

# tterra

A world of research & creativity at Oregon State University · Winter 2013



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Master Naturalists share their devotion to the land

### A PLACE OF BELONGING

Immigrants bridge  
two cultures

### SEX IN PLAY

Media messages  
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*The midnight sun shines on "main street" at the North Greenland Eemian Ice Core camp, as the flags of participating nations blow in the Arctic wind. See "Ice Core Diaries," Page 26. (Photo: Julia Rosen)*

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Oregon State is Oregon's leading public research university with more than \$281 million in research funding in FY2012. Classified by the Carnegie Foundation for the Advancement of Teaching in its top category (very high research activity), OSU is one of only two American universities to hold the Land-, Sea-, Sun- and Space-Grant designations. OSU comprises 11 academic colleges with strengths in Earth systems, health, entrepreneurship and the arts and sciences.

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On the cover  
**Master Naturalist Dave Bone surveys wildlife  
at Lake of the Woods in Klamath County.**  
(Photo: Lynn Ketchum, Extension and  
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## STAYING IN TOUCH

When my mother came to the United States, she never intended to stay. She grew up in the Netherlands and, when she was 8, her mom and dad moved her and her three siblings to Long Beach, California. Despite occasional trips back to Europe courtesy of Shell Oil, her dad's employer, she missed familiar places, her friends, her grandparents.

Kids in Long Beach didn't understand why she wasn't overjoyed to be in America. Europe, after all, was still recovering from a war. It was 1927.

As Mom finished high school, threats of another war grew abroad. She never did go back to live in Holland. She became a citizen of the United States, married a Dutch sailor and eventually bought a home in which to raise her family. She always spoke her native language with her parents, but at work and in the community, it was English. She was determined that would be my language, too.

I've heard similar stories from other descendants of European immigrants. Many are unable to talk with their extended families in their ancestral language. We may have old photos of great-aunts and great-uncles and great-grandparents at dinner parties in unfamiliar places. We may have even gone back to see the homes they lived in. But we've lost the language link to the culture that nourished our families. Now, we visit as tourists.

Susana Rivera-Mills is writing another version of this story. Her research on language and cultural ties shows how people from Mexico, El Salvador and other Spanish-speaking countries stay connected to their past (see "A Place of Belonging," Page 20). Whether families trace their roots back one generation or five, they often retain an identity linked to their traditions. Her work can help us understand this complex society we call America.

My mother had her eyes focused on the future. America is the only home my sisters and I have ever known. Fortunately, most of our Dutch relatives speak English. We stay in touch.

Editor



*Susan Houtman, right, came to the United States as a child but never lost the language of her homeland.*



# Volunteers for Science

Citizens contribute valuable data

RICK SPINRAD, VICE PRESIDENT FOR RESEARCH



I get to call myself a scientist because I've got a Ph.D. in oceanography, but is that a prerequisite? No. Before there were "scientists," even "ordinary people" did science. They learned to grow crops and domesticate animals. They associated the heavens with the seasons and events on Earth. Keen insight into plant properties, animal behavior and weather patterns is what gave early *Homo sapiens* the evolutionary edge in a

dangerous world. Today, we call this native environmental acuity "traditional ecological knowledge." It's citizen science at its most fundamental.

In Oregon and across the continent, citizens contribute immeasurably to the scientific process. Bird watchers document changes in the abundance and range of bird species through the annual Audubon Christmas Bird Count. Amateur astronomers working from their backyards discover comets and supernovae. School children analyze streams, lakes and coastal waters, learning fundamental scientific principles as they provide valuable data to their communities.

## Strength in Numbers

But there's a worrisome wrinkle, the uncertain mash-up of amateur enthusiasm with demands for analytical rigor. Science operates through four basic steps: expression of an hypothesis, controlled experimentation, analysis of results and statement of defensible conclusions. Citizens participate in this process by making observations and sometimes helping with experiments. But designing those projects and interpreting their results takes strict adherence to established methods and time-tested procedures. That's what gives conclusions their validity and allows scientists to broaden understanding.

Nevertheless, a vast pool of data gatherers can be a boon to researchers doing large-scale studies. Increasingly, scientists and research organizations are enlisting and training regular folks. Citizens are measuring rainfall, counting insects and monitoring the annual life-cycles of plants. For these kinds of studies, there's no way that scientists can collect

the mountains of data that tens of thousands of binocular-wielding volunteers can capture in a single day.

Oregon State's newly launched Oregon Master Naturalist program (see "Corps of Discovery," Page 12) represents another type of citizen science, one that centers on education and outreach. People with a bent for exploration and a love of their local environment are meeting in person with scientists, usually university researchers, to learn about their own eco-regions. After 80-plus hours of training that takes place online, in the classroom and outdoors, these Master Naturalists are ready to extend their knowledge to the broader public as volunteers with local nonprofits and state agencies. Oregon's is one of about 40 similar programs nationwide.

Also, to the non-scientific observer, research often verges on the edge of being esoteric, so the citizen scientist can be an important link between the specialist in the field and the public. The urgent scientific challenges of our day require not only informed decision-makers but also a mobilized citizenry. Scientists use rigorous methods to conduct experiments, but their findings alone will not solve problems or shape policy. State and national agencies, city planners, county commissioners, lawmakers at every level of government and, ultimately, voters will decide whether and how to act upon the science.

That may be the most powerful promise of citizen science. A citizenry that is not only scientifically sophisticated but also personally committed is our best hope for collective action on behalf of a healthy planet.







## The Hidden Dangers of Flame Retardants

Chemicals may harm brain development in young children



Your old sofa, as comfy as it is, could be a hazard to your children's health. That's because fabrics and foam manufactured before 2005 likely were treated with flame retardants like PBDEs. These toxic chemicals may affect brain development in young children, research suggests.

A new study at Oregon State is designed to help clarify the risks. A multidisciplinary team of researchers at the Corvallis and OSU-Cascades campuses is monitoring 100 preschoolers in both communities, looking at chemical exposure and children's behavior, particularly their ability to self-regulate, a key to school readiness.

"Given the fact that the numbers of children with neurological and cognitive disabilities is on the rise in the developing world, many have hypothesized that exposure to chemicals may be a contributing factor," says Molly Kile, the public health environmental epidemiologist who is leading the study.

## Depths of Knowledge

Instruments on the seafloor will record data inside the Earth

The strange device with the Beaver-orange dome looks like a giant wok with a lid. But you won't find a stir-fry inside. Made of a composite material — fiberglass, epoxy resin and glass micro-spheres — it was designed by Oregon State researchers to protect sensitive instruments from crushing pressure 10,000 feet under the sea.

Roberto Albertani in the College of Engineering and Adam Schultz in the College of Earth, Ocean, and Atmospheric Sciences call their invention a "multiphysics bottom lander." Its dome shape resists disturbances from ocean currents and



trawl nets. Coupled to a detachable, dissolvable concrete base, it will be packed with instruments to collect geophysical data. By measuring seismic waves as well as magnetic and electrical fields deep in the Earth, it will reveal important clues about the planet's interior.

In addition, Schultz is using it to aid the emerging offshore power industry. "We can advise them if their designs emit detectable levels of electric or magnetic fields, or if they cause the seafloor to vibrate," he says. "Either could potentially be a concern to the fishing industry, as well as to the environment."

## BITS AND PIECES • News Briefs from Oregon State

**HEART HEALTH.** It's not just hype. Fish oil really is good for you. That's the conclusion of biochemist Donald Jump after analyzing a number of studies, some with conflicting findings. The fatty acids found in fish and certain other foods do indeed help stop the onset of heart disease. If you already have heart disease, however, the benefits are less clear.

**MEADOW LOSS.** Just as glaciers are shrinking on mountain slopes, so are meadows. Alpine meadows — high-altitude ecosystems of native grasses and shrubs splashed with wildflowers — are giving way to tree invasion across the American West, says forest scientist Harold Zald. Climate change, fire suppression and invasive species are the culprits.

**SCALPEL SLIP-UPS.** Young surgeons are more prone to errors when there's commotion in the surgical suite. During a simulated gall bladder operation, mistakes by inexperienced surgeons spiked when noises, questions or conversation disrupted the O.R., systems engineer Robin Feuerbacher of OSU-Cascades discovered in a joint study with the Oregon Health & Science University.



## It's Only Natural

### Methane-fueled vehicles could be an energy boon

The way Americans fuel their cars and trucks is being re-envisioned, and OSU-Cascades is in the front seat of the new thinking.

Energy engineering researcher Chris Hagen is leading a \$700,000 project to design a compact engine that runs on natural gas and can be refueled at home. One of 13 innovative projects funded by the U.S. Department of Energy to tap the vast stores of natural gas in the United States, it seeks to overcome current barriers to fueling vehicles with natural gas. The goal is a smaller, lighter engine that not only runs the car but also compresses natural gas for storage.

## Twice the Rice

### Adding vitamin B1 may boost nutrition and immunity

Through genetic engineering, a new breed of rice could fend off crop-damaging diseases and improve human health at the same time.

Vitamin B1 (thiamine) helps plants resist such scourges as bacterial leaf blight and "rice blast," big problems in Southeast Asia. At the same time, people whose diets are dependent on white rice often suffer from thiamine deficiency.

Enter Oregon State researcher Aymeric Goyer, a plant biologist in Hermiston. The genes that synthesize vitamin B1 in rice are Goyer's focus. He is collaborating with Pamela Ronald of the University of California, Davis, to develop plants that over-express these genes. Bumping up thiamine and, along with it, disease resistance would mean less pesticide use and greater yields, Goyer says.



## The Road to Ecosystem Safeguards

### Unsnarling the regulatory tangle in transportation planning

When a highway project meets a bog turtle, everything can come to a screeching halt. The project languishes as agencies scramble to find current habitat data and conservation maps for the endangered reptile.

If transportation planners and environmental protection agencies could join hands early in the process, costly delays could be avoided and sensitive ecosystems could be better protected. Enter a powerful new tool designed by researchers at the Institute for Natural Resources based at Oregon State. Using the Integrated Ecological Framework,

planners can address the requirements of the Endangered Species Act and the Clean Water Act from Day One instead of bumping up against them when the project is already moving ahead.

"Particularly for wetlands and endangered species, regulatory conflicts and delays largely result from transportation planners and regulators having insufficient, incomplete or poor-quality data," say OSU researchers Lisa Gaines, interim director for the institute, and Jimmy Kagan. "This new tool will help speed up transportation projects while beefing up environmental stewardship."



Further testing and refinement of the tool is under way with continued support from the Transportation Research Board of the National Academies, which is looking ahead to rolling the framework out nationally.



# Sex in *Play*

From dolls to sports, sexualized culture affects youth

BY NICK HOUTMAN



## Sex may sell everything from magazines to perfume, but the effects of pervasive sexuality in marketing and consumer products go far beyond the cash register.

In 2007, the American Psychological Association released a report — *APA Report on the Sexualization of Girls* — on the impacts of media displays of women as sexual objects. It summarized what psychologists know about how exposure to sexualized images harms children and teens — depression, lowered aspirations, eating disorders, lack of assertiveness, unhealthy sexual behavior, dissatisfaction with their own appearance — and offered recommendations to counteract them.

Two developmental psychologists at Oregon State University are exploring the consequences of sexualization for child development. A team led by Aurora Sherman is delving into girls' career aspirations. She is asking how exposure to the impossibly proportioned but ever popular Barbie might affect their career choices. At OSU-Cascades in Bend, Elizabeth Daniels has focused on media portrayals of women in sports. Her studies contrast the effects of sexualized images with those that show women engaged in athletics.

Taken together, their results have implications for parents and youth organizations. They suggest that it takes media savvy and strong role models to promote healthy development in the face of what the APA calls “the massive expo-

sure to portrayals that sexualize women and girls and teach girls that women are sexual objects.”

### Choices for Girls

Among successful dolls, Barbie tops the list. The manufacturer, Mattel Inc., estimates that one is sold somewhere in the world every three seconds. According to the website [barbiemedia.com](http://barbiemedia.com), the doll's inventor, Ruth Handler, wanted a doll that would expand opportunities for girls. “Barbie always represented the fact that a woman has choices,” she said.

When the APA report came out, Sherman remembers being startled on reading that so little research had been done on the influence of dolls on girls' development. “If we're going to have this conversation about sexualization, how can we overlook the most widely sold plaything on the planet?” she says.

Surprisingly, psychologists are only beginning to look closely at how dolls affect girls' psychological health — their



aspirations, self-confidence, body image and mood. And dolls are just one element of the popular culture that helps to shape attitudes and personality. TV, video games, movies, magazines and websites blare messages about what it means to be a woman or a man and what social expectations stem from gender.

"Toys are just one part of the socialization process," says Sherman, an assistant professor in OSU's School of Psychological Sciences. "But they are a very important part. Barbie displays adult features, and girls love to imagine what it would be like to be an adult."



So, in looking at how dolls affect girls' career choices, Sherman chose to use Barbie in her research. She and her collaborator, Eileen Zurbriggen of the University of California, Santa Cruz, (and chair of the APA task force that produced the 2007 report) designed an experiment in which 37 4- to 7-year-old girls were randomly assigned to play with either a Barbie or a Mrs. Potato Head doll for five minutes. The girls then answered a series of questions about career choices in 10 fields, five typically held by men and five by women.

The results showed that playing with Barbie had a clear impact on girls' career perceptions. Girls who played with the Potato Head doll did not make a distinction between the number of jobs that girls and boys could do. However, those who played with Barbie tended to think that more careers are open to boys than to girls. "It's difficult in social science to find an effect with this kind of treatment," Sherman says. "I was astounded that after so short a time, the girls who played with the Barbie reported such an effect." The team's paper has been submitted to the journal *Sex Roles*.

The focus on youth is a change for Sherman who has specialized in health, social relations and aging. To find girls willing to participate, she worked with Corvallis-area families to explain the nature of the project. "Parents run the gamut from a strong dislike of Barbie to strongly liking her," she says. "I was careful to remain neutral, so I didn't inadvertently bias the pool."

Sherman is continuing her work on the influence of dolls with support from the John C. Erkkila, M.D. Endowment for Health and Human Performance at Good Samaritan Hospital in Corvallis. Her focus is on the impact of sexualized dolls — Barbie as well as Bratz™ dolls (a more sexualized line of dolls made by MGA Entertainment) — on body satisfaction and self-esteem.

Sherman hopes to promote thoughtful discussion about the issues raised by these dolls. "Barbies are here to stay," she says. "They're a very loved, more than 50-year-old cultural icon. They're very engaging dolls. They're serving some kind of need for girls. So what can we do with kids and parents to minimize whatever the detrimental impact might be? If we've got a very well-beloved plaything, what can we do to make it work for us?"

## Women in Sports

Athletics can build girls' self-esteem and confidence, says Elizabeth Daniels, but media portrayals of female athletes can have the opposite effect. They fall into two categories: images of women performing a sport and images of female athletes in sexy poses. "Over the past four decades or so, researchers have studied how female viewers are affected by idealized images of women (i.e., thin, airbrushed, 'sexed-up,' etc.)," Daniels explains. "In general, these images make female viewers feel bad about their own bodies. Almost no research has investigated how female viewers respond to alternative images of women, e.g., female athletes depicted as athletes."

Sports is an important domain for youth and increasingly for girls. Since passage of Title IX in 1972, the participation of high-school girls in athletics has skyrocketed. Today, girls comprise 42 percent of all high-school athletes, and about 180,000 women play college sports.

Unfortunately, media often emphasize female athletes' sexual, rather than athletic, qualities. For example, just before the winter 2010 Olympics, the *Sports Illustrated* swimsuit edition featured skiers Lindsay Vonn and Lacy Schnoor as well as snowboarders Hannah Teter and Claire Bedez in bikinis. Swimmer Amanda Beard appeared nude in *Playboy*. Tennis player Anna Kournikova is the only athlete to be named by *For Him Magazine* as the sexiest woman in the world.

Daniels speculates that profitable endorsement deals may influence some athletes. "Athletes have limited opportunities to gain endorsements, which are far more lucrative than their salaries," she says. "The few endorsement opportunities that do exist for elite female athletes might require a focus on the athletes' sexual appeal. Some female athletes



may agree to participate in a sexualized photo shoot because of a lack of alternatives.”

In her studies, Daniels worked with high-school and college-age students. She showed them images of female athletes performing their sports, photos emphasizing their sexual qualities and sexualized images of models who are not athletes. She asked participants to respond in an open-ended format to elicit their opinions and feelings about the images. “An open-ended format opens up the possibility of responses that I could not have predicted,” she says.

Daniels found that both boys and girls tend to dismiss or devalue the athletic abilities of female athletes portrayed in sexualized images. In contrast, performance images of strong female athletes elicited a positive response. Both boys and girls respected these women’s strength and skills. Girls recognized the athletes as strong role models.

## Taking Action

Images of women performing their sport “could be a powerful counterweight to the overly thin standard portrayal of females currently dominating the media,” Daniels wrote in the *Journal of Applied Developmental Psychology*. “As educators, parents, and social activists call for a change in the content of problematic media,” she adds, “there is a need to suggest alternative imagery such as female athletes depicted as athletes. My research provides the evidence that these images have a positive impact on youth.”

To help girls understand and counter sexual stereotypes, Daniels has shared her results with community and professional groups. She has worked with the Bend chapter of Girls on the Run, an international organization that pairs running with information about nutrition, emotional health and other elements of healthy youth development.

Daniels has expanded her research beyond athletics. She has found, for example, that boys and girls make positive evaluations of images of accomplished women in business and the military.

She is currently examining how girls are judged on social media sites such as Facebook. To date, she has found that girls who use sexy profile photos are perceived negatively by other girls. They are in a tough position, she explains. “They’re inundated with all these media telling them to be sexy and hot, but they are still developing the cognitive skills to understand what happens if they do that.

“We need to have a counterweight to the negative idealized images that create so much dissatisfaction,” she adds. “We need to do a much better job educating youth and families about how to manage media in their lives and to cultivate positive attitudes toward the body.” **terra**



### ELIZABETH DANIELS

At OSU-Cascades in Bend, Elizabeth Daniels (standing) leads an undergraduate research team of Brent Reynolds (left), Desiree Jackson, Taylor McGowan and Emily Clark. The assistant professor of psychology teaches courses in developmental science, gender issues, and research methodologies. She earned her Ph.D. at the University of California, Santa Cruz and completed a post-doctoral fellowship in Sport Psychology at the University of California, Los Angeles. (Photo: Steve Gardner)



### AURORA SHERMAN

In the Oregon State psychology lab, Aurora Sherman, left, and master’s student Pamela Lundberg prepare to interview girls. Before coming to OSU in 2007, Sherman worked in the Psychology Department at Brandeis University and completed post-doctoral study at Wake Forest. She received her Ph.D. from the University of Michigan with an emphasis in lifespan development. She teaches courses in research methods, health psychology, lifespan development and psychology of gender. (Photo: Jeff Basinger)



# Corps of Discovery

MASTERING THE  
NATURAL HISTORY OF  
OREGON'S STORIED  
LANDS AND WATERS —  
AND PASSING IT ON

BY LEE SHERMAN  
PHOTOS BY LYNN KETCHUM

When Mary Crow paddles her kayak on Sparks Lake near Sisters, she can hear the water draining into the lava tubes below. Listening to the water gurgle, thinking about the ancient eruptions that formed Central Oregon's porous landscape, makes her shiver with wonder and delight.

Dave Bone can't stop talking about the wild wolves he spotted in Yellowstone Park last summer. If he tells you the story more than once — about how the pack jostled and tumbled playfully on a meadow where bison grazed, unperturbed — he should be forgiven. His awe is boundless and unabashed.

Crow and Bone are lifelong naturalists. Only on the land do they feel whole. Harvard's Howard Gardner, author of the theory of multiple intelligences, believes this bone-deep connection to the earth is innate. He calls it "naturalist intelligence" or "nature smart." Just as some babies are born with special gifts for music or math, Gardner argues, others come into the world with an exceptional sensitivity to nature.

It is this gift, this abiding passion, that Oregon State University's Oregon Master Naturalist program (OMN) was designed to embrace and extend. "We are building support





*The sun rises over the mudflats of the South Slough near Coos Bay.*

for wise stewardship of the environment and deeper understanding of natural resource management,” says Jason O’Brien who coordinates the program for the Oregon State Extension Service. It is one of nearly 40 similar programs around the nation.

Crow and Bone are two of the first 46 participants to complete all 80-plus hours of training for OMN, which began as a pilot effort on the Oregon coast in 2010. An online curriculum gave them an overview of Oregon’s biology, geology and ecology as well as natural resources stewardship and management. They then met face-to-face with university scientists and other experts for classroom instruction and fieldwork in one of three ecoregions: East Cascades, Oregon coast and Willamette Valley. (Additional ecoregions will be brought into the program pending demand.)

Instruction spanned every perspective: macro to micro, flora and fauna, volcanic and tectonic forces shaping the landscape. One Saturday, the coastal participants

met on the headlands at Cape Perpetua. There, Bob Lillie, an emeritus professor in OSU’s College of Earth, Ocean, and Atmospheric Sciences, told them about geological phenomena like tsunamis and plate tectonics. Another time, the class convened at the Tillamook State Forest, where Frank Burris, an Extension watershed educator, and Glenn Ahrens, an Extension forester, delved into watersheds and riparian zones. Jamie Doyle, an educator with Sea Grant Extension, taught a class on Pacific Ocean fisheries and marine protected areas.

What the graduates do with their expertise looks different from place to place, person to person. One person might collect data as a citizen scientist, counting dead seabirds for COASST (Coastal Observation and Seabird Survey Team), for instance, or monitoring water quality for the Oregon Department of Fish and Wildlife. Another person might be a guide, leading interpretive hikes for the Deschutes Land Trust. A third might opt for hands-on stewardship,

planting aspen seedlings or building beaver barriers for a local watershed council. People who are less physically active might greet visitors at an interpretive center or use their skills behind the scenes designing brochures, editing newsletters or updating websites.

Hooking into an existing organization — either a natural resources agency or an environmental nonprofit — is the common denominator for all Master Naturalists, who must volunteer at least 40 hours yearly to keep their certification.

“The program leverages the time and talents of highly capable volunteers,” notes O’Brien, whose degrees are in wildlife biology and natural resources interpretation, and who is himself a fervent naturalist. “It can be a huge help to private and public organizations, especially in times of tight budgets or when professional staff can’t accomplish all the services they’re mandated to provide. It’s an embodiment of the land grant mission — serving the needs of the public.”



## South Slough

Where the waters mix

COOS BAY – Lots of people fantasize about appearing on *American Idol* or *Wheel of Fortune*. But *Oregon Field Guide*? Not so much — that is, unless you happen to be Anne Farrell-Matthews and Philip Matthews. Whether they're heaving bags of oysters around a sandbar or hauling groundwater monitors across a salt marsh, this pair of Oregon Master Naturalists could easily imagine OPB TV host Steve Amen showing up with a video crew. For the Coos Bay couple, joining in on ecosystem science and restoration is that glamorous.

So how is it that this hip couple in their 40s gets all excited about red tree voles, beaver scat and shimmy worms? Why would a general contractor and a graphic designer get up at 5 a.m. to wade around in the muck trying to save native oysters? Why would a pair of avid surfers forego great waves to study physical oceanography and the Cascadia Subduction Zone late into the night?

Partly because the South Slough runs through their veins. Philip tramped these mudflats and salt marshes relentlessly as a kid, his Irish setter Britta beside him. Anne came to Coos Bay later, at 19, from landlocked Denver where her bedroom walls had been plastered with whale posters. Finally, she felt like she could breathe. Together, they've explored every twist and tangle of the slough, which became the nation's first national estuarine research reserve in the 1970s.

The other answer is more cerebral. It has to do with making amends and taking ownership. It has to do with helping to heal the landscape

---

*"After all, this is our own backyard."*

— Anne Farrell-Matthews

---

they love, a landscape that has been stressed by overharvesting, pollution and population growth over the past century and a half.

Philip's motives are particularly personal. "I'm half French, half redneck," he likes to joke. Describing his mom's family, the French side of the clan, as "extreme environmentalists," he hammers home his point by saying, "My uncle once chained himself to City Hall to protect shorebirds from hunters." It's his dad's side for which he's now making atonement. "My dad came from people who took advantage of the environment — poaching, fishing for salmon with dynamite, some pretty serious abuses of nature," he explains. "I want to help offset some of the negative stuff."



## A NATURAL COLLABORATION

Who's involved — and how you can be, too

You can become an Oregon Master Naturalist! For details on classes, volunteer opportunities and more, visit [oregonmasternaturalist.org](http://oregonmasternaturalist.org).

Support for the Oregon Master Naturalist program comes from the Oregon Department of Forestry, OSU Extension (Forestry & Natural Resources, Agriculture & Natural Resources and Sea Grant), the National Science Foundation and other organizations. Through a regional collaboration known as the Centers for Ocean Sciences Education Excellence – Pacific Partnership, the program was piloted on the coast in 2010. Its success depends on local partners, including OSU's Hatfield Marine Science Center, the University of Oregon Institute of Marine Biology, the Oregon Coast Aquarium and the South Slough National Estuarine Research Reserve.

### TURNING THE TIDE

One August morning just as the sun is displacing the moon, Philip and Anne are skimming across the slough in a skiff with a team of scientists, students and volunteers, all Velcroed into brown neoprene chest waders and slip-proof boots. They set anchor at a spit called Younker Point. Footprints of shorebirds trace trails in the wet sand as the team, working fast against the tide, digs up bundle after bundle of oysters for transfer to a new location as part of a NOAA-funded project led by the South Slough Estuarine Research Reserve. Restoring native Olympia oysters (*Ostrea lurida*) to the slough is the project's long-term goal, and preliminary findings show that the oysters, transplanted from Whiskey Creek Shellfish Hatchery in Tillamook, could survive and grow. But over time, excessive siltation turned out to be a problem at Younker Point, explains Dave Landkamer, an aquaculturist with Oregon Sea Grant, who's helping with the oyster transfer.

"They've been suffocated in silt," Landkamer says. "You can see by the ripples in the wet sand that there's too much wave and tidal energy here for good oyster habitat."

That's why, after wrestling the mesh bags from the sand's sucking grip, the team slings them into the skiff and another small boat for

relocation. The morning sun is just cresting the treetops as the team speeds toward Long Island Point, a place where ancient shell middens are evidence of long-ago oyster beds. Alongshore, white egrets and blue herons stalk their prey. Cormorants circle overhead. Gulls cry out. A bald eagle rises from the pinnacle of a fir.

Out at the point, the team hurriedly stacks the bags to create a reef of oyster shells in hopes that the "Olys" will settle and spawn. This is just an early stage of longer-term studies. The National Estuarine Research Reserve Science Collaborative, which brings local stakeholders into its research process, is funding the next phase of the investigation. Someday, native oysters may once again be abundant in the South Slough.

### NATURAL MASTERY

As the team disembarks back at Charleston Bay's boat basin, Philip's face is smudged with mud. Anne is wet to the skin from the saltwater that "topped over" her waders. So it's more than a little incongruous that their expressions fall somewhere between serenity and ecstasy. Clearly, getting sweaty, soggy and dirty is exactly what they signed up for when they chose to become Oregon Master Naturalists.

"I'm cold and I'm muddy," Anne says with a huge grin. "And I had a great time!"

*Anne Farrell-Matthews and Philip Matthews (opposite page) volunteer with a team of researchers working to reestablish native Olympia oysters in the slough. The team has created reefs of large Japanese oyster shells (shown below) where the tiny "Olys" can settle and spawn.*



Then she adds reflectively: "Estuaries are the nurseries of the planet. If I can contribute in some tiny way to keeping them healthy, that's what I want to do. After all, this is our own backyard."



# Rimrock Ranch

Where steelhead will swim again

**SISTERS** – A group of hikers stands on the rim of Whychus Canyon, a steep V gouging the rangeland. The canyon’s exposed layers reveal 5 million years of geologic history. Far below, Whychus Creek glints among aspen and cottonwood whose leaves have turned the color of butter. Black Butte and Mount Jefferson command the western horizon.

On this bright October day at Rimrock Ranch — where Red Anguses ruminate, saddle horses graze, and the sky stretches forever — guide Mary Crow is telling a story about the natural history of this protected place when someone calls, “Look!” Every face turns just as a golden eagle comes into view, soaring on wings as wide as a human

is tall. Riding a thermal along the rimrock, its shadow skimming the yellow rock face, the bird is so close the hikers can almost touch it.

## TREK THROUGH TIME

The eagle’s passage sets the tone for the next four hours — a magical trek into a landscape forged over eons by eruptions and floods, altered by early settlers and 20th-century engineers, and now being restored to ecosystem health by the Deschutes Land Trust, which is sponsoring the hike.

Guiding tours for the Land Trust has been, for years, an outgrowth of Crow’s passion for the land. As a life-long adventurer in the East Cascades ecoregion, she has been getting to know these mountains, rivers and rangelands as she hikes, skis and kayaks. So when she heard about Oregon State’s new Master Naturalist program, this self-described “wannabe scientist” jumped at the opportunity.

“I always felt I had gaps in my knowledge,” says Crow, a retired librarian and former technician at Intel in Hillsboro. “Now, with the Master Naturalist program, I feel like I’m able to give more to the participants in my tours.”



Mary Crow leads a “fall colors” hike in Central Oregon’s Whychus Canyon.

*“I always felt I had gaps in my knowledge.”*

— Mary Crow

As she leads the hikers — mostly retired professionals including a school superintendent, a geophysicist and a university professor — she points out the wind-sculpted rock towers called hoodoos that jut upward from the canyon walls. She talks about the Deschutes Formation, layers of sedimentary and volcanic deposits laid down between the Miocene and Pliocene, upon which Rimrock Ranch’s 1,100 acres sit. The Land Trust, she says, is removing juniper (which sucks up tons of water) and restoring Ponderosa pine (which smells like a caramel latte if you get close enough to sniff the bark). Native grasses are coming back as local “weed warriors” eradicate invasive plants.

At the bottom of the canyon, the hikers contemplate the creek that once ran thick with steelhead. Someday, Crow tells them, Chinook salmon and steelhead will once again swim and spawn in the Whychus, a Deschutes River tributary origi-



nating in the Three Sisters Wilderness and channelized in the 1960s to control flooding. It will reclaim its meandering path through the meadow as part of the Land Trust's agreement with landowners Bob and Gayle Baker, who have put the ranch into a conservation easement for perpetual protection.

The sun slips past its zenith, and the group loops back toward the trailhead. Crow takes a whiskbroom from the backseat of her all-wheel-drive Toyota and shows the hikers how to brush their boots before heading home. It's not dust she's worried about. It's invasive seed heads. "We don't want these ending up over at the Metolius River," she explains.

*Eager fourth-graders cluster around Maggie Thornton as she shares the steps to growing vegetables.*

## Concord Elementary School

Where vegetables sprout (and kids, too)

MILWAUKIE – Kids may not love finding a squash on their dinner plate. But when that squash is growing on a leafy vine in their school garden, it can be an object of delight. "Hey, this looks like a UFO!" declares one fourth-grader at Concord Elementary School, holding

up a white, disk-shaped squash called a patty pan. Exclaims another, "The tiny tomatoes hanging on this branch look like raindrops — like it's raining tomatoes!"

### POETRY IN MOTION

It's as if a bunch of pint-sized poets have been unleashed on this autumn day in Milwaukie, a Portland suburb. The metaphors and similes are as plentiful as the tomatoes here in the Willamette Valley ecoregion. "This looks like a witch's nose!" one boy says, holding up a red orb with a hooked protrusion. "Look!" a girl calls out, dangling five or six bean pods in front of her chin. "I have a beard of beans!"

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*"They're so delighted to be outdoors."*

— Maggie Thornton

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Set loose in the school garden at harvest time, the students' imaginations are on overdrive. But amid the chaos, the kids are learning about the art of gardening. Teaching them to pull weeds, prep soil and sow seeds for cool-weather vegetables is Maggie Thornton, an OSU alum and Oregon Master Naturalist participant. "I like the way the program ties everything together — vegetation, geology, climate," she says. "It recaptures the idea of the citizen scientist."

With a bucketful of tools and a pocketful of seed packets, Thornton attracts clusters of kids like crape myrtle attracts honeybees. Growing things is, for her, "just a very natural part of life." She's been gardening since she was old enough to toddle around the family plot in Bend where she grew up. So a few years ago when her daughter's first-grade class was growing sunflower seeds in jars for a science project, she was taken aback by the kids' astonishment at seeing seeds germinate and sprout for the

first time. "It was shocking and sad to see how many of them had no idea how nature works," she recalls. "I decided I wanted to help get kids outside and connected to the natural world." As the marketing manager for a horticulture company, she started a program to help schools put in gardens.

## WRANGLING WEEDS

She stands back from the hubbub to watch the fourth-graders dig seed troughs for packets of radishes and turnips, wrangle with stubborn weeds, and shriek over the occasional slug or daddy longlegs. "It's amazing and gratifying to see their reactions," Thornton says. "They're so joyful. They're so delighted to be outdoors."

Some of the kids have even made the connection between growing veggies and eating them. "You can slice up that patty pan and fry it in butter," one girl observes. "It's really good!"



# Lake of the Woods

Where the wild things are

MEDFORD – One evening when he was 8, Dave Bone's mom bundled him up against the cold, set him on a wooden sled and told him to hang on tight. Then, leaning into the night, she pulled the sled through the snowy streets of Greene, Iowa. At City Hall on 2nd Street, she brought the sled to a stop and took her son by the hand.

Unbeknownst to him, little Dave was about to become a member of Cub Scout Pack 26, which was meeting on the second floor of the old brick building. "This looks like fun," he remembers thinking when he walked in and saw the cluster of boys in their blue-and-yellow uniforms.



At Camp McLoughlin in the High Cascades Ranger District, Eagle Scout Dave Bone delights in sharing his knowledge of nature with youngsters.




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*“It’s the wildlife that makes it come alive.”*

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— Dave Bone

Beverly Bone couldn’t have imagined that 55 years later and 2,000 miles away, her son still would be scouting. That fateful sled ride launched him on a lifetime of outdoor exploration, service and education. This Eagle Scout’s recent segue into Oregon Master Naturalists was just a logical extension of what he’s been doing for a half-century.

## ANIMAL PLANET

One mist-gray morning in Southern Oregon, Bone is striding along the shore at Lake of the Woods in Klamath County when a flash of white catches his eye. “Bald eagle!” he calls out, pointing toward a reedy promontory. He quickly sets up his spotting scope as the bird unfolds its massive wings and lifts off, disappearing into the dense forest that hems the lake. “Hot dog!” he

exclaims. Then, again, quietly to himself, “Hot dog.”

His excited reaction might suggest that this was his first eagle sighting. But Bone — a retired schoolteacher who taught science in the logging community of Butte Falls — has seen hundreds of eagles, “clouds” of snow geese and countless other raptors and waterfowl while tramping the mountains, valleys and wetlands near his Medford home.

While he loves birds, he’s an equal-opportunity wildlife enthusiast. Beavers, yellow-bellied marmots, flying squirrels — even the tiniest chipmunk and lowliest skunk — stir his sense of wonder even after many years as a Boy Scout camp administrator and, more recently, a volunteer at Camp McLoughlin on Lake of the Woods. Not content to stay inland, Bone also serves as a site captain and interpreter for Whale Watching Spoken Here (a program of the Oregon Department of Parks and Recreation) and as education chair for Shoreline Education for Awareness (a “friends group” of the U.S. Fish and Wildlife Service).

“Scenery is fantastic, but it’s the wildlife that makes it come alive,” he says. To emphasize his point, he reaches into the pocket of his rain pants and pulls out a clump of folded bills bound by a silver money clip, a gift from his wife, Bea. He reads aloud the inscription, a quote from the 1972 movie *Home*. “If all the animals were gone, man would die of a great loneliness of spirit.”

## THE WOW FACTOR

Sharing nature has been his calling ever since earning his master’s in outdoor education at Southern Oregon University after he moved west with his bride, a native Oregonian. “The three key words in the mission of Oregon Master Naturalists are explore, connect, contribute,” he says. “Those are the same concepts I work with in the Boy Scouts. Taking people outdoors, guiding discovery, encouraging conservation — that’s what both programs are all about.”

For him, it all comes together in the astonished gasp of a wide-eyed child. “I call it the ‘wow factor,’” he says. “It warms the cockles of my heart.” **terra**





*A mural in downtown Independence depicts the historical context of the community where Susana Rivera-Mills is studying Latino language and culture.*



# A Place of Belonging

Once a child immigrant, Susana Rivera-Mills'  
past became her future

BY LEE SHERMAN | PHOTOS BY FRANK MILLER

Her childhood comes back to her in fragments, like a half-forgotten dream. Treasured moments of comfort and love live in her memory alongside terrifying flashes of violence and hate. She was 8 when the civil war began stirring in the streets of El Salvador. As the conflict grew, it became an ever-present menace to the simple moments of ordinary

life — moments like watching her mother press her uniform (a light-blue jumper and white blouse) so it would pass the nuns' inspection at school. Playing with her rag doll, Esther, named for the grandmother who had sewn it with her own hands. Listening to her grandfather's stories of a time when men wore suits and ties and tipped their hats to the ladies.



It was tragic enough that Susana's girlhood was visited by war. It was frightening enough to flee her hometown of San Salvador on a dark night bundled in the backseat of the family Fiat with her little brother Fabio. And yet, as improbable as it seems, the hardest part was still ahead.

San Francisco, where the family took refuge with an aunt, seemed cold and impersonal. The glass-and-steel towers, frenzied highways and constant din made her homesick for San Salvador's graceful 17th-century architecture, open-air patios and vendors selling tortillas and balloons along tree-lined avenues. The food affronted her palate: How could she stand to eat frozen potpies or peanut butter from a jar when she had so often dined on *chile relLENos* and plucked sun-ripened *marañones* right off the tree? Most jarring was the language she could neither speak nor understand. She mourned for her native Spanish.

She didn't know it then — after all, she was only 12 — but her painful struggle to find footing in a strange land would become the cornerstone of her career. Today, Susana Rivera-Mills' mission can be distilled into one driving idea: to create a place of

belonging for Latinos in America. "Because of my own experience, I'm driven by a need to create a safe space where people can see themselves, where people can hear somebody saying, 'You're not alone,'" she says.

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*"I realized that I wasn't 100 percent Salvadoran. At the same time, I wasn't an American from the U.S."*

~ Susana Rivera-Mills

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As associate dean of Oregon State's College of Liberal Arts and founding director of the university's new Center for Latino/Latina Studies and Engagement, CL@SE (pronounced claw-SAY), the immigrant who once struggled for identity uses the tools of social science to study the challenges faced by other Spanish-speaking immigrants and their descendants. From her platform as a professor of Spanish linguistics, she enlightens and inspires new generations of Latinos and Latinas. And, with her passion for advocacy,

she has helped engage and empower communities from the American Southwest to the Pacific Northwest.

"It's research, it's teaching, it's advocating, it's learning," she says. "I can't separate them."

## Battles Within and Without

How do you understand war when you're 8 years old? How do you make sense of angry demonstrations in the public square? Of slogans and placards demanding political reform? Of escalating threats and intimidation, gunfire in the streets, rumors of torture, neighbors disappearing without a trace?

When the *pop-pop-pop* of gunfire resounded too close to Susana's school, the nuns would lead the girls into the chapel to wait out the violence. She felt safe in the sanctuary, where candlelight flickered warmly against wooden panels painted with images of Christ. The girls prayed and did their homework, sometimes waiting for hours before it was safe to go home.

But as the years unfolded, even home wasn't safe. Armed men were extorting money from business owners like her father, who had a trucking company. It was just



## Words to Live By

### Language and culture meet identity

Even on a drizzly Sunday morning in November, Carniceria Mi Casita is hopping. The bustle of business begins on the sidewalk in front of the market, where a man brandishing a long fork tends a cast-iron barbeque the size of a battleship. As he flips the mounds of chicken and pork sizzling on the grate, a truck rumbles up to the curb. A delivery guy jumps out and starts unloading trays piled with *pan dulce* (Mexican pastries). Inside, a clerk banters in Spanish with customers as they browse the imported merchandise jamming the shelves, ceiling to floor — dried chilies in giant plastic bags, prepaid phone cards from Mexico Cellular and ATM Mexico, Barbie and SpongeBob piñatas, pickled cactus, *hoja tamal* (corn husks) by the dozens.





a matter of time, the family knew, before that threat would come knocking at their door just as it had for her uncle. A high-ranking official in San Salvador, he was assassinated on his doorstep as his wife and children stood helplessly by. Then there was the night Susana woke to the sound of windows shattering and bullets rattling on the roof. She remembers her mother's screams. Susana cried "Mama!" as her mother pulled her from her warm covers and pushed her under the bed before sliding in close beside her. "Shhh, shhh, you must be very quiet," her mother shushed her wailing child as bullets ripped through the house.

Amidst the violence, her father's business foundered. Finally, he confronted the only option he had: He must get his family out of El Salvador. Susana, by then 12 years old, packed what she could fit into her small suitcase. The doll Esther and a teddy bear named Eddie could come, her mother said. The other toys must stay behind. Susana's grandfather cried as she hugged him goodbye. Three decades have passed, yet her throat still tightens as she recalls the stoic, dignified man she called PapaGerardo weeping while

To the first-time visitor, it feels like slipping through a portal that drops you south of the border. Yet this blast of Mexicana thrives right on Main Street in Independence, an historic town southwest of Salem. For Susana Rivera-Mills, Carniceria Mi Casita is more than just one of the many Latino-owned businesses in Independence, which is 35 percent Hispanic. For the Oregon State researcher, the market is also a "point of contact," a place where she and her students have connected with local Latinas and Latinos for a long-term linguistic study.

Over the past three years, her team has interviewed 125 residents at the market and at four other places — a Mexican restaurant, a housing complex for farm workers, a dress shop catering to Latinas and the Heritage Museum — about their personal and family histories as immigrants or descendants of immigrants. Now she begins the task of analyzing data, looking at patterns of language retention across generations to better understand how social networks shape those patterns.

"My research is about Spanish in the United States, but even more than that, it's about understanding how communities of Spanish-speaking people navigate the complex issues surrounding loss of language," says Rivera-Mills. "How does language affect their sense of belonging, their definition of community, their access to education?"

*The market called Carniceria Mi Casita stocks traditional products from south of the border, such as the pan dulce that Susana Rivera-Mills buys on her way to interview a local family.*





his daughter, son-in-law and two youngest grandchildren loaded up the Fiat and motored into the night. The long-ago leave-taking rushes back to her in all its pathos. She pauses in her story, turning to look out her window in Gilkey Hall until she regains her composure. “I never saw PapaGerardo again.”

## Between and Betwixt

The family thought their exile to the United States would be temporary, that any day the war would end and they could steer the Fiat toward home. Instead, things got worse in El Salvador. After a year, Susana’s parents let go of their dream to go back. They liquidated their remaining assets and moved north to Eureka, 100 miles south of the Oregon border. They took minimum-wage jobs at a plant nursery. Susana went to school. Summers, she worked in the nursery alongside her mom and dad.

Within six months, she was speaking English (“It just happened, sort of like magic,” she recalls) and was placed in the talented-and-gifted program. But the stress of the new life that had been thrust upon her — of being the only Latina in her class, of being responsible for little Fabio while her parents worked long hours at the nursery, of being the family translator in business transactions — filled her with resentment as she entered adolescence. Her parents may have given up on going back to El Salvador, but Susana never had. Not a day had passed during those seven years in California when she hadn’t pictured the house where she grew up, its low stone wall enclosing tropical plants and flowering trees noisy with parrots and songbirds. Hundreds of times she had imagined herself eating breakfast on the patio, sharing the just-picked fruit with the family’s pet turtles, iguanas and rabbits.

She imagined, in short, slipping seamlessly back into her old life as a Salvadoran.

Over and over she begged her parents to let her go back. Fearful for her safety, they always said no.

Then in 1991 the war ended. A peace agreement was signed. Brushing off her parents’ worries, 19-year-old Susana wasted no time. She used money she had earned as a legal assistant for the State of California to buy a ticket to San Salvador.

Her older brother met her at the family home. Nothing looked the way she remembered it. The 3-foot wall was now a 12-foot fortress. The house seemed to have shrunk. Her old bedroom felt tiny and unfamiliar. Her brother took her to a musty room in the back of the house where her toys had been stored. Expectantly, she lifted the lid on a cardboard box. A puff of dust and mold choked her. Cockroaches skittered away from the light. She jumped back, shuddering.



As Susana Rivera-Mills interviews longtime Independence resident Felix Inocencio Oliveros, her main goal is to “listen, listen, listen.”

## Language as Identity

Borrowing terminology from the environmental sciences, Rivera-Mills characterizes her work as the study of “linguistic landscapes” or the “ecology of languages.” She teases apart variables — age of arrival in the United States, educational attainment,

indigenous roots, family cohesion and multiple language domains (school, church, bank, marketplace) — that determine whether Latinos retain their language and their ancestral identity as they create new lives in America.

“Susana’s research on language maintenance and shift during contact with the dominant culture is well regarded in the field,” notes Tobin Hansen, an OSU Spanish instructor who has participated in the Independence project.

It’s too soon to draw firm conclusions; it will take another year to crunch all the numbers. But the early findings from Independence have surprised Rivera-Mills, who has been doing sociolinguistic research for 15 years. They reveal a community that is holding onto Spanish for five and six generations, much longer than other Latinos she has studied in New Mexico, California, Arizona and elsewhere in Oregon. Spanish typically disappears by the third generation after arrival in the United States, as has been the pattern among European immigrants.

## Recipe for *Menudo*

She attributes this robust language retention in part to Independence’s deeply rooted Latino heritage — passed down in the extended family, *los padres* to *sus hijos*, *los abuelos* to *sus nietos* — by hard-working, close-knit, tradition-loving families like the Oliveros.

On her way to interview the Oliveros, one of the oldest Latino families in Independence, Rivera-Mills swings by Carniceria



Her long-imagined homecoming was crumbling like a piece of newsprint left too long in the sun.

“That was probably the most transformative experience for me,” she says. “I thought I would be returning to what I remembered from my childhood. But instead, it was like hitting a brick wall. All of a sudden, the person I thought I was really wasn’t me.

“I realized that I wasn’t 100 percent Salvadoran. At the same time, I wasn’t an American from the U.S. — I wouldn’t be accepted there 100 percent. I would have to create a hybrid identity that made sense to me. I returned to the U.S., but I returned with a whole new perspective.”

### A Poet’s Voice

In search of that elusive self, she went off to the University of Iowa to study business and physics. “I thought I wanted to work at

NASA,” she says, smiling a little sheepishly. She soon switched her major to Spanish. But even as she started working on her master’s, she remained uncertain about her path. That changed in one serendipitous instant. A professor offered his students extra credit to attend a bilingual poetry reading on campus. Susana, running late, half-jogged to the small auditorium. She wedged herself into a standing-room-only audience at the back of the room. What happened next shifted the fault lines of her inner landscape. As the poet’s voice resounded through the crowd, Susana realized she was hearing the words of an immigrant like herself. The poet’s story was Susana’s story — a story that, until that moment, she thought no one else had lived. She started to sob.

After the reading, a teary-eyed Susana walked up to the poet. “You have no idea what you have just done for me,” she said. “This is the very

first time I’ve heard anybody else talk about what I’ve been experiencing all these years. I had no idea anybody else knew what it felt like.”

As if the poet had passed her a baton, she ran full-speed ahead with her newfound insight. She earned a Ph.D. in Romance languages at the University of New Mexico, focusing on sociolinguistics — the study of the relationship between language and society. Step 1 in all her sociolinguistic studies is connecting with Latino communities wherever she goes (see “Words to Live By,” Page 22).

“What motivates my research,” she says, “is my drive to understand communities of Spanish-speaking people — how do these communities navigate issues of identity, language loss, access to education? How do they create a place of belonging for themselves?” **terra**

Mi Casita to pick up some *pan dulce* as a thank-you offering. This morning, the meat counter displays hand-printed signs advertising *panal* (honeycomb) at \$2.69 a pound and *librillo* (beef stomach) at \$3.59 a pound — ingredients for making a traditional soup called *menudo*. And *menudo* is exactly what the family is serving to the stream of relatives that begins to arrive soon after church lets out. Amid the hubbub — a TV flickering, smart phones ringing, people coming and going — Rivera-Mills interviews family patriarch Felix Inocencio Oliveros, who, as a teenager, came to Independence from Texas with his family to help harvest 3,000 acres of asparagus. The year was 1961. For three years, they lived in a camp for agricultural workers.

“The conditions were not the greatest,” he recalls, sitting at the dining-room table of his daughter Cristina. “But you have to deal with what you’ve got. You make the best of it.” Besides, there was a silver lining: He was making \$1 an hour in Oregon, compared to the 25 cents he got in Texas, where his dad had been a farm worker since World War II.

Family stories like these, told in Spanish over steaming bowls of chili-red *menudo*, are the community’s cultural DNA encoded in a shared language. Rivera-Mills’ job is to translate human experience into scholarship and, once all the standard deviations have been run and the statistics compiled, deeper understanding.

“The research I do is engaged research,” Rivera-Mills says. “It’s not a one-way street. It’s a partnership between academia and the community to create shared knowledge. You give the community your ear and listen, listen, listen.”

*Editor’s note: A permanent exhibit on the history of Latinos in Independence featuring photos from OSU’s extensive Braceros in Oregon Photograph Collection can be seen at the Heritage Museum, 112 S. Third Street, 1 p.m. to 5 p.m., Wednesday through Saturday.*







# ICE CORE DIARIES

Records from the past carry warnings for our future

BY JULIA ROSEN | ILLUSTRATION BY HANK OSUNA

*Editor's note: Julia Rosen is working toward her Ph.D. in the Oregon State University Ice Core Laboratory under the guidance of Ed Brook, professor in the College of Earth, Ocean, and Atmospheric Sciences and a Fellow of the American Association for the Advancement of Science. Support for the lab has come from the National Science Foundation's Office of Polar Programs.*

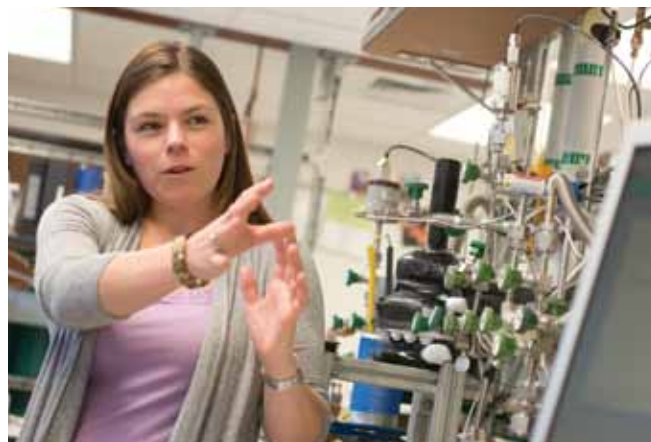
A shard of ice sits on the black surface of the lab desk, buoyed in a growing puddle. Three small heads hover above in a tight huddle. "It's cold," notes one of the kids. Somehow, this obvious observation always catches me off guard, as if I've forgotten the most fundamental quality of water's solid phase. "That's true," I reply, "it's also 10,000 years old."

"Wow!" the students chorus, and their eyes widen as they look again with renewed awe at this innocuous specimen that could have come from an ice-cube tray in their freezer. Whether I am visiting loquacious third-graders or shyly curious middle-schoolers, I am always touched by the unjaded willingness of youth to imagine and attempt to grasp the unseen. It's the reason every scientist falls in love with science.

I analyze ice cores in the Oregon State University Ice Core Laboratory and no longer think about their cool touch. I have learned that, like people, the most interesting things about them lie hidden inside. And, like people, it takes time and patience to understand them. When we succeed, these frozen time capsules from Greenland and Antarctica allow us to reconstruct climate far into the past so that by understanding its natural rhythms and quirks, we can predict what kind of future awaits these students.



*Lit by an Arctic midnight sun, this iceberg was spawned by one of Greenland's fastest moving glaciers near Illulissat. About 400 feet high, it covered an area larger than a city block. (Photo: Julia Rosen)*



*Clockwise from top left  
Fresh cores await logging in the drill trench at the North Greenland Eemian (NEEM) Ice Core camp (Photo: Julia Rosen)  
Julia Rosen explains how to extract ancient air from ice samples in OSU's Ice Core Laboratory (Photo: Jeff Basinger)  
A thin section of ice reveals tiny bubbles of trapped air (Photo: Ed Brook)  
Rosen prepares a core for analysis in the NEEM science trench in Greenland (Photo: Nerilie Abram)*

But let's start with the obvious: a clear, smooth cylinder of ice glittering with tiny bubbles like a flute of frozen champagne. Stunningly boring to behold, only an occasional band of volcanic ash or the subtle cloudy layers formed during dusty polar winters break its translucent monotony. However, this continuity is actually an ice core's greatest strength. It provides a complete, unbroken record of past climates, one that is unavailable in almost any other natural archive.

As detectives of Earth's history, geologists reconstruct stories from snapshots of ancient seas and whispers of long-dead creatures, piecing together a hazy story of our planet's past. Ice cores are the long-lost diaries of climate. Every day, they recorded the temperature, sniffed the air and noted the snow-fall. They sensed changes far from their polar homes — the amount of dust lofted from Asia, the gurgle of tropical volcanoes and much more. From the top to the bottom of a core lie flakes that witnessed every moment of geologic time that elapsed in between.

### Thin Air

Physicists, chemists and geologists have spent 60 years learning to translate the primordial language of ice. Early pioneers of ice-core science discovered that they could estimate temperature using the chemistry of rain and snow. As the

air warms, precipitation gathers more heavy molecules and fewer light molecules (known as isotopes) of water. The ratio of these isotopes thus provides a record of temperature. These scientists had the transformative idea of using old ice to reconstruct climate by exploiting this valuable relationship.

Each new analytical tool that becomes available to scientists provides another Rosetta Stone for decoding long-lost archives of the ice. Today, we can measure trace amounts of chemical impurities deposited on the ice sheets as dust and aerosols. They tell us how sea ice waxed and waned and which way the wind blew. They reveal the fingerprints of individual volcanic eruptions. While only the pristine inner core provides suitably clean ice for these highly sensitive measurements, the "snow dust" from cutting and cleaning the core does not go to waste. It can be used, for example, to reconstruct concentrations of a rare element, beryllium-10. Produced by cosmic rays high in the atmosphere, the abundance of this element reflects shifts in solar radiation.



Of all the stories that ice cores tell, however, the bubbles of air embedded within them actually contain the most impressive secrets. As snow accumulated over thousands of years, slowly hardening into solid ice and forming the massive polar ice sheets, it sealed off little breaths of ancient air between the grains of snow — the very same air we would have inhaled if we had stood on top of the ice sheet 8,000 years ago, or 80,000 or 800,000. From those microscopic samples, we can retrace the evolution of our planet's atmosphere across almost a million years of Earth history, a period that encompasses nearly all of human existence.

## Revelations

In Antarctica, where extreme cold and meager snowfall limit the flow of ice, these cores stretch back across eight glacial cycles. During each, the Earth oscillated between periods

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*"...never in the past 800,000 years did these gases reach concentrations even remotely approaching current levels."*

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— Julia Rosen

of cold climate and expansive ice, including a vast glacial blanket that smothered northern North America, and a time of balmy warmth with ice sheets comparable in size to those on Earth today. Wobbles in the planet's orbit periodically brought it closer to and farther from the sun's furnace, setting the rhythm of the climatic metronome.

Across these dramatic changes, carbon dioxide and other greenhouse gases rose and fell with the global temperature as the Earth's oceans and biosphere adjusted to a

changing environment. These gases both responded to climate change and amplified it through their potent ability to trap the Earth's outgoing energy. But never in the past 800,000 years did these gases reach concentrations even remotely approaching current levels, and never did they rise so quickly, or shoot up at the end of an interglacial period when the receding sun should have lulled the Earth back into an icy slumber.

At the other pole, ice cores in Greenland felt those same changes, although the records of climate before 120,000 years ago crept away through the unstoppable march of glaciers to the sea. Nonetheless, these cores tell us something else completely new. Throughout the last cold period on Earth, which our ancestors waited out in the mild climates of Africa, the Northern Hemisphere experienced a barrage of climate changes so swift and so huge that certain places on Earth warmed by 20 degrees Fahrenheit in a matter of decades. The cause of these dramatic jolts remains a mystery, but their power to radically reorganize the Earth system attests to the inherent volatility of the world in which modern civilization has only recently made a home.

We are slowly beginning to understand the anatomy of global climate and how it changes, its geographic fingerprint and its tempo. Ice cores paint a complex and sometimes surprising picture, one that generations of scientists will spend decades trying to fully understand. We now know the correct greenhouse gas concentrations to feed into our calculations as we simulate past climates in order to validate models for the future.

Ice cores have made one thing abundantly clear: Humans are in uncharted territory. In 800 millennia of records, no entries document a climate like the one we live in today. Even as you read this, we are busy writing the next page of the ice-core diaries. **terra**



*The 109th Airlift Wing of the New York Air National Guard supports National Science Foundation fieldwork in Greenland, ferrying scientists and supplies to and from the North Greenland Eemian Ice Core camp. (Photo: Julia Rosen).*

## Time to Listen

These observations from opposite poles forewarn of a perilous future for our planet. We know without question that we've entered a period in geologic history for which there is no natural analog, and we know that the Earth's climate can respond dramatically to perhaps even the smallest nudge.

However, the most terrifying lesson I learned from ice cores did not come from drilling into the past, but from just standing on the surface. At 80 degrees North, well above the Arctic Circle in the empty white wilds of the Greenland ice sheet, I watched a supply plane on skis repeatedly try to lift off. First the crew dumped cargo and then off-loaded all their fuel except what they needed to get home. Finally, on their seventh attempt, they succeeded.

The problem? The snow had warmed to the freezing point, and microscopic drops of water on the surface made the friction between the skis and the ice too great to break. Last summer, 97 percent of the surface of Greenland experienced temperatures above freezing, more than any year in NASA's 30 years of satellite observations.

The ice cores have told us all they know, and now it's up to us to listen.

— Julia Rosen



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*"Frightening and stressing cattle is bad because it's wrong to treat animals badly, and it's also bad business."*

— Temple Grandin, *Animals Make Us Human*

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# Caring for Cows



**Humane treatment of livestock benefits industry as well as animals**

**BY LEE SHERMAN | PHOTOS BY LYNN KETCHUM**

*Editor's note: This is the second installment in a three-part series on the care and use of animals for research and teaching at Oregon State.*

**T**he Black Baldies cluster inside the holding pen as if glued together, waiting. They know the drill. Quietly, a cowboy coaxes the cows toward the sorting shed, where they're about to be artificially inseminated. One by one, they enter the "squeeze chute," a hydraulic contraption that closes in around the animal to hold her steady. Over bursts of disgruntled mooing, a second man reads out a number printed on each cow's ear tag as a research assistant records it in a ledger. Ranch manager Kenny Fite, wearing hot-pink latex gloves up to his elbows, administers the bull semen, which has been chilling in a giant vat of liquid nitrogen.

A few of the cows balk, but most endure the process with placid resignation. Cattle prods ("hot shots")

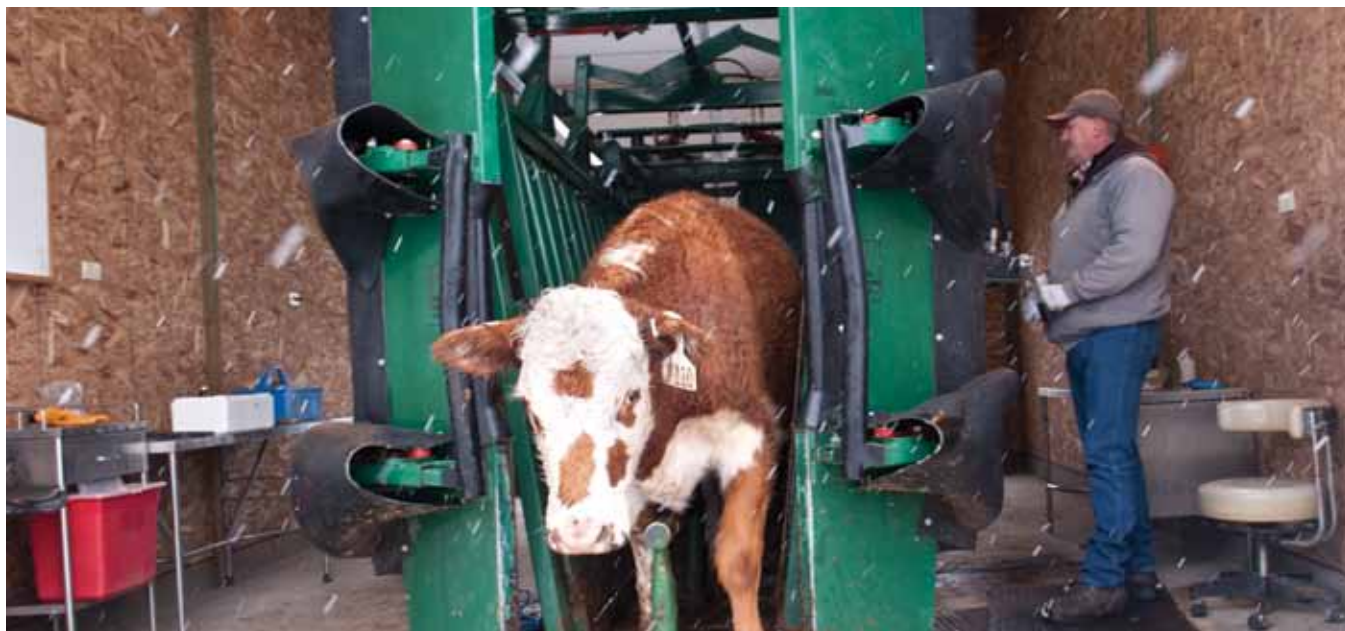
are forbidden here at the Eastern Oregon Agricultural Research Center in Union. Yelling, too, is *verboten*. Instead, Fite and his team gentle their cows into compliance. It helps that the chute's design was inspired by Temple Grandin, the internationally renowned animal-behavior expert who gave several lectures at Oregon State in 2010. Her innate sensitivity to animals' feelings and fears has revolutionized livestock handling.

"You have to remain calm and have patience," explains Oregon State researcher Reinaldo Cooke, who frequently cites Grandin in his work at the other Eastern Oregon ag research center in Burns. Cooke's cattle-handling expertise is in demand all over, garnering invitations to speak and consult across the American West and abroad.

"Cattle have their own temperament, just like people," says Cooke, who grew up on the rangelands of Brazil. "Some are more prone to stress, which causes problems for health and reproduction."

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*Facing page: Lynn Carlon, research technician at the OSU Eastern Oregon Agricultural Research Center in Burns, soothes every cow with a head scratch following a vaccination.*



That's why discovering ways to minimize stress in cattle is a research priority in Cooke's lab. Handling by humans — vaccination, castration, insemination, supplementation, transportation, especially the long haul from ranch to feedlot — can suppress a cow's immune system, depress her appetite and disrupt her hormonal balance. Studies show that a stressed animal is more likely to be a sick, scrawny, infertile animal — hardly the formula for business success if you're a rancher or dairyman.

The stakes are huge. In Oregon, beef and milk ranked third and fourth, dollar-wise, among farm and ranch commodities for 2011. For these industries, together worth more than \$1 billion, low-stress handling isn't just a check-off box on the compliance list for animal-care protocols overseen by OSU's Institutional Animal Care and Use Committee (see "The Ethic of Care," *Terra*, Fall 2012). It's not even just the right thing to do for the animals. Humane, ethical care is critical to growers' bottom line.

"In our industry if we were treating the animals bad, we would not be successful," notes Dave Bohnert, director of the Burns research center. "The poor managers, the people who aren't doing it right, aren't going to be in business that long."

When the subject of livestock abuse comes up, he frowns deeply. He recalls the notorious 2009 incident in California when hidden cameras captured a sick cow being pushed along a concrete floor by a forklift. The video went viral, playing over and over on TV for several news cycles — the animal-abuse equivalent of the Rodney King police beating. It sickened the nation. And it outraged Bohnert.

"All it takes is one or two bad events where you've got some bad employees or managers, where you've got downed cows that are being mistreated or you've got starved horses or cattle, and it's a black eye for the whole

*Researchers at the OSU Eastern Oregon Agricultural Research Center in Burns use a squeeze chute when they vaccinate cattle.*

industry," Bohnert grouches. "But in reality, that's a very, very small proportion of our industry."

## RED TAPE FOR A REASON

If you drive east from Corvallis along Highway 20 into Harney County — one of Oregon's top beef-producing counties with 100,000 head — you might wonder how cattle can thrive here at all. Desert vegetation — sage, rabbitbrush, juniper, Ponderosa pine — stretches from horizon to horizon. Rain is rare. Frost is frequent. And grass is green for just over a nanosecond. For cows, that means eating dry, fibrous forage or hay much of the year. Out here, extra protein and other nutrients are essential supplements to the poor-quality grasses.

In Burns, Bohnert devotes much of his time to nutrition research, analyzing protein, fiber, nitrogen and mineral content to design optimal diets. So does Tim DelCurto, his counterpart farther east in Union. Rangeland ecology, too, gets a great deal of scrutiny at OSU. But whether the scientists are studying stress by measuring cortisol (a stress-triggered hormone), diet by analyzing ruminal fermentation (digestion), or ecology by tracking cattle via GPS collars, each study must pass muster with the university's animal-care protocols.

There was some grumbling in the beginning, back when attending veterinarian Helen Diggs tightened up on reporting and spearheaded OSU's accreditation review by the Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC).

"A few people had to be dragged to the table screaming, 'I don't know why I have to justify this!'" Bohnert recalls. "The new daily reporting system, I'll admit, was something I initially felt was going to be a royal pain in



the neck. Every day, I've got to log into it and let OSU's attending veterinarian know that our animals are being cared for properly and everything's OK. Sometimes it's frustrating, the red tape you have to go through. However, I understand and acknowledge that we need to do everything in our power to make sure that OSU's animals are treated properly and that we can document proper care. That's just the cost of doing animal research."

## AN EVOLUTION IN ATTITUDES

Teddy, a Black Angus with a white blaze on his forehead, looks formidable, weighing upwards of 1,300 pounds. Yet this hulking creature that could knock you flat with a well-aimed kick is scared of the dark. "Cows are just like big babies," says pre-vet teaching assistant Erin Mason, who's giving an animal-facilities tour on campus for students enrolled in ANS 121, Intro to Animal Sciences. Learning the stressors for cows — loud noises, dark places, sudden motions, unfamiliar routines — is Chapter 1 for anyone who wants to work with livestock.

In his left side, Teddy has a "cannula," a surgically implanted rubber window something like a porthole. Through this porthole, the contents of his stomach can be easily accessed and analyzed for teaching and research. Given a choice, Teddy surely would prefer grazing on the open range to facing a clump of wide-eyed undergrads

who are about to stick their arms inside his stomach. Still, as a teaching cow at Oregon State, he gets top-notch treatment in strict adherence to animal-care protocols. And soon, he'll be residing in a new, high-tech facility equipped with the latest in Temple Grandin designs. Phase 1 of the James E. Oldfield Animal Teaching Facility on the Corvallis campus opened in the fall. Phases 2, 3 and 4 will be rolled out over the next several years.

Ballooning interest in Animal and Rangeland Sciences, whose enrollment has spiked four-fold since the 1990s, brings with it an evolution in attitudes in the department and across all disciplines that work with animals. One signal: A tenure-track position has been created to study the "human-animal bond." Another sign: VM 739 (Veterinary Medical Ethics) and ANS 315 (Contentious Social Issues in Animal Agriculture) are now part of the curriculum at Oregon State (see sidebar). Perhaps the strongest indicator of Oregon State's animal-welfare mindfulness is the flying-colors report conferred on the university by AAALAC along with whole-campus accreditation in March 2012.

"We've changed so much in Oregon since I came here in the late '90s," says Bohnert. "I think there's a bigger awareness. In our industry, in general, we realize that we want to minimize the pain and stress to animals." **terra**

## An Ethical Tightrope

### Learning to make delicate choices

Making ethical choices about animals can be a philosophical high-wire act — a precarious balance of practicality and principle. Weighing practical needs against "normative ethics" — right or wrong, good or bad, just or unjust — requires more than a handbook of do's and don'ts.

"The institutional protocols — the laws, regulations, policies — provide a framework, but a lot of situations are subject to interpretation," says OSU Professor Jill Parker, a large-animal surgeon who teaches Veterinary Medical Ethics to second-year veterinary students. "Decisions need to be based on a reasoned decision process."

For students eyeing careers at clinics, biomedical labs or other veterinary enterprises, ethical skills count as much as finesse with a syringe, a scalpel or a stethoscope. Through role-play and case studies, Parker pushes her students to challenge their assumptions. In one scenario, for example, fictional researchers at a make-believe university are using pigs to develop heart valves for humans. Parker's students pretend to be various characters, such as university researcher Dr. D. Zyne and heart patient B.D. Hart. The scenario is further complicated by hypothetical animal-rights protesters.

Across campus in Animal and Rangeland Sciences, Matt Kennedy wades into equally uncomfortable territory when he teaches Contentious Social Issues in Animal Agriculture. The course, which draws 200 students yearly from majors as diverse as engineering and art, tackles such hot-button issues as agri-terrorism, horse slaughter, wolves versus livestock, gestation crates for pigs, genetic engineering and the history of the animal rights movement.

"We educate them to look at the facts before the emotions," says Kennedy, who manages the Campus Swine Unit and Steer-A-Year program. "Our goal is not to sway them to one side or another, but to let them make their own decisions through critical thinking."



*An undergrad meets a teaching cow, a Black Angus named Teddy, in her Intro to Animal Sciences class.*



## Oregon State in Asia

Scientific partnerships flourish  
across the region

**FOR GROWTH IN RESEARCH** and educational opportunities, Oregon State University faculty and students increasingly look west. Connections to Asia are expanding. They encompass a wide range of activities including academic conferences, student exchanges and faculty collaborations. They focus on business, engineering, pharmaceuticals, agriculture, wood science, music and more.

The university's growing international influence is fueled by student recruitment through INTO OSU as well as by direct enrollment in many of our leading research-based graduate programs, says Provost Sabah Randhawa.

"OSU enjoys a strong reputation in Asia and is cited as one of the top 150 universities in the world in international ranking programs," Randhawa adds. "Many top universities in the region are eager to partner with us for student and faculty exchange programs and global research initiatives."

### BUSINESS

The Global Business Analysis Group is working with Dalian University of Technology and the City University of Hong Kong in China and with Yonsei University in South Korea. Researchers are focusing on supply chains, sustainability, business law and operations management.

### APPAREL AND AGING

With colleagues in China, Taiwan and South Korea, Oregon State researchers are exploring cross-national consumer behavior in the domestic and international textile and apparel industries.

### EARTHQUAKES AND TSUNAMIS

In Indonesia, Oregon State researchers are working with scientists on the historical record of earthquakes and tsunamis. The subduction zone just west of Sumatra is similar to the Cascadia subduction zone off the Oregon coast.

### MUSIC

For the past 12 years, Oregon State's Department of Music has conducted an exchange program with the cultural ministry of Henan Province in China.

### PHARMACEUTICALS

Oregon State scientists are participating in the search for new antibiotics with colleagues in China, Indonesia, South Korea and Thailand. In Indonesia, they are identifying novel compounds with antimicrobial benefits.

### ENVIRONMENT AND AGRICULTURE

Air quality, dam construction and agricultural crops are under study by Oregon State and Chinese colleagues. They have documented the impacts of polluted air and dam construction. Agricultural scientists have focused on grass seed, forage crops and livestock.





# The Glove Goes Wireless

Student team wins national award for innovative design

BY NICK HOUTMAN

**TIRED OF DOING THE SCROLL**, click and drag with a mouse? A team of Oregon State University student engineers has developed a more natural way to use computers. Their “wireless hand sensor” may not only help reduce hand and wrist injuries associated with repetitive motion but may have applications in robotics, medicine and computer gaming.

Mushfiqur Sarker, Jason Muhlestein and Anton Bilbaeno attached their sensor to a glove equipped with communications capability and conductive fabric. By moving the hand left and right or up and down, users can move objects on a computer screen. Moreover, by touching the glove’s thumb to a spot on one of the fingers, they can perform operations such as opening or closing files or navigating through a digital map.

The students won the Industry Award at the annual Oregon State engineering expo last spring. In July, they took second place (and a \$7,500 award) in a national analog design contest sponsored by Texas Instruments, one of the world’s largest microprocessor manufacturers. They estimate the cost of the wireless glove at just under \$50.

“It allows you to control a computer from a distance,” says Muhlestein. “It could be fit to other devices, such as a ‘smart’ TV, an air conditioner equipped with wireless capability or sundry devices in the home.”

Remote control is familiar to gamers (Nintendo’s popular Wii computer game uses a “Wiimote”), and new devices such as Leap Motion ([leapmotion.com](http://leapmotion.com)) recognize hand gestures. The students saw room for improvement. “We didn’t like the fact that you have to hold it (the Wiimote),” says Muhlestein. “Our device eliminates all of that. We also don’t need any extra hardware. Everything is on your hand.”

The heart of the invention consists of two components: an accelerometer to measure the velocity of hand movements and a gyroscope to track rotation. They

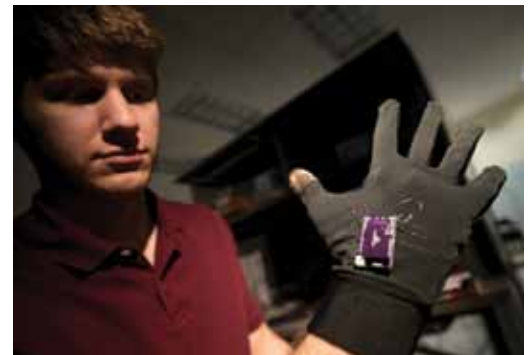


comprise an “inertial measurement unit” that is attached to the back of the glove, leaving the thumb and fingers free.

In manufacturing, the glove could give technicians a natural way to control robotic arms. It could also assist surgeons in performing operations remotely.

“The wireless hand sensor project was exceptional because it approached the project from a real usability standpoint,” says Donald Heer, who taught the capstone design course in which the students were enrolled. “They thought about the user, the technology and marketability. This very broad approach really let them shine as one of the best examples of Electrical and Computer Engineering senior design.”

For the time being, further development has taken a back seat to other priorities. Sarker is now pursuing a Ph.D. in “smart grid” technologies at the University of Washington. Muhlestein has entered the master’s program at Oregon State, working in analog-to-digital signal



*With a wave of the hand and click of the fingers, Jason Muhlestein controls a computer in the College of Engineering. (Photo: Jeff Basinger)*

conversion with professor Un-Ku Moon. Bilbaeno is employed by Allion Engineering Services in Portland.

If it were commercialized, their invention could compete with another innovation that traces its roots to Oregon State. Alumnus Douglas Englebart invented the computer mouse in 1964.



## Normative Science

It is easy — and wrong — for scientists to become stealth policy advocates

ROBERT T. LACKEY, COURTESY PROFESSOR, DEPARTMENT OF FISHERIES AND WILDLIFE

**SCIENTIFIC INFORMATION** is important in many policy debates in the Pacific Northwest (salmon; wildfire severity; human activities and climate; genetically modified organisms; water scarcity). Science is essential in such policy debates, but I am concerned that policy-biased science is increasingly common.

Science should be objective and based on the best information available. Too often, however, scientific information presented to the public and decision-makers is infused with hidden policy preferences. Such science is termed normative, and it is a corruption of the practice of good science. Normative science is defined as “information that is developed, presented or interpreted based on an assumed, usually unstated, preference for a particular policy choice.”

Using normative science in policy deliberations is stealth advocacy. I use “stealth” because the average person reading or listening to such scientific statements is likely to be unaware of the underlying advocacy. Normative science is a corruption of science and should not be tolerated in the scientific community — without exception.

Let me illustrate with a current policy issue: “Should certain dams be removed to restore salmon runs?”

Scientists can assess with some degree of confidence the likely effects of removing or maintaining a particular dam. Scientific information alone, however, is an insufficient justification for deciding to keep or remove a dam. There are biological consequences of dam removal (and maintenance), and those consequences may be substantial from a salmon perspective, but ecological consequences are but one of many elements that the public and decision-makers must weigh when making a policy choice.

Policy-makers, not scientists, decide whether preserving salmon runs should trump flood protection, irrigated agriculture or electricity generation. As the public and decision-makers balance policy alternatives, what they need from scientists are facts and probabilities. What they do not need from scientists are their or their employer’s values and policy preferences masked within scientific information disguised as being policy neutral.

There are other common examples. In working with scientists, I often encounter value-laden terms like “degradation,” “improvement,” “good,” “poor,” “impact,” or “alien invasive.” Scientists should avoid these types of normative words in conveying scientific information. Such words imply a preferred ecological state, a desired condition, an accepted benchmark or a favored class of policy options. This is not science; it is a form of policy advocacy — subtle, sometimes unintentional, but it is patently stealth policy advocacy.

Consider the widespread use of concepts such as “ecosystem health.” It is normative science! “Ecosystem health” is a value-driven policy construct, but it is often passed off as science to unsuspecting policy-makers and the public. Think what the average person actually hears when scientific data or assessments are packaged or presented under the rubric of “ecosystem health.” Healthy is good. Any other state of the ecosystem must be unhealthy, hence, undesirable.

Scientific information must remain a cornerstone of public policy decisions, but I offer cautionary guidance to scientists: Get involved in policy deliberations, but play the appropriate role. Provide facts, probabilities and analysis, but avoid normative science. Scientists have much to offer the public and decision-makers but also have much to lose when they practice stealth policy advocacy.



The author retired in 2008 from the U.S. Environmental Protection Agency’s Corvallis national research laboratory where he worked for 27 years as a senior scientist and deputy director. (Photo: Jeff Basinger)

### Editor’s note:

Terra invites letters to the editor on this topic for possible inclusion in the spring 2013 issue. Comments can be posted online at [oregonstate.edu/terra](http://oregonstate.edu/terra).





## Igniting Dreams, Raising Aspirations



### Underserved kids can imagine themselves in a mortarboard

For a lot of kids, attending college is a far-fetched idea, a goal beyond reach. Oregon State wasn't satisfied to let thousands of children give up on higher education before they even got started. So the university launched a program to ignite the dreams and raise the aspirations of underserved youngsters via campus events, curriculum support and school-based clubs in science, technology, engineering and math.

That program, called SMILE (Science & Math Investigative Learning), is now 25 years old. Among its achievements:

- » More than 7,000 rural Oregon students have participated
- » Nearly 90 percent of participants have gone on to college
- » The high school graduation rate among four-year participants is 95 percent

The benefits are being passed along within families and communities. "After many years of investment in SMILE, our students know that they can go to college and succeed," says science teacher Ken Dickey of Nyssa, where SMILE has been around for two decades. "Their older brothers and sisters, their cousins and friends have already proven it so."

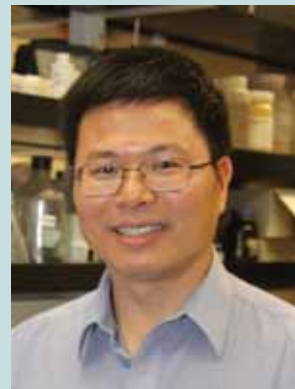
## Ties That Bind

### Sugar could substitute for toxic binders in molds for manufacturing

Sugar, soy, flour and starch: Sounds like a cook's shopping list. But what Oregon State researcher Kaichang Li has been mixing up in his lab has nothing to do with dinner. He has discovered how to use sugar, along with other food-based substances, in molds that shape metals into parts for industries like aerospace, auto manufacturing and mining.

Precision casting typically uses toxic resins such as phenol form-aldehyde to bind sand in molds for making parts of aluminum, cast iron, bronze, copper, tin, steel and other metals.

"We were surprised that simple sugar could bind sand together so strongly," says Li, an expert in adhesion science in the Oregon State College of Forestry. "Sugar and other carbohydrates are abundant, inexpensive, food-grade materials. The binder systems we've developed should be much less expensive than existing binders and not have toxicity concerns."



*Kaichang Li*

## Relief from Chronic Skin Disease

### Mouse model mimics human eczema



*Arup Indra*

It can start with an itchy rash, but left untreated, the common skin disease known as eczema (AD or atopic dermatitis) can flare up across the body. Most sufferers develop symptoms as infants. There is no cure.

Managing this chronic illness means applying moisturizing lotions and corticosteroids, which can have harmful side effects. Now scientists at Oregon State have developed a research model that may lead to more effective treatment.

A team led by Arup Indra in the College of Pharmacy has confirmed that a laboratory mouse deficient in the protein CTIP2 mimics eczema in humans. Researchers are already using it to test new approaches to eczema treatment.

Skin lipids (ceramides, cholesterol and free fatty acids) vary from person to person, says Indra. Every individual can have a slightly different combination of them. "Since there are different sub-types of AD, we can work with companies to customize moisturizers to a person's lipid profile," he adds.

Indra specializes in skin diseases (see "Co-conspirators in Melanoma," *Terra*, Fall, 2011). His team is working with OSU's Linus Pauling Institute and the Oregon Health & Science University. They have received funding from the National Institutes of Health.

# 10 Steps for Innovators

>>Follow the twisting trail from idea to outcome

By Nick Houtman | Illustration by Heather Miller

The journey from idea to innovation turns, twists and hits the occasional roadblock. Follow the progress of an Oregon State idea that is making the wood products industry more sustainable. Research by wood-science professor Kaichang Li has enabled Columbia Forest Products, North America's largest manufacturer of hardwood plywood, to switch from adhesives made with formaldehyde to a safer alternative.

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## PATENT POTENTIAL

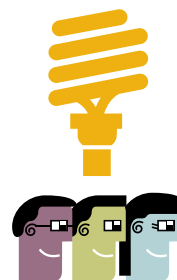
In 2002, OSU filed patents based on the Li team's research and then licensed the right to use the patented technology to Hercules Inc., a chemical company in 2004. The OSU Office for Commercialization & Corporate Development records more than 75 invention disclosures every year and files patent applications for a few dozen.



5

## THE PROJECT

Li's team used the mussel protein as a template. They experimented by attaching key functional groups onto soy protein and blocking some groups that are abundant in soy but absent in mussel. They found that they could mimic the strength and water resistance of the mussel adhesive. The OSU Research Office reviewed the proposal for compliance with state and federal regulations.



7

## REPORTING RESULTS

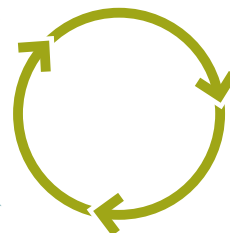
Li submitted a report to the USDA and published a peer-reviewed paper in the *Journal of American Oil Chemists' Society*. He contacted the country's three largest adhesives manufacturers but found little interest. At the 2003 Annual Meeting of the Forest Products Society, he presented his team's findings. A representative of Columbia Forest Products contacted Li.



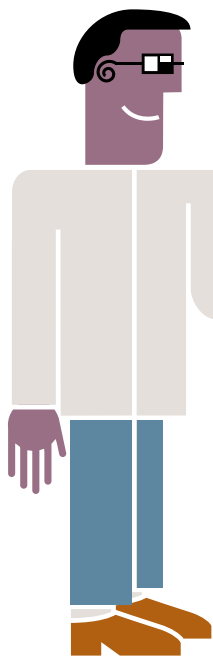
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## TRANSLATION TO INDUSTRY

With support from Hercules and Columbia Forest Products, Li's team worked for more than a year to adapt the new adhesive to an industrial-scale process. In late 2004, joint efforts by OSU and the two companies successfully commercialized the adhesive.







1

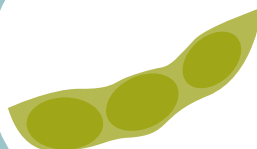
### INSPIRATION

Some adhesives contain urea formaldehyde resins, which can cause cancer in humans. In the summer of 2000, inspired by mussels that cling to rocks underwater, Kaichang Li envisioned a safer adhesive that is inexpensive, available in industrial quantities and compatible with manufacturing.

2

### FIRST STEPS

Li searched the scientific literature and found descriptions of a strong mussel adhesive protein. Could it be used as a template to create an adhesive from a plentiful, local source? While eating tofu for lunch one day, he realized that a good candidate was soybeans.



4

### FEDERAL PRIORITIES

Congress allocates research funds to federal agencies, such as USDA, which set priorities according to their missions. After researchers submit proposals, an agency program manager handles reviews and recommends those for funding. Agencies regularly report on the results to Congress. Priorities for USDA: increase wood utilization and the market for agricultural products.



3

### GRANT PROPOSAL

In 2001, Li wrote a successful proposal to the U.S. Department of Agriculture, National Research Initiative Competitive Grants Program — Improved Utilization of Wood and Wood Fiber. His goal: modify soy protein using mussel adhesive protein as a template and test it in formaldehyde-free adhesive applications.



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### COMMERCIAL PRODUCT

Columbia Forest Products began marketing hardwood plywood under the label "PureBond® formaldehyde-free technology" in 2005. Today, the benefits include higher air quality for workers, lower manufacturing emissions and a healthier product and home environment. The new adhesive has helped the company grow market share and weather the recession. Through continuing support of Li's research, the company hopes to adopt new innovations to its product line. As the inventor, Li's lab receives a portion of licensing revenues to support further research.



10

### CULTURE OF EXCELLENCE

Innovative, high-impact science is a key value of OSU's research community. Guidance comes from a Research Agenda that emphasizes relevance, integration, collaboration, leadership and accessibility. Those qualities are expressed in the wood adhesive project. With basic science (protein chemistry) and translational research (focused on production and cost), it met environmental, health and industrial goals.

*Oregon State psychologist Aurora Sherman, right, prepares to observe children playing with Barbie and with Mrs. Potato Head dolls while Pamela Lundberg, master's student and research assistant, arranges the testing station. Experiments by Sherman and Elizabeth Daniels at OSU-Cascades reveal how children and youth respond to sexualized images in popular culture. See "Sex in Play," Page 8. (Photo: Jeff Basinger)*

