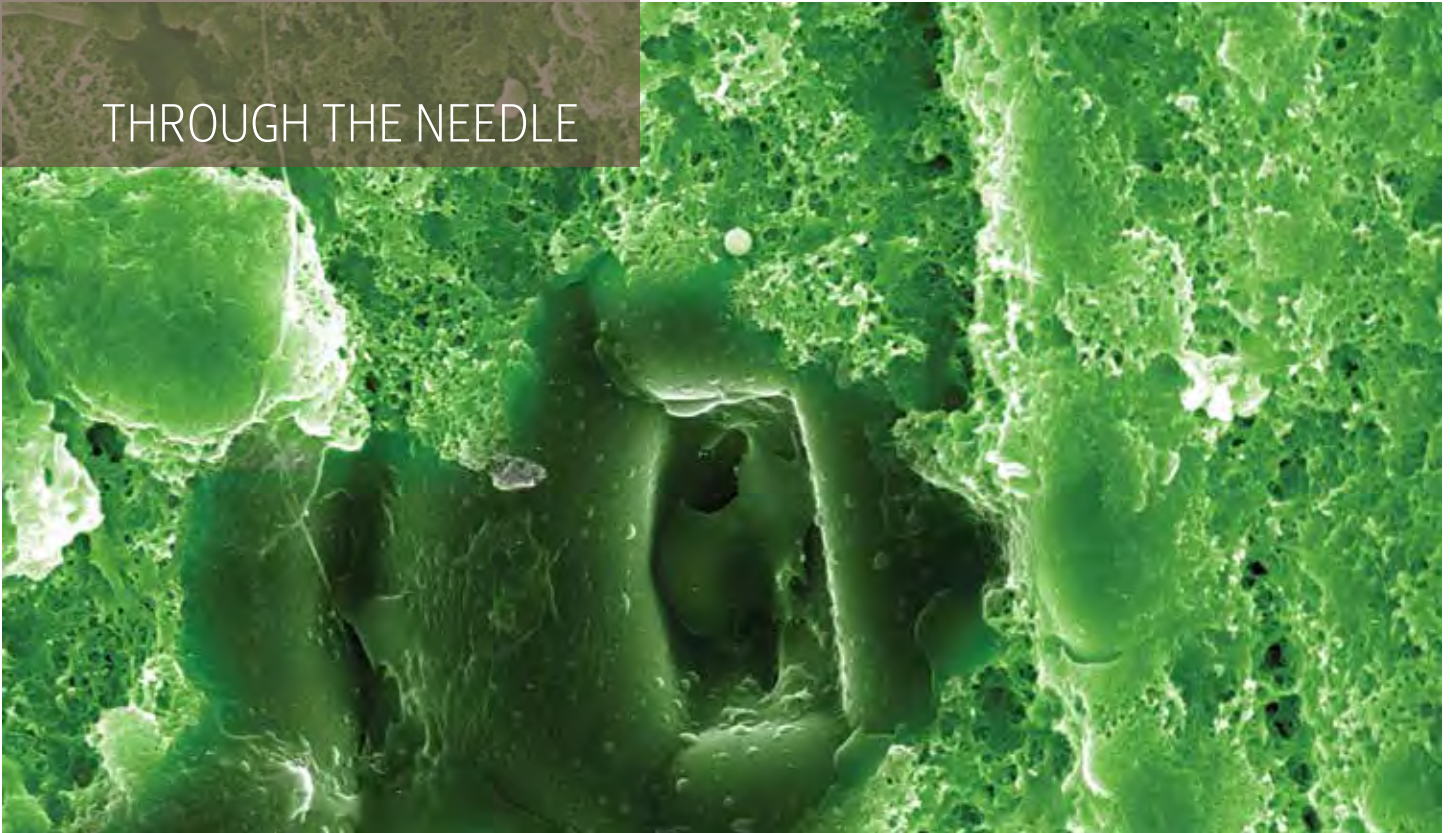
Their images show clearly that oyster larvae falter when they are grown in acidified water. A small misshapen shell (above, right) dooms them to a life cut short. That's because shell development is required for other stages of oyster growth, says Waldbusser, who uses SEM to study the dynamics of the process. "It's really important that they get the shell built in a short window of time. Increasing atmospheric CO₂ levels will shrink the window for initial shell formation."

VIRAL DIAGNOSTICS



Rocky Baker, supervisor of the virology lab in the Oregon State University Veterinary Diagnostic Laboratory, identified this influenza virus in pet ferrets whose owner had come down with the flu. Ferrets are susceptible, he says, and the owner was concerned that his animals

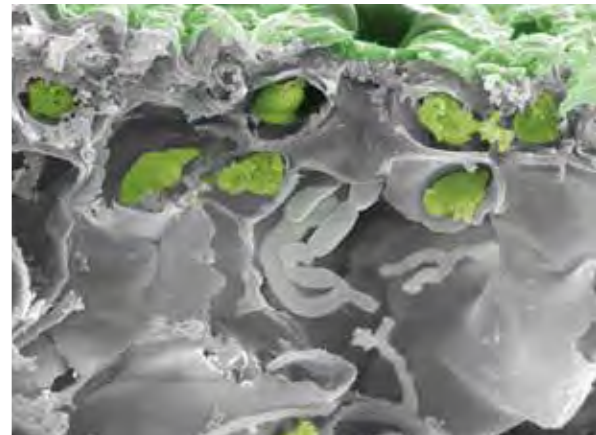
THROUGH THE NEEDLE



On a Douglas-fir needle, the spore of a fungal pathogen (*Phaeocryptopus gaeumannii*) germinates and sends forth threads (hyphae). As it matures, it grows inside the needle and reproduces. By interfering with the tree's ability to exchange air and water, it shuts down photosynthesis. Thus starts a disease known as Swiss needle cast, which causes more than \$200 million in reduced Douglas-fir growth annually in Oregon.

Researchers in Oregon State's Swiss Needle Cast Cooperative are studying the disease to develop treatments. Robin Rose, professor of forestry, used a scanning electron microscope to show a needle opening, or stomata, (above) and what appear to be hyphae among the needle's cells (right).

The Oregon Department of Forestry, USDA Forest Service, the forest industry and OSU founded the co-op in 1997 to maintain productivity in Douglas-fir forests.



became sick after contact with a family member who had influenza symptoms.

The College of Veterinary Medicine plays a vital role in animal and human health by diagnosing causes of disease. Baker uses transmission electron microscopy

(TEM) weekly to rapidly identify viruses in pets and livestock.

"It's invaluable to narrowing the playing field," he says. "There's a lot of money you can throw at a sample trying to determine what you've got. Often, if I can see it by electron microscopy, that's all I need."

Baker has identified ORF virus in sheep that had sores on their teats and canine parvovirus in a puppy that had severe diarrhea. In the puppy's case, a kit test had found no evidence of parvo. Such tests are highly sensitive, he says, to when they are done in the disease cycle.



THE WARSAW DISCOURSES

When the world convened in Poland for climate talks,
Gregg Walker was there

BY LEE SHERMAN



Protesters march through Warsaw demanding “climate justice” during the recent U.N. climate change negotiations. (Photo: Lee Sherman)

WARSAW, Poland — “This is like a climate change city,” says Gregg Walker as he hurries along a crowded corridor, dodging men in suits and ties, sidestepping women in bright scarves, wool leggings and leather boots. Tote bags are slung over shoulders. Cell phones are clapped to ears. Etched upon their collective faces are the ancestral roots of an entire globe.

Walker rushes through the computer center, where a couple hundred people work at laptops locked to long tables. IT experts hover, ready to troubleshoot. Medical staffers hustle past in orange jumpsuits. Volunteers mill about in green quilted vests, speaking into walkie-talkies. Even indoors, emissaries from tropical latitudes button their overcoats against Eastern Europe’s November chill, their mufflers snugged against skin accustomed to Pacific island breezes or equatorial heat.

Walker strides quickly down

another long hallway, where earnest-looking 20- and 30-somethings recline in beanbag chairs as they scrutinize huge paper maps of the venue or check their iPhone apps for meeting updates. Imprinted on the cherry-red beanbags is the message, “This rest station provided by the United Arab Emirates.” He passes through the U.S. hospitality pavilion where a few conferees cluster around a video about ocean acidification and whizzes past the Chinese pavilion where friendly hosts hand out canvas totes adorned with traditional brush paintings.

In this kaleidoscope of humanity, one feature is universal: Each individual wears a lanyard from which hangs a color-coded photo ID — pink for delegates, gold for observers, green for journalists, blue for staff. Without one of these official ID badges, no one has a prayer of getting past the massive electronic screening devices and the squadron of security

guards that protect the COP19 — the 19th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). Insiders call it simply the UNF Triple C. The “parties” are the 195 industrialized and developing nations that have been meeting together since 1995 to hammer out a cooperative global agreement limiting the fossil fuel emissions that are warming Planet Earth to dangerous — potentially devastating — levels.

In all, 10,000 people hold UN credentials for the two-week event in Warsaw. “The population of my whole country would fit inside this venue,” says a delegate from the tiny South Pacific island nation of Nauru one chilly morning as she hurries inside. “There are 10,000 minds here working on this problem.”

Walker, a professor of speech communication at Oregon State University and a specialist in environmental conflict resolution, is



Gregg Walker heads to the Global Landscapes Forum held at the University of Warsaw as part of the U.N. talks. (Photo: Tomasz Sobiecki)

after an audience with as many of those 10,000 minds as he can reach. He wears two hats for his climate change endeavors: advocacy and research. In his advocacy hat, he tries to persuade delegates to craft a global agreement containing conflict-resolution language to ward off violence as people struggle to adapt to rising seas, shifting rains, food shortages and water scarcity. To spread his message, he makes presentations, leads committees and talks with delegates and observers, one-to-one, every chance he gets. “It’s all about relationships,” he says.

In his research hat, he observes, listens and collects documents, all of which he will analyze once the series of negotiations ends in 2015. The chance to witness, first-hand, this historical process — clearly, the ultimate international negotiation ever undertaken — is too good to miss for this lifelong communications scholar.

Being both a scholar and an advocate is, Walker concedes, a delicate balancing act. “It’s a continual challenge to make sure my research agenda and my advo-

cacy agenda are compatible — that I’m not compromising one to serve the other,” he says.

Mediating Peace

With the gold badge of an official observer dangling from his neck, Walker is making his way along Level 2 of the eight-level mega-meeting facility that wraps around *Stadion Narodowy*, Poland’s national soccer stadium. The red-and-silver structure with soaring spires seems to hover, spaceship-like, on the east bank of Warsaw’s Vistula River. While many of the participants look a bit overwhelmed by the size and scope of the conference, Walker appears completely at ease. After all, he’s been attending these climate conferences for half a decade. The singular culture of international climate change negotiations has become, for him, as comfy as a beanbag chair.

The professor gets his UNFCCC credentials through an international nonprofit called Mediators Beyond Borders (MBB), one of several hundred UNFCCC “official observer organizations” that have

sent representatives to Warsaw. Like MBB, most observer groups are NGOs (non-governmental organizations). Their missions include environmental advocacy (The Nature Conservancy, Climate Action Network, Rainforest Alliance, for example), philanthropy (Carnegie, Rockefeller, Clinton), humanitarian aid and development (Save the Children, Family Health International), higher education (MIT, Rutgers, Stanford, Oxford) and research (Max Planck, Brookings, Woods Hole). There are faith groups and indigenous peoples groups. There are groups dedicated to wildlife, to environmental justice, to business and industry.

Working in troubled places such as Colombia, Israel and Sierra Leone, Walker’s group builds local partnerships for unity and peace founded on mediation and other conflict-resolution strategies. As co-director of MBB’s Climate Change Project, he and his colleagues are lobbying to weave the language of peaceful conflict resolution into the final climate agreement. Ultimately, they’re promoting the inclusion of

a single sentence in Article 14 of the negotiated text: “Recognizing that conflicts and disputes are an inevitable and adverse effect of climate change, the Parties are encouraged to use mediation, conciliation, arbitration, and actions before the International Court of Justice to settle their climate change conflicts and disputes.”

Since 2009, Walker and the MBB team have been boarding jets to all corners of the Earth — Denmark, Qatar, Mexico, South Africa, Germany and now Poland — carrying that one critical sentence in their pocket, sharing it with anyone who will listen.

“Side events” are one place they find receptive audiences. In Warsaw, Walker shares the MBB message with about 80 conferees at one of these unofficial presentations given by observer groups as add-ons to the official negotiation sessions. Holding a microphone and pacing about the room energetically, “he gets everyone involved, asking questions,” MBB ambassador and attorney Suzanna Norbeck reports.

Exhibit booths are another platform for getting the word out. One morning during the conference’s first week, Walker is deep in conversation with an African delegate who has stopped by the MBB booth, one of 150 lining a mazelike Exhibition Hall. While most display piles of glossy handouts or even play videos on a continuous loop, MBB’s sports a few fact sheets printed modestly on tinted computer paper. Instead of full-color brochures, Walker and his team rely on dialog.

The African delegate identifies himself to Walker as a member of parliament in Namibia and a marine engineer desperate to short-circuit his country’s fast-spreading desertification by “greening” the Kalahari. “Namibia is not receiving enough rain,” says the man named Moses. “Animals are dying. People



are chopping down trees for income. We have to give them another option, low-cost technology for the grassroots, cheap, so they will stop cutting the trees.” Walker listens as Moses’s words tumble from him urgently, as if he feels the blade of the axe with every syllable. Handing Moses his OSU business card, the professor suggests they continue the dialog by email.

As a key MBB team member, Walker alternates shifts at the booth with several others, including founding member and Climate Change Project co-director Mark Kirwin, an attorney who also runs the Kirwin Foundation dedicated to international relief efforts. “We’re so lucky to have Gregg’s vast experience in mediation, international negotiation and even forestry,” says Norbeck. “He follows progress on the climate talks every day. He’s a perfect resource for MBB.”

During his stay in Warsaw, Walker exchanges business cards with a professor at the University of Mumbai, a regional director for the Clinton Foundation’s Climate Initiative, the climate change coordinator for FANRPAN (Food, Agriculture and Natural Resources Policy Analysis Network) in Pretoria, and a trustee with the Shree Vivekanand Research and Training Institute in

Mumbai. And that’s just a drop in Walker’s orange rucksack. Once he gets home, he’ll reach out to his myriad contacts in hopes of broadening his network and fostering new relationships that can grease the path to a climate treaty favorable to peaceful conflict resolution.

Climate Wordsmiths

Switching hats again, from advocate to scholar, Walker leaves Norbeck in command of the booth and charges down the corridor toward the Crakow Room. “This should be interesting,” he says, slipping into a space dominated by a massive rectangular table where delegates from 40 or 50 countries sit at microphones. A facilitator is leading the discussion: the hyper-detailed fine-tuning of a report on climate change adaptation strategies. As the working group debates the relative merits of certain verbs (“urge” versus “encourage”), adjectives (whether “serious” should modify “shortfall”) and terms that can obfuscate rather than clarify (“Leverage” is just government jargonese,” grouses a Canadian delegate), Walker — who has been scribbling in a spiral notebook — leans over and whispers, “You wonder how they can ever reach consensus.”

International negotiation — legally precise, infinitely complex



Walker is trying to unravel a discursive Gordian knot unprecedented in human history.



Following the dialog at a plenary session requires concentration and acronym proficiency. (Photos: Lee Sherman)

and exceedingly slow — is one of Professor Walker’s life-long fields of study. What better laboratory for a scholar of multilateral consensus-building than this worldwide endeavor to push back global warming? As an expert on the U.N. Law of the Sea Convention — a worldwide treaty forged by 160 nations between 1973 and 1982 — Walker thought he had seen the ultimate in international consensus. “At the time,” he says, “the Law of the Sea was the most complex multilateral international agreement ever.”

Not anymore. As Walker globe-hops from climate conference to climate conference, he is trying to unravel a discursive Gordian knot unprecedented in human history. To a scholar, it’s both maddening and captivating. “I’ve been studying, teaching and writing about international negotiations for 25 years — the Law of the Sea, the General Agreement on Tariffs and Trade (GATT), arms control negotiations and agreements,” he says. “But now I’m seeing language used in ways I’ve never imagined.”

Take the word “intervention,” for example. “Every time someone speaks at a plenary session, it’s called an intervention,” Walker explains. Another odd usage is the term “non-paper,” which refers to certain reports submitted by delegations. “I asked one of the delegates, ‘Why are they called non-papers?’” Walker recalls. “He said, ‘I think it’s because we don’t want it to sound official.’ So it’s not a formal paper like a submission. It’s more of a discussion piece.”

Walker is gleaning from the talks a “representative sample” of the formal and informal papers and discussions that reflect the broad diversity of the overall “discourse,” which he defines as “any language-based communication.” He then uses his original Unifying Negotiations Framework to sort and organize the material. He created the framework with fellow researchers Steven Daniels of Utah State and Jens Emborg of the University of Copenhagen. Published recently in *Conflict*

Resolution Quarterly, it “draws attention to cultural, institutional, motivational and other factors for organizing and interpreting the discourse.”

From its initial focus on fossil fuel reduction, the UNFCCC has over the years broadened its scope. That’s because even if the parties agree to (and then abide by) a severe reduction in emissions going forward, the greenhouse gases already in the atmosphere will warm the planet for many decades to come, scientists agree. Island nations, coastal communities and arid countries already are facing severe challenges from climate-related inundation, flooding and drought. To address the escalating threats, the convention now stands on “four pillars”: mitigation (reducing greenhouse gases), adaptation (building resilient communities), technology (creating and disseminating low-emissions energy sources) and finance (contributing to various “green funds” to assist poor countries). Other hot-button topics in Warsaw include gender (the role of women in climate mitigation and adaptation), capacity building (empowering local communities with technology and know-how) and “loss and damage” (compensation for climate-related displacement and destruction).

The gray-bearded academic who schlepps two laptops, two cell phones and an iPad in his rucksack has been a steady presence at UNFCCC since Barcelona in 2009. He’s brimming with nonstop stories that begin, “When I was in Doha (or Cancun or Durban or Bonn)...” Usually, he finances his travels personally by teaching extra classes and, as an adjunct professor in OSU’s College of Forestry, facilitating collaborative projects for the U.S. Forest Service. For the Warsaw trip, he received a Faculty Internationalization Grant from the university. Still, he’s traveling on the cheap as he always does, riding mass transit, avoiding fancy restaurants (he munches on trail mix in lieu of lunch) and steering clear of cushy digs (he rents a utility apartment with a fridge and a stove). At the



At the University of Warsaw, Walker (front left corner) records notes in a spiral notebook, one of dozens he has filled during his climate research. (Photo: Tomasz Sobiecki)

Cancun conference in 2010, he took a 20-minute dip in the Gulf of Mexico, but his heart wasn't in it. Those sorts of frills (pearly beaches, turquoise seas) make him uncomfortable. He dried off and went back to work.

Acronym Soup

The No. 1 tool in Warsaw is talk. The lingua franca is English. For those who need it, simultaneous interpretation is available in six other languages through headsets. But even native English speakers often find themselves in need of transla-

tion. That's because international climate negotiations have their own arcane vocabulary, much of which swims in an opaque soup of acronyms. Every discussion is larded with terms like NAMA, LAPA and NAPA; RINGO, BINGO and ENGO; ADP, MRV, GHG and LDC; SBI, AOSIS, UNEP, REDD, REDD+ and LULUCF. This alphabetic shorthand has the effect, whether intended or not, of sanitizing the meaning behind the symbols.

In Warsaw, where tensions between rich and poor nations

loom large and the dialog's glacial pace incites widespread discontent (and even a last-minute walkout in protest), debate on one big topic hinges, in the end, on one little word. The final negotiation session on loss and damage — how to compensate countries for climate-related death and destruction — comes down to 11th-hour word wrangling over the preposition “under.”

As Walker tells it, a delegate from Fiji, speaking on behalf of the G77 & China coalition, stated that the developing countries were “on the

“It’s Nice to Say Something”

Universities mostly watch from the sidelines

First thing every morning at the UNFCCC meeting in Warsaw, Walker attends meetings in his capacity as a steering committee member for a coalition of organizations called RINGO (Research and Independent Non-Governmental Organizations to the UNFCCC).

“RINGO is for universities, think tanks and NGOs doing research on climate change,” Walker explains.

On the fifth day of the conference, he joins his fellow RINGO leaders in the Crakow Room to recap yesterday's events. By the time the meeting comes to order, several dozen researchers and university students from around the

world have wandered in, eager to share their scientific aspirations with like-minded conferees. There's a Swedish sociologist working on crisis management, a Japanese researcher studying tech transfer, a Canadian student investigating ecological restoration of marine environments. There are scholars from Ontario's University of Waterloo, from Sweden's Gothenburg University, from the U.S.A.'s Swarthmore, Duke and the University of Colorado. There's a biologist from Honduras, an environmental law expert from Stockholm, a chemist from the Netherlands.

For university researchers and

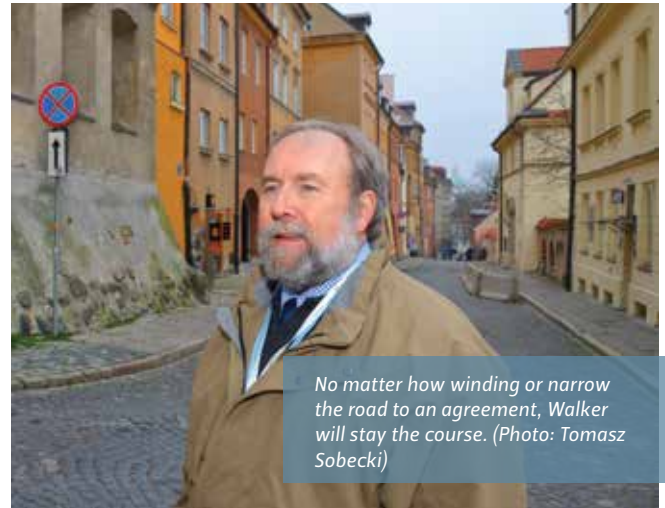
students, RINGO meetings are one of the few places they get to speak out and be heard. “It's nice to sit at the table and say something,” one student remarks, alluding to her status as a silent observer during the delegates' negotiating sessions. In fact, as neutral third parties, observers often are shut out of the talks altogether. Someone suggests creating an online network, a “database of expertise” where RINGOs can connect and share. As the idea gains traction, a flurry of business cards is exchanged. Walker notes, “A number of research collaborations have come out of RINGO in the past.”

brink of consensus,” agreeing to “every single word of the document — except for ‘under.’ Then a delegate from the Philippines linked the word ‘under’ to trust. He called for the bold step of getting that one word out of the way. Next, a delegate from Bangladesh asserts that the parties are still a world apart if the word ‘under’ remains in the text.” The conflict, which may seem trivial on the surface, arose from this question: Should the mechanism for loss and damage be incorporated “under” the existing Cancun Adaptation Framework (negotiated in Mexico in 2010)? Or should the delegates create an autonomous, stand-alone mechanism, a type of international FEMA (the Federal Emergency Management Agency that handles natural disasters in the United States)? Despite the protestations, “under” remained in the final wording of what is now known as the “Warsaw mechanism” for loss and damage.

Words may seem to be a weak weapon against mass extinction, but taken as a whole they embody the spirit of collective strength that drives the UNFCCC process. That spirit rejects alarm, panic and despair, instead embracing reason, calm and optimism. When, on the first day of the conference, Philippines delegate Yeb Sano wept openly at the plenary session as he pleaded for action just hours after Super Typhoon Haiyan (which he characterized as an “extreme climate event”) had crashed through his country, the horrifying stakes of unmitigated greenhouse gases burst into the polite dialog. For a moment, the world’s delegates shared Sano’s anguish at what he called the “madness” of the climate crisis. But just as quickly, they turned back to the sterile-seeming business at hand: Drafting an international climate change agreement to replace the recently expired Kyoto Protocol by 2015, when the UNFCCC convenes in Paris.

This is where Walker digs in as a researcher. For one thing, he’s trying to ferret out the “dominant discourses” that drive this vast landscape of conversations. Certain mismatched assumptions can sabotage understanding, he asserts.

“The statements of developing countries are often grounded in culture,” he explains. “For them, it’s about survival, about preserving one’s culture and national identity. On the other hand, the developed countries — Japan, Canada, the U.S., the EU — are focused on economic sustainability. They tend to emphasize institutional and structural aspects, such as verifiability and accountability. So you wonder, how do we find common ground between a country like the Maldives, which is worried about staying above water, both figuratively and literally, and a country like the U.S. which, while not



No matter how winding or narrow the road to an agreement, Walker will stay the course. (Photo: Tomasz Sobocki)

ignoring the Maldives, is worried about jobs and economic recovery? Choosing between jobs and the environment is, in my opinion, a false dichotomy, but it has become part of the discourse. That’s the kind of stuff I’m interested in figuring out.”

For another thing, Walker is trying to identify how the climate talks correspond — or fail to correspond — with the research literature on negotiation theory and practice. He offers up an example. “International negotiation scholars urge dividing up complex matters into smaller, more manageable decisions,” he says, citing Harvard professor Roger Fisher’s recommendation to “fractionate” troublesome issues. “But the parties to the UNFCCC have committed themselves to an all-or-nothing approach.”

For the Duration

At the end of each long day, Walker and the other conferees head for their hotel rooms, flop on the bed and flip on the TV. On Al Jazeera and CNN, Typhoon Haiyan dominates the news with images of crumpled cities. In Somalia, a cyclone has left a trail of death and debris. In Vietnam and Australia, unprecedented floods have scoured the land, while in the American Midwest killer tornadoes have crushed neighborhoods. In the blue glow of their hotel TV, the conferees watch survivors blink dazedly at the litter of their lives. They observe parents carrying their children through raging floodwaters. They witness the stakes of their deliberations in real time and then, in the morning, they return to the task at hand.

For Walker, that task is twofold: Understanding a process that seems to defy understanding, and winning acceptance of a single sentence amidst the clamor of 10,000 voices. Temperamentally, Walker is up to the task, bringing powers of observation honed over decades, an easy-going and gregarious nature and a bottomless font of patience.

One delegate, after listening to Walker’s case for conflict-resolution language, replied, “Everything you’ve told me makes sense, but we have bigger issues to resolve before we get to yours.”

“That’s fine,” Walker answered. “I’ll be here.” **terra**



Shoring Up Our Coasts

Ocean communities plan for climate change by building trust

“The world’s oceans have largely been left out of the mainstream discussion of global climate change.”

— United Nations Environment Programme

Sparkling seas wash the Yucatan Peninsula — the Caribbean to the east, the Gulf of Mexico to the west. So it’s more than a little ironic that ocean and coastal issues were mostly absent from the official agenda when the UNFCCC met on the peninsula in 2010. Even as the azure waves lapped outside the Cancun venue, the negotiators inside talked mostly about land-based issues. As one observer grumbled, the delegates “can’t see the ocean through the trees.”

For Miriah Russo Kelly, an Oregon State University Ph.D. student who was in Cancun for the international climate change conference along with her mentor and adviser Gregg Walker, that oversight was unsettling.

“As the ocean heats up and sea levels rise, many, many, many thousands of people who live in coastal areas are becoming very vulnerable to immense hazards — storm surges, flooding, erosion,” says Kelly. “Quite frankly, if we don’t do something now to mitigate emissions at the international level, many of these communities, many of these cultures, will cease to exist.”

Ocean scientists and non-governmental organizations (NGOs) are pushing hard to broaden the UNFCCC dialog from the current emphasis on forests and agriculture to, for example, ocean acidification and “blue carbon” — the colossal promise of mangroves, sea grasses and salt marshes as carbon sinks.

Since Cancun, Kelly has undertaken a bicoastal study of communities that are preparing for climate change. She has four case studies — two in Oregon (Coos Bay and Neskowin) and two in Maine (Ellsworth and Saco Bay) — where residents are engaged in local or regional climate adaptation planning. “Oregon Sea Grant and Maine Sea Grant have collaborated in the past to do survey research on the perception of climate change in coastal communities,” she says. “While there are some significant differences, Maine is not unlike Oregon. They are dealing with a lot of the same issues that we are.”

As a scholar in environmental communications, she’s digging into the interpersonal dynamics of collaboration and cooperation among people who may share little in common

Miriah Russo Kelly at Oregon’s Neskowin Beach (Photo: Hannah O’Leary)

except locale — fishermen and hotel managers, loggers and grocers, political leaders and homeowners, climate scientists and climate skeptics. “As more and more communities want to adapt to climate change,” she notes, “it’s going to require people to come together, to work together, from very different parts of the community.”

Her focus is the social psychology behind forging strong bonds among disparate members — the “human process of coming together and engaging in negotiations,” as she puts it. Investigating these “human dimensions” of climate change, Kelly’s research questions range from how climate science is used in decision-making to how individual, organizational and leadership roles best facilitate collaboration.

Trust is critical, she says, especially in the emotion-laden topic of climate change. When scientists listen, when they let group members steer requests for data and other scientific input, they win acceptance where they might have met resistance, Kelly is finding. “In all the projects I’ve been studying,” she says, “there is this ‘co-development of knowledge’ happening, where scientists are truly engaging with the community to find out what information they need.”

As a certified mediator who teams up with Walker to conduct conflict-management trainings and facilitate multi-stakeholder dialog, Kelly blends professional negotiation skills with her deep commitment to a healthy planet, a commitment that awakened one day when, at age 12, she was scanning her parents’ book collection for something to read and happened upon Rachel Carson’s *Silent Spring*. “That set me on a path to care about the environment and consider how humans interact with the natural world.”

Kelly is a founding member of the OSU student chapter of Mediators Beyond Borders International. “We do a lot of work on environmental conflict management, training students and others in how to deal with conflict effectively and productively.” Online, visit www.groups.oregonstate.edu/mediators.

AT THE INTERFACE

Anthropologist-turned-engineer brings social science to computing

By Nick Houtman | Illustration by Heather Miller

In the late 1980s, computer engineer Cherri Pancake made a discovery that startled her: Despite the millions of dollars invested in computer hardware and the explosive growth in software, no published research focused on how people actually use these devices.

The issue came up when Susan Utter, Pancake's master's student at Auburn University, wanted to develop software for the supercomputing industry. "My first question was: Who uses these computers?" says Pancake, now a professor in the School of Electrical Engineering and Computer Science at Oregon State University. "What problems do they work on and how do they think about these problems?" When a search of the published literature found no studies on those issues, she saw an opportunity to use skills she had learned in her past as a social scientist. "I couldn't help it. The anthropologist came out," she adds.

In fact, as a graduate engineering student, Pancake had avoided her more than six years of experience as an ethnographer in the highlands of Guatemala. The engineering culture, she found, was not terribly open to someone in the social sciences.

Pancake got her bachelor's in environmental design at Cornell and took graduate courses in anthropology at Louisiana State. A stint in the Peace Corps took her to Peru. Later, as curator of the Ixchel Ethnological Museum in Guatemala City, she collected stories in isolated Mayan communities that had developed their own customs and even distinct languages. Human behavior intrigued her.

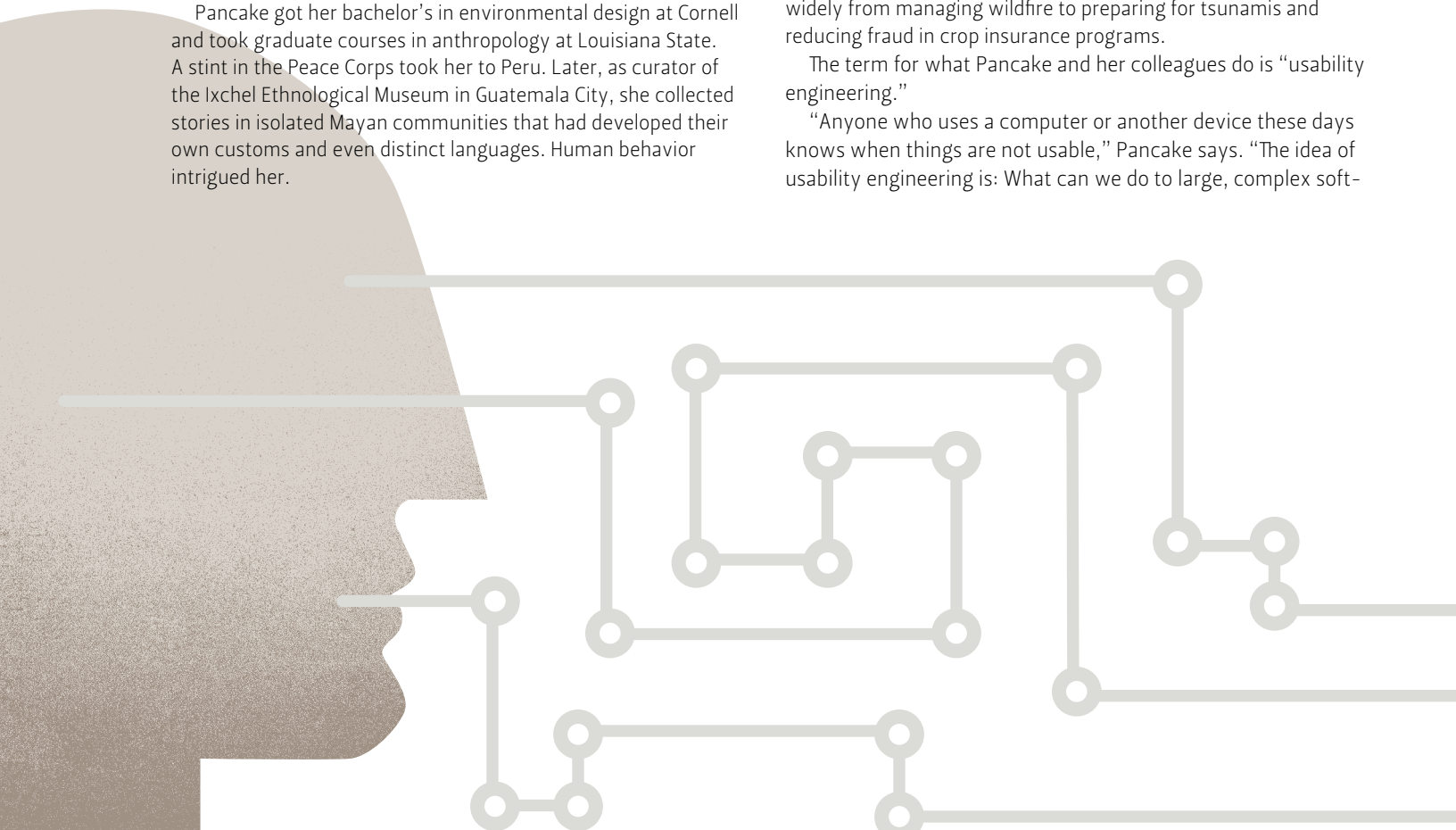
In communicating with her Indian field crew, Pancake observed a skill that would prove to be useful in her engineering career: When conversing in a second language, people tend to take pains to be clear. They choose words carefully and provide context. The same deliberate approach to communication, Pancake has learned, can benefit scientists and engineers.

Cross Cultural

Since then, engineering has changed dramatically. As director of the Northwest Alliance for Computational Science and Engineering (NACSE, pronounced "nacks") at Oregon State University, Pancake combines knowledge of human behavior with expertise in computational systems and software. She and her colleagues work with universities, industry, government agencies and nonprofits to take knowledge from the confines of technical specialties — climatology, hydrogeology, seismic motion in the Earth's crust, wildfire science — and adapt it for use in other fields. Most of their clients are natural resources managers who use models to make decisions based on scientific input. Their responsibilities range widely from managing wildfire to preparing for tsunamis and reducing fraud in crop insurance programs.

The term for what Pancake and her colleagues do is "usability engineering."

"Anyone who uses a computer or another device these days knows when things are not usable," Pancake says. "The idea of usability engineering is: What can we do to large, complex soft-





ware and data systems to adapt them to how users think rather than forcing users to think like the software?”

When Pancake began studying how programmers and software users approach their work, she faced skepticism. She was among the first to ask them questions about why they did things a certain way and whether they had ever tried other methods and failed. “I got them to start recording for me when they reached a dead end,” she says, “when they thought something was going to work but proved not to. And I would have them save scrap paper that they used to jot down notes while they were working. I gave them a box and asked them just to throw it there instead of the trash can. They thought I was nuts.”

At the interface between computers and people, Pancake also applied lessons from her physical anthropology past. “We are humans. We are in these bodies, and they are a blessing and a curse,” she says. “If you get down to it, how we think and even the errors we make have to do with our physical limitations, with how we learn things, how much attention span we have, how many things we can remember at a given time, what goes wrong when we’re trying to form logical models of things.”

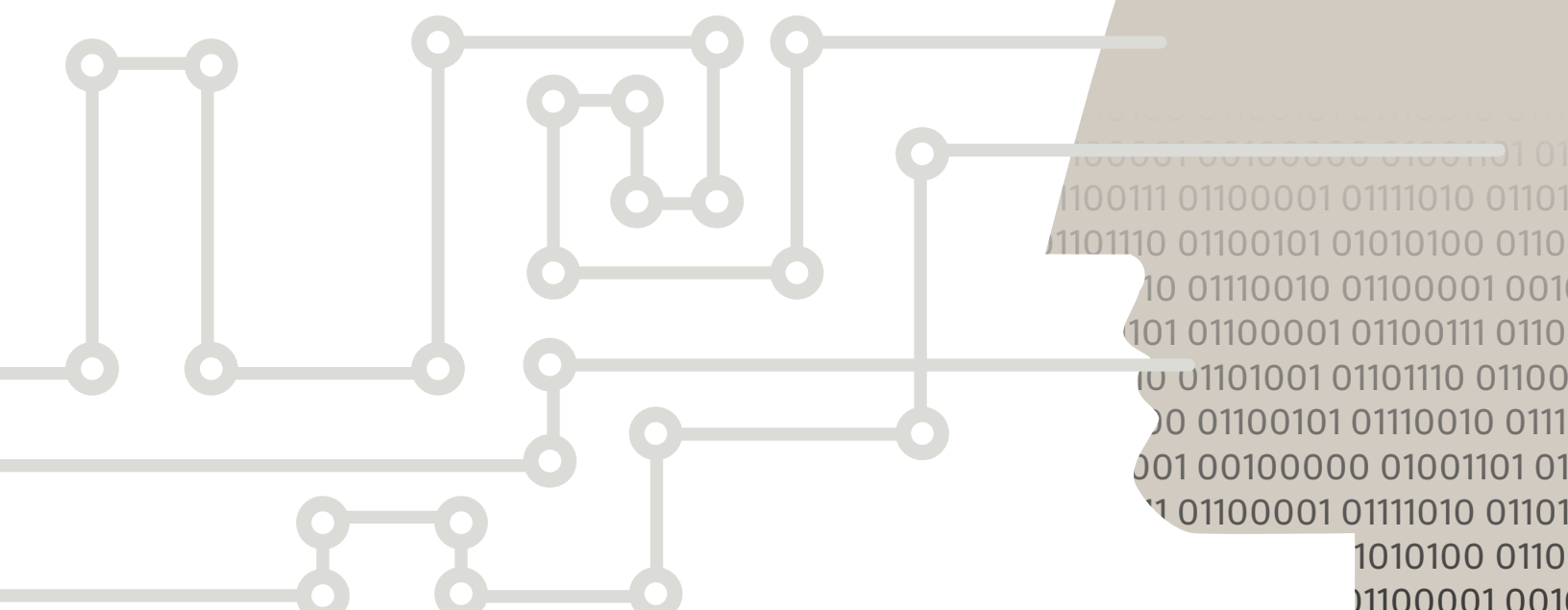
The supercomputing industry (including Intel, HP and IBM)

In OSU’s Kelley Engineering Building, Cheri Pancake leads efforts to adapt software to the preferences of users. (Photo: Hannah O’Leary)

funded her research. “They were trying to understand how to create better tools by understanding why people found their machines so difficult to use. Uniformly, the users of these machines hated the tools and the languages that were being provided to them. And uniformly, the industry people thought they were doing a great job of providing tools.”

With a staff of 15 full- and part-time researchers, NACSE operates out of the Kelley Engineering Building on the OSU campus. Pancake and her colleagues, including Chris Daly, chief scientist, and Dylan Keon, geographic information systems coordinator, have brought together an interdisciplinary team. All have expertise in two or more specialties, from computational geography to crop and soil science.

“I’ve found that if you’ve trained in a science, it’s relatively easy to learn the techniques of a new discipline,” says Pancake, “but what’s very hard is to communicate with people in a different discipline. To me, the great pleasure is in being able to combine all of those threads to solve problems in a different way.”



“I Feel Like Two People”



The Latino spirit imbues both the heart and the intellect of Kayla García, professor, writer and translator

BY LEE SHERMAN
PHOTOS BY CHRIS BECERRA

Kayla García was 16 the first time she conversed with a native Spanish speaker. Riding in the front seat of a taxi in Mexico City, the high school girl from La Crosse, Wisconsin, found herself chatting comfortably with the cabbie just minutes after deplaning. Traveling with her sister and her

feisty 80-year-old great aunt, Helen Jefferson (Aunt Jeffie), and equipped with five years of secondary-school Spanish lessons, this descendent of Daniel Boone was about to discover her other self — or maybe her truer self — at the Instituto Allende, a language school in San Miguel de Allende, Mexico. There, she spent the summer immersed in a second language that would become as familiar as her first, and would shape every aspect of her identity and profession.

A professor of Spanish in Oregon State University’s School of Language, Culture & Society, García has just launched her newest book, *Latino and Latina Leaders of the 21st Century*, which celebrates the “Latino spirit” she

embraced fully as a young girl and then internalized deeply over the decades. In a recent conversation with *Terra*’s Lee Sherman, García shares insights into her life and work.

Terra: Mexico changed your life.

García: It was as if Mexico had gotten into my blood. I had to go back. So I babysat and sold chocolate candy door-to-door to earn money for airfare and another year of summer school. I lived in a studio apartment that was a converted chicken coop.

Terra: Did you return to Mexico?

García: After college, I went back with a one-way ticket and \$200 in my pocket. I found a job, got married and ended up staying for many years. The Mexicans were so welcoming, so inclusive. They would say to me, “You’re not American — you’re a Mexican with a pale skin.” I kept my married name even after my husband and I divorced. I did my Ph.D. while single-parenting my two kids.

Terra: Your first name changed too.

García: My legal name is Kay. But when I lived in Mexico, everybody would add syllables to it because they don’t usually have one-syllable names. And so they called me Kayecita or Kati or Katita or Catalina. I decided I should invent my own second syllable.

Terra: It seems as if you had a natural affinity for Spanish.

García: When I first started learning Spanish, I felt like it was a language that I was remembering — not something I was learning for the first time. Things would just fall into place; they would just make sense. I don’t know if language is part of the human collective memory, but there was an obvious affinity.

Terra: How did you get started as a writer?

García: The first book that I wrote

was *Broken Bars*. It profiles four Latina writers whose stories portray positive female protagonists. So many of the women in Mexican literature are portrayed negatively — they go crazy, or they get killed, or they get shut up in prison, or they die and they never achieve what they want to in life. I went to Mexico City and interviewed all four writers, who received me with open arms. Their work reflects upon the female experience, what it means to be a woman, the pros and cons, the difficulties, the obstacles of living in a *machista* society. Two of them identify themselves as feminists. The other two are obviously concerned about women, but they are reluctant to identify themselves as feminists. That label in Mexico sometimes turns people away. It's sometimes lonely for Mexican feminists. However, there's a lot of sisterhood, a lot of solidarity among the women themselves.

Terra: Your first translation was an offshoot of that book, right?

García: Yes, my next book, *Eleven Days*, was a translation of a novel by one of the authors from the first book, Brianda Domecq. In real life, she was kidnapped and held prisoner for 11 days. Afterward, she wrote a novelized version of the experience. The narrative is an extraordinarily powerful story of how she survived, of the tactics she used to win over the kidnappers, one by one, while blindfolded. Since that translation was published in 1994, I've translated four more books.

Terra: As a translator, you have to move back and forth not only between languages but also between cultural identities.

García: I feel like I'm two people. I'm one person when I'm speaking English, and I'm another person when I'm speaking Spanish. That's my double identity, or *desdoblamiento*. Sometimes it can be confusing, but mainly it's enriching.

Terra: Where is the confusion?

García: Well, sometimes when I'm speaking English there's something I could say more easily in Spanish, so I struggle. I might be talking to you in English but I'm thinking in Spanish. Sometimes things don't quite translate exactly.

Terra: Who are the subjects featured in your new book, *Latino and Latina Leaders of the 21st Century: Ordinary Beginnings, Extraordinary Outcomes*?

García: There are 18 voices in the book, all of them currently active in their field, all serving as role models, all having overcome adversity, set precedents and stayed connected to the Latino community. They include Sonia Sotomayor, the first Latina on the U.S. Supreme Court; news anchor and advocate Jorge Ramos; author and activist Sandra Cisneros; and Benton County, Oregon, District Attorney John Haroldson and his wife, activist Maria Chavez-Haroldson.

Terra: What uniquely Latino traits have helped these leaders thrive?

García: Love for one's family, a sense of humor — the ability to laugh at oneself, and not take oneself too seriously — an appreciation for life, a very open attitude toward people of all kinds. Latino families are very united and strong. Latinos are survivors. They've managed to make the best of really difficult situations. Several of the people I interviewed mentioned their "Latino spirit."

Terra: What about religion?

García: Religion is a source of strength for some. Others expressed an important spiritual life, but not

necessarily connected to organized religion. The Catholic Church has some aspects that are oppressive of women. So while the feminists have not rejected religion and spirituality altogether, they have transformed it to fit their own needs. Sandra Cisneros, for instance, has invented Buddha-Lupe, who is a combination of Buddha and the Virgin of Guadalupe. Sandra has a tattoo on her arm of the Virgin of Guadalupe sitting like a Buddha statue.

Terra: Most European immigrants strived to become Americanized as fast as possible. The Latino experience is quite different, right?

García: Yes. Both the U.S. and the Mexican governments, for example, have changed their laws to permit dual citizenships so that, legally, people don't have to choose between countries.



“Me siento como dos personas”



The Gas Track

OSU-Cascades undergrad builds a lab while he earns a degree

BY NICK HOUTMAN | PHOTOS BY STEVE GARDNER

For an undergraduate, Josh Tibbitts faced an unusual problem last winter: where to find a source of high-pressure natural gas for a new research lab. We're not talking about double or triple the pressure that produces the blue flame in your furnace or a kitchen stove — typically less than one-quarter of a pound per square inch (PSI). Tibbitts needed to find a supply at 2,000 PSI.

The senior in the Energy Systems Engineering program at OSU-Cascades in Bend talked with utilities and gas suppliers, but despite some efforts to help, he came up empty-handed. “We got a lot of blank stares,” he says. “Or like they’re thinking, ‘Are you out of your mind? What do you need this for?’ They just thought we were crazy.”

It wasn't the first time Tibbitts had pushed into new terrain. A native of Utah, he moved to Ashland in 2000 where he worked as a building contractor and cabinetmaker. After the recession hit, orders dried up, so he folded his business and enrolled at OSU-Cascades. His timing, it turned out, was perfect. With a \$700,000 grant from the U.S. Department of Energy (DOE), Chris Hagen, assistant professor in Energy Systems Engineering, had just begun building a lab to develop a way for people to pump natural gas into cars and trucks at home. He needed students with skills to move the project along.

Now Tibbitts works as a project manager for Hagen. “I couldn't have been in a better place at a better time,” he says.

The CNG Promise

Hagen's lab could be at the forefront of a change in our driving habits. The United States has a plentiful supply of natural gas, partly based on the controversial practice known as fracking. Running our vehicles on methane, the primary component of natural gas, could reduce our dependence on foreign energy sources. A methane fill-up can also help address the threat of global warming. On an energy-equivalent basis, natural gas produces 5 percent to 9 percent fewer greenhouse gas emissions than does gasoline. DOE's research program, known as MOVE, Methane Opportunities for Vehicular Energy, aims to increase the use of natural gas in transportation.

So, Hagen has subcontracted with researchers at Colorado State University and worked with Czero, an engineering company in Fort Collins, Colorado, to develop a method for compressing and storing natural gas in a vehicle. But there's a problem: This fuel takes up a lot of space. In fact, it takes 127 cubic feet of natural gas, about the size of a coat closet, to equal the energy content of one gallon of gasoline. Imagine filling up your car with the methane equivalent of 10 gallons of gasoline. You'd need a tank the size of a small bedroom.

To give natural-gas vehicles a range comparable to those that run on gasoline, the OSU-Cascades researchers are developing a



system that will pump a lot of methane into a reinforced gas tank. Their goal is to compress natural gas to nearly 3,600 PSI. Moreover, they plan to run the vehicle's engine as a compressor, so drivers can refuel quickly at home.

And that takes us back to Tibbitts' search for a source of high-pressure natural gas. The researchers need a steady, high-volume supply to do experiments. Just breaking in a custom-built test engine will take about 40 hours of continuous operation. "You run (the engine) at low rpm consistently," says Tibbitts, "so the seals really seal before you start working it hard. That's an industry standard. To run the engine for 40 hours straight, we need quite a bit of gas."

After breaking in the engine, they will test it in what they call "fill mode." One of the engine's cylinders has been modified to act as a compressor — pumping natural gas into a storage tank — while the remaining cylinders power the process. Researchers aim for their system to complete a fill-up in less than two hours.

After exhausting sources of natural gas in Central Oregon, Tibbitts was able to strike a deal with Airgas, a national supplier of industrial gases. The company will make regular deliveries of 5-foot-high cylinders of compressed methane.

A Framework for Experiments

That wasn't the only job on Tibbitts' plate. He also coordinated teams of electricians, plumbers, welders and other technicians to construct the heart of the lab's testing facility: a massive steel frame that holds test engines and a 1,400-pound electric motor. Other components include computers to collect and store data and, for the safety of people working in the lab, a half-inch-thick bulletproof Lexan (a tough polycarbonate plastic) shield to separate the pressurized engines from the workspace.

Regular visits from DOE officials kept the pressure on the research team as well. "It was a lot needing to come together at once," Tibbitts says. "There have been times when it got stressful."

Hagen praises Tibbitts' contribution to the project. "Josh really takes to the task and gets the job done," says Hagen. "He takes charge and comes to me only if he has questions."

For Tibbitts, compressed natural gas is part of a holistic approach to energy. "A lot of people want to subscribe to all renewables," he says, "but the truth is that there is no one way. It will take a variety of approaches. Natural gas has benefits for energy independence and provides an economic boost at home. It's something that has to be explored."

Tibbitts plans to graduate in March after completing a capstone project on thermal energy storage for Hydro Flask, a Bend startup company that makes stainless steel, vacuum-insulated water bottles.



(Opposite page) Josh Tibbitts helped to establish an OSU-Cascades lab for testing engines that compress and store natural gas. (Right) Tibbitts and Chris Hagen, assistant professor at OSU-Cascades in Bend, discuss testing protocols on the engine.



The Oh! Zone • Far-out findings from science



(Photo: Lynn Ketchum)

Flight of the Bumblebees

Responding to the sting of declining honeybee populations, Oregon State University entomologists and engineers are planning to track native bumblebees with tiny sensors. Many aspects of bumblebee behavior are unknown, but better understanding may lead to bee-friendly agricultural practices, says Sujaya Rao, an entomologist in the College of Agricultural Sciences.

“Lack of pollination is a risk to human food production,” says Rao, an expert on native bees. “With our sensors, we are searching for answers to basic questions, such as: Do all members of one colony go to pollinate the same field together? Do bumblebees communicate in the colony where food is located? Are bumblebees loyal as a group?”

With support from a \$500,000 grant from the U.S. Department of Agriculture, Rao will work with Oregon State engineering professors Patrick Chiang and Arun Natarajan to design sensors that can fit comfortably on the insects without affecting their behavior.

Landscaping tactics, such as planting flowers and hedgerows near crops, are believed to promote the presence and population of bumblebees, as well as increase crop yields.

High Noon for Forest Fires

Modelers aim to assist policymakers

Decades of fire suppression have put the ponderosa pine forests of Eastern Oregon at risk. Despite being adapted to frequent low-intensity fire, they have accumulated high fuel loads. Forest managers must decide when to let low-intensity fires burn and where to invest in costly fuel reduction treatments.

With a \$1.2 million grant from the National Science Foundation, Tom Dietterich, distinguished professor in the Oregon State College of Engineering, is leading a team of OSU researchers to develop computational methods for optimizing these forest management decisions. The team has developed the Oregon Centennial Fire Simulator, which predicts the consequences of management decisions over the next 100 years. With this grant, they will provide forest managers, landowners, timber-industry representatives and other stakeholders with methods for optimizing and visualizing forest management policies.

OSU collaborators include Ron Metoyer in Engineering and Claire Montgomery and Heidi Albers in the College of Forestry.

Where the Wild Whales Are

Researchers map genetic variation across the seascape

Some researchers are gene hunters. They track wildlife populations by following differences and similarities in genetic profiles. Now, a research team led by Scott Baker, associate director of OSU’s Marine Mammal Institute, is helping scientists visualize genetic information from individual whales across the ocean. A member of Baker’s team, Ph.D. student Dori Dick in the College of Earth, Ocean, and Atmospheric Sciences, is developing mapping tools and a website, geneGIS.org.

When fully operational, the software will enable researchers to browse and summarize genetic records to understand how whale populations mix and move. The Office of Naval Research provided funding support.

“The goal is to enable researchers to visualize and study spatial patterns of genetic variability,” says Dick. “This information is important for conservation and management purposes. It could indicate that different groups of individuals require different management strategies.”

In February, Dick led a workshop on geneGIS tools at the OSU Fisheries and Wildlife Graduate Student Association’s annual symposium.





Oregon State Researchers Honored for Major Achievements

AWARD: *Something conferred as a reward for merit; a prize, reward, honor* (Oxford English Dictionary)

Remote Sensing of the Oceans

DUDLEY CHELTON

Distinguished Professor, College of Earth, Ocean, and Atmospheric Sciences

AWARD: 2013

William T. Pecora Award for achievement in Earth remote sensing

SPONSORING ORGANIZATION: NASA and the U.S. Department of the Interior

For more than 30 years, Chelton has led efforts to improve satellite-derived measurements of the four primary ocean variables that can be sensed remotely: sea surface height, surface winds, sea surface temperature and ocean surface biological productivity. His work has led to new hypotheses in ocean studies and has inspired many follow-up investigations by the ocean remote-sensing community.



Disease-Resistant Crops

BRETT TYLER

Director of the Center for Genome Research and Biocomputing, College of Agricultural Sciences

AWARD: Friendship

Award of China

SPONSORING ORGANIZATION: People's Republic of China

Major advances against some of the world's most devastating plant diseases are starting to emerge from more than a decade of international scientific collaboration led by Brett Tyler. The holder of the Stewart Chair in Gene Research at Oregon State, Tyler coordinates a worldwide research program on plant pathogens known to scientists as *oomycetes*.



New Chemical Elements

WALTER LOVELAND

Professor of Nuclear Chemistry, College of Science

AWARD: Glenn T. Seaborg Award for Nuclear Chemistry

SPONSORING

ORGANIZATION:

American Chemical Society

Loveland has contributed to the development of experimental techniques and theoretical understanding that have led to the synthesis and discovery of new chemical elements. His research on nuclear reactions has contributed to the understanding of fusion and the stability of products that result when nuclei collide. He has also applied nuclear chemistry to track the dispersal of pollutants in the environment.



BITS & PIECES • News Briefs from Oregon State

Growing Poplar

Forest geneticists at OSU have created genetically modified poplar trees that grow faster, have resistance to insect pests and are able to retain expression of the inserted genes for at least 14 years. The advance could prove especially useful in the paper and pulp industries and in an emerging biofuel industry that could be based on hybrid poplar plantations, says Steven Strauss, distinguished professor of forest biotechnology in the OSU College of Forestry.

Coastal Erosion

Oregon's beaches are changing. An assessment along the Pacific Northwest coast from the late 1800s to present found that while most beaches are stable or slightly accreting (adding sand), many in Oregon have experienced an increase in erosion hazards. Some of the hardest-hit areas include Neskowin and Beverly Beach. In those areas, shoreline change rates have averaged more than one meter of erosion a year since the 1960s, says Peter Ruggiero, an OSU coastal hazards specialist.

Drug Interactions

Statin drugs are a frontline treatment for cholesterol, but a new study has found that other drugs interfere with statin metabolism. Such interactions can contribute to a common side effect of taking statins: muscle pain. The problem has been known for some time, says Matt Ito, a professor in the OSU College of Pharmacy and president of the National Lipid Association, which funded the study. Physicians and pharmacists could often choose different medications or adjust dosages to retain the value of statin drugs without causing this side effect.



Carnivores in Retreat

Researchers call for global conservation initiative

In ecosystems around the world, the decline of large predators such as lions, wolves and cougars is changing the face of landscapes from the tropics to the Arctic. An analysis of 31 carnivore species shows how threats such as habitat loss, persecution by humans and reductions in prey combine to create global hotspots of carnivore decline.

More than 75 percent of 31 large-carnivore species are losing ground; 17 species now occupy less than half of their former ranges. Bill Ripple of OSU's College of Forestry led the international review of more than 100 published studies.

"Globally, we are losing our large carnivores," Ripple says. "Their ranges are collapsing. Ironically, they are vanishing just as we are learning about their important ecological effects." (See "High Alert," *Terra*, spring 2007.)

The researchers, including OSU's Robert Beschta and Michael Nelson, call for an international initiative to conserve large predators in coexistence with people.



Federal Boost for OSU Spinoff

Department of Energy supports NuScale

A promising new form of nuclear power that evolved in part from research more than a decade ago at Oregon State University has received a significant boost: up to \$226 million in funding to NuScale

Power from the U.S. Department of Energy. NuScale began as a spinoff company based on the pioneering research of OSU professor Jose Reyes. It has become one of the international leaders in the creation of small "modular" nuclear reactors. (See "Power Surge," *Terra*, spring 2009.)

This technology holds enormous promise for developing nuclear power with small reactors that can minimize investment costs, improve safety, provide flexibility in meeting power demands and produce energy without greenhouse gas emissions.

NuScale has developed unique and proprietary break-through technology for an innovative, simple, safe, economic and scalable small modular reactor.



Partners Raise \$1.5 Million for Earthquake Research

Resilience and safety are top priorities

Looming in Oregon's future is a massive 9.0 earthquake. Roads, bridges, buildings, sewers, gas and water lines and lives are at risk. To meet the threat, Oregon State University and partners from government and industry have created a research initiative known as the Cascadia Lifelines Program.

They have raised \$1.5 million to support studies of building design, soils, landslide vulnerability and other issues. (See "Oregon 9.0" in *Terra*, spring 2013.)

"With programs like this and the commitment of our partners, there's a great deal we can do to proactively prepare for this disaster and get our lifelines back up and running after the event," says Scott Ashford, director of the new program. The Kearney Professor of Engineering in the Oregon State College of Engineering has studied the impact of subduction zone earthquakes in much of the Pacific Rim.



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.

Neighbors in Tech: Advantage Partners

HP and Oregon State collaborate on next-gen products

In most neighborhoods, talk turns to family, weather or sports. But when the neighbors include a global high-tech company and the state's largest research university, the conversation bends to technology.

"In choosing a location for its Advanced Products Division in 1974, key criteria for HP included quality of life and proximity to a great engineering university

and talent pool," says Tim Weber, vice president and general manager at HP. "Corvallis and OSU fit the bill for HP. From the high rate of hiring OSU engineering graduates to joint research efforts, HP and OSU have enjoyed a strong partnership over the years."

Here are examples of ongoing collaborations between HP and Oregon State University.

Magnetic Alignment

The most common type of desktop printer uses inkjet technology. However, researchers are refining the underlying process — the precise application of liquid drops to paper, plastic and other substrates — to make new electronic circuits. "Just like you print things on paper, you would be able to print a circuit with magnetic materials," says Pallavi Dhagat of the School of Electrical Engineering and Computer Science. With funding from HP and OSU, researchers developed a method for controlling the alignment of magnetic particles in each drop. Standard techniques align magnetic particles in a single direction, but the new process allows particles to be arranged in radial, spiral and other patterns. The benefits will be seen in improved circuit components such as antennae and inductors.

Sensors for Health Monitoring

As we age, health-care costs climb. Researchers are looking for efficiencies to keep us healthy and in our own homes. A collaboration between OSU's VLSI (very-large-scale integration) Research Group and HP aims to produce a health-monitoring device the size of a Band-Aid. Combined with HP's Richter sensor, which measures acceleration as an object moves, a wireless system could transmit data to health professionals. Information about how a person walks, for example, could indicate a need for treatment. Existing systems for monitoring heart rate and respiration use bat-

teries and tend to be bulky. The OSU-HP goal, says Patrick Chiang, OSU electrical engineer, is a lightweight, convenient device that harvests energy from a base station.

Cool Operator

Computers, inkjet printers and many other electronic devices produce heat that can limit performance, so designers and manufacturers resort to many different cooling technologies. One set of materials, known as piezoelectrics, produce voltage in response to a mechanical stress and are already used to eject the ink in some inkjet printers. However, most of these materials contain lead, which is gradually being phased out of industrial products. Researchers at OSU have demonstrated novel lead-free materials that are piezoelectric and can extract heat from their surroundings. "The properties of lead-based materials are so good, they will be hard to replace," says Brady Gibbons, associate professor of materials science and mechanical engineering. "But the market is so large, the payoff could be huge." In the course of a five-year collaboration with HP, Gibbons, his colleague David Cann and student researchers have discovered a class of lead-free ceramic materials that have excellent piezoelectric properties and great potential for use in solid state cooling applications. One patent has been received, and several more are in the pipeline. Support has been provided by HP, the Oregon Metals Initiative, the Oregon Nanoscience and Microtechnologies Institute (ONAMI) and OSU's Venture Development Fund.

To discover what the **Oregon State University Advantage** and the **Advantage Partnerships program** can do for your business, contact Ron Adams, Executive Associate Vice President for Research, 541-737-7722. oregonstate.edu/advantage



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The familiar scent of rosemary oil can be traced to spherical particles, known as trichomes, on the plant's needles. The oil helps protect the plant from pests and makes it a favorite herb in Mediterranean cooking. See "High Beams," Page 14. (Photo: Teresa Sawyer)

