

A photograph of a person working in a field of green plants, likely a greenhouse or nursery, during sunset. The person is seen from the back, wearing a light-colored shirt, and is reaching over a row of plants. The background shows a wooden structure and a bright sunset sky. The overall scene is warm and focused on agriculture.

tterra

A world of research & creativity at Oregon State University • Fall 2009

Fields of Green

Organic farming boosts profits and ecology

THE BUSINESS OF ORGANICS

With a short growing season and an elevation of more than 4,000 feet, the Klamath Basin has always pushed farmers to get a crop. But some in the flood plains of the Lower Klamath and Tule lake wildlife refuges have another advantage: Water floods their fields in the winter and creates favorable conditions for organic production the following summer.

In the fastest growing segment of the agricultural economy, Klamath County has more certified organic acres (31,000, or more than 25 percent of Oregon's total) than any other county in the state, growing wheat, barley, hay, potatoes and other crops. Brian Charlton of Oregon State University's Klamath Basin Research and Extension Center says rich flood-plain soils boost production, and the climate helps reduce pests. Farmers take advantage to grow one of the basin's newest products, organic Klamath Pearl Potatoes, whose sweetness and light texture draw rave reviews from chefs in high-end restaurants. Also being eyed by the Klamath Basin's organic producers is a new specialty potato known as Purple Pelisse, a variety high in antioxidants and developed through OSU leadership.

Since the mid-1970s, Oregon has been at the forefront of the organic agriculture movement. Oregon Tilth created the nation's first organic standards, which were adopted by California and Washington state and became a model for the USDA's national program. In the past decade, the number of certified organic farms in the country has grown by two-thirds. Although the USDA's 2007 Census of Agriculture ranked Oregon 28th for value of all agricultural products sold, the state is in the top 10 for the number of organic farms and is now home to Amy's Kitchen, the country's largest producer of frozen organic foods.

Organic farms still account for less than 1 percent of the state's agricultural acres, but OSU researchers are nurturing them by establishing predictable methods that meet standards and solve the everyday problems common to all food producers. Their efforts include one of the world's largest certified organic blueberry trials. Studies are under way with hazelnuts, pears, cherries, potatoes (Oregon's most valuable vegetable), forage and other crops. Dairy scientists from OSU, Cornell and the University of Wisconsin-Madison are comparing management and milk production on conventional and organic dairy farms.

Oregon's organic sector brought in more than \$88 million in 2007, according to the USDA. Recent news stories note that for the first time in a decade, the recession is taking a bite out of organic food sales. Nevertheless, as our cover story notes, organic farming has gone from being the commitment of a few to a mainstream business strategy.

— Nick Houtman





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OSU is a leading public research university with more than \$252 million in research funding in FY2009. 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.

Terra is published three times per year by University Advancement with support from the Oregon State University Foundation. It is printed with vegetable-based inks on paper with 50% recycled content.

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Lettuce leaves glow in morning sun
at Mustard Seed Farms in St. Paul
(Photo by Jan Sonnenmair)



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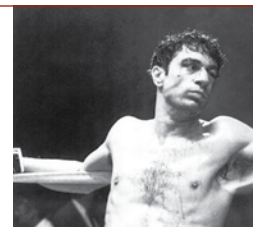
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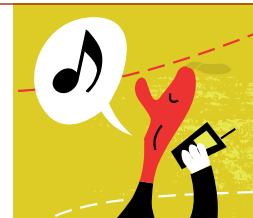
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FROM MARGIN

Scientists help farmers boost organic production | By Lee Sherman



TO MAINSTREAM

When California-based Amy's Kitchen opened a plant in Southern Oregon in 2006, the Oregon Department of Agriculture called it "a large feather in Oregon's organic cap." The nation's largest producer of organic frozen foods, from complete meals to pizza, now employs about 700 full-time workers in White City. Its success is a sign that, over the last decade, organics have morphed from counterculture to mainstream.

Whether you've tossed a box of Amy's enchiladas into your shopping cart, picked up salad greens from Gathering Together Farms at the local farmers market or purchased organic milk in the Fred Meyer natural foods aisle, you're part of this fastest growing segment of American agriculture. For many Americans, anxiety about pesticide residues in their meals and contaminants in their environment prompts them to pay more at the checkout to protect their family and their planet. Until the recent economic slump, consumer sales were galloping ahead at 20 percent a year, according to the Organic Trade Association, reaching nearly \$17 billion in 2006.

In Oregon, organics have taken off even faster. Between 2007 and 2008, certified organic acreage across the state shot up nearly 40 percent (from 83,000 to 115,000 acres), according to Oregon Tilth. Although that's a fraction of the state's 16.4 million agricultural acres, Oregon ranks eighth nationwide for number of certified organic farms. And the impact of the new ethic doesn't stop there. Many conventional growers, too, are adopting sustainable practices to meet regulatory standards or to appeal to niche consumer markets.

True to its land grant roots, Oregon State University has a history of bringing advanced science and technologies to agriculture. Now, to help growers compete in the organic and natural foods industries, scientists are working hand-in-hand with farmers and ranchers — cranberry growers on the Pacific coast, cattle ranchers on the Zumwalt Prairie, vineyard managers near Portland, wheat farmers in the Klamath Basin — to boost yields, bolster nutrition and compound profits while eliminating chemicals that can disrupt ecosystems and threaten human health. OSU's organic agriculture program includes 29 researchers

developing methods in fruit, vegetable, dairy and livestock production.

Organic growers range from small farm to corporate. *Terra* takes you to a vegetable acreage in the northern Willamette Valley and a pear orchard in Southern Oregon's Rogue Valley to meet researchers working with what some are calling the "ecological farmer." On Dave Brown's Mustard Seed Farms and Harry & David's Bear Creek Orchards, crops are being raised where nature intersects science.

Color of Earth

Dave Brown's fields burst with color 10 months a year. From the cool greens of spring lettuce through the warm golds of winter squash, his organic farm sprouts a rainbow of nutrients. He owes the brilliance of his royal-purple broccoli and flame-orange cauliflower to the russet soils of his farm in St. Paul just north of Salem. If he can enhance the life-giving properties of that rich Willamette Valley earth, his vegetables will be bigger and brighter — and so will his business.

That's why he's part of an ongoing OSU study to investigate a key building block of plant growth: nitrogen.

"These studies are giving

On Mustard Seed Farms in the northern Willamette Valley, farmer Dave Brown switched over to organic methods after making a personal commitment to healthier eating. (Photo: Jan Sonnenmair)

“The organic movement has evolved from a fringe element associated with a lost generation to a core business strategy of the world's largest corporations.

Reuters News Service
September 2008



me concrete data I can work with,” says Brown, sitting at the kitchen table of 80-acre Mustard Seed Farms one drizzly day in April. “I know what’s going on in my soils.”

Framed and Bagged

West of the farmhouse a battered pickup bumps along a dirt road, jostling OSU Extension agent Nick Andrews and his assistant, Kristin Pool, en route to a study site funded by the USDA and Western Sustainable Agriculture Research and Education. The muck-booted pair piles out and grabs armloads of gear: four-foot-square metal frames, brown paper bags, harvest knives and the obligatory rainwear. Now into their fourth year studying nitrogen in the valley, Andrews and Pool have become fixtures on Brown’s acreage.

Andrews waves his arm toward a field dotted with little red flags. “In this plot we’re growing common vetch,” he says. “Over here is a mixture of vetch and cereal rye, and over there is still more vetch, this time

mixed with phacelia.” The experimental plots are “cover crops” — soil-building plants typically grown over the winter and tilled into the earth come spring. They contribute to bigger pumpkins, tastier squash, more bountiful broccoli and more nutritious cauliflower by boosting soil fertility and structure.

Wading into the dewy, knee-deep vetch, Andrews and Pool place a metal frame over a patch of plants and then, kneeling under a pewter sky, begin carefully cutting away all stalks, leaves and flowers growing inside the square. Four samples from each plot will go back to the lab at OSU’s North Willamette Research and Extension Center in Aurora for analysis.

Benefits of Cover Crops

Farmers use grasses and broadleaf plants as cover crops, but legumes are of keen interest because of their special ability, in tandem with root-dwelling microbes, to take gaseous nitrogen from the atmosphere and convert it into a plant-available form. Scientists call this

process nitrogen “fixing.” When tilled into the soil before spring planting, these nitrogen-rich crops boost productivity naturally, letting farmers save money on nitrogen fertilizers and reduce groundwater contamination. The emerald canopies, flowers of yellow, lavender and indigo, and bacteria-nurturing root nodules offer other pluses, too: pollen and nectar for bees and butterflies; habitat for ground beetles, spiders and other beneficial insects; nutrients for earthworms and microbes; suppression of weeds and control of erosion.

But just how much nitrogen vetch and other legumes (members of the pea and bean families) contribute to the soils has long been a question for farmers. “Nitrogen contributions from cover crops vary widely,” Andrews explains. “Last year, one 26-inch tall cover crop of oats and vetch supplied only 10 pounds of plant-available nitrogen per acre, but a nearby 20-inch crop with more vetch supplied 60 pounds of available nitrogen. That’s a huge difference.

Growers need a simple science-based method to account for this nitrogen supply.”

That’s what the OSU study aims to do: give growers new tools for estimating nitrogen availability from cover crops. In all, the researchers are monitoring 32 plots at each of five northern Willamette Valley farms to see how well various legumes perform in diverse soil types and farming methods. Soil cores taken early-on were frozen and their nitrogen content analyzed for baseline data. Then cover crops in 20-foot by 80-foot plots were planted. After fixing nitrogen all winter, the live plants were sampled and shipped off to the lab. Then a tractor blended the remaining nitrogen-loaded plants back into the earth to become “green manure.”

Nitrate levels and vegetable crop yields will be compared against those of untreated control plots, and cumulative effects will be measured over time. Meanwhile, in OSU’s Department of Crop and Soil Science, Associate Professor Dan Sullivan and graduate student RonJon Datta are measuring the amount and timing of plant-available nitrogen released from cover crops. They are identifying “reliable predictors of plant-available nitrogen in the field.”

“Our goal,” says Andrews, “is to be able to quantify the plant-available nitrogen so farmers can, with confidence, reduce nitrogen fertilizer based on the value of the cover crop.”

After last year’s findings suggested cutting back on chicken manure for certain low-nitrogen crops, Brown got eye-popping results. “I had the most beautiful winter squash I’ve ever had,” he reports. “Big plants, big fruit.”

Andrews explains the phenomenon this way: “Some crops will suck up a lot more nitrogen than others. Sweet corn, broccoli and cauliflower are very heavy feeders. Squash, on the other hand, is a modest feeder so it doesn’t need all that manure. Too much nitrogen has actually been shown to decrease squash yield. That’s because over-fertilized plants will keep growing leaves and stems rather than fruit.”

Faith of the Seed

For Dave Brown, going organic was the culmination of a personal journey. As a long-time conventional grower who relied on chemicals to enrich soils, control weeds and kill bugs, he got interested in nutrition in the late-1980s. Synthetic insecticides, herbicides and fertilizers started to seem jarringly out of sync with his new health-conscious lifestyle. “My wife Nancy and I decided that if we lived that way personally, we should grow our crops that way, too,” he says.

So he switched to fish fertilizer. Next he junked the chemicals. Organic certification followed three years later.

Taking something small — a tiny seed, a type of vegetable, an acre of land — and maximizing its potential is what Brown is all about. He pushes the envelope on everything.

“I’m not satisfied with white cauliflower — I have to grow purple and orange and green, also,” he says. “I don’t just do red beets, I do Chioggia and gold, too. A lot of people will grow acorn squash and butternut, maybe some Kabocha and a little Delicata. But I grow 19 or 20 kinds of squash.”

“If you’re gonna grow ‘em, grow ‘em all — as long as you

have a market.”

Finding a market for his organic produce hasn’t cost him one sleepless night. Business is brisk. Brown sells most of his produce to Organically Grown Company, the Northwest’s largest organic wholesaler. From his modest farm on Portland’s urban fringe, his vegetables might wind up at a big chain (Whole Foods, New Seasons, Fred Meyer, Albertson’s) or they might land in a community co-op, a mom-and-pop grocery, an elegant restaurant or a funky cafe. Surpluses go to the food bank.

A deeply spiritual man (he named his farm after the Biblical parable of the mustard seed), Brown sees no contradiction in his embrace of science. To him,



enhancing God’s handiwork through hard data and agricultural research just makes sense.

“I’m a numbers person,” he says. “I like to analyze things.”

Moth Squad

In Southern Oregon, the name Harry & David evokes a down-home setting. The company’s famous pears do originate in the bucolic reaches of Oregon’s Rogue Valley. But their trademark, Royal Riviera, tells a truer story. These regal fruits,

An OSU study to help farmers estimate nitrogen contributions from cover crops will boost yields of organic vegetables. (Photo: Jan Sonnenmair)

gentled in jiggle-proof boxes, travel everywhere in the U.S. and Canada by jet and semi. Once-humble Harry & David, headquartered in Medford, is a \$400 million corporation owned by the Wasserstein Group of New York City.

In this mountainous country, pears are very big business.

At Bear Creek Orchards, a Harry & David subsidiary, tens of thousands of trees in postcard-perfect symmetry grace acre upon acre of prime orchard land in Jackson County, producing not only gourmet Comice but also Bosc, Bartlett and D'Anjou for a handful of large growers and a dozen or so smaller ones. The region's \$30 million annual crop supplies one-tenth of the pears that wind up in America's lunchboxes and salad bowls.

Rogue Valley pears, unblemished by bugs or blight, owe their perfection to a century-long partnership among growers and OSU researchers. Together, they have worked to outwit insects, fend off fungi and foil diseases that can decimate crops and destroy livelihoods. Science and technology have become indis-

pensable allies for an industry driven by the vagaries of weather and other exigencies of nature.

New threats can emerge, quite literally, overnight.

Chief among the threats is the codling moth — a small, drab-winged pest that seems harmless until you see the ugly wormhole bored by its larva. In the old days, growers fought the moth with lead arsenate, a stomach poison. Then came the broad-spectrum pesticides — first DDT, followed by other neurotoxins such as the organophosphates, carbamates and pyrethroids — which killed everything that crawled and flew, the good bugs along with the bad. As a result, ecosystems tipped off-kilter. New pests popped up. The cycle of eradication began again.

OSU helped growers get off the overkill treadmill by introducing “integrated pest management” — using a mixture of nature-friendly tactics to keep insects in check. Thanks to research at OSU, other land grant universities and the Agricultural Research

Service, Rogue Valley growers now spray host-specific viruses that target only the codling moth. And they rely heavily on pheromones — sex scents — that confuse male moths and disrupt reproduction. Exploiting nature's own processes not only makes a lighter footprint on the Earth, it benefits the bottom line.

“You want it to be sustainable, but also profitable,” says lead entomologist Richard Hilton. “Growers are saving \$100 to \$150 an acre by going to a soft system. It's significant.”

Rumors of Mites

Codling moths, along with other bugs in the “pear pest complex” — spider mites, pear psylla, San Jose scale, pear rust mites — provide regular fodder for the bimonthly brown-bags hosted by the Southern Oregon Research and Extension Center in Central Point. One noon-hour in May, OSU scientists are sitting around a long table with a spirited cross-section of industry folks: Mega-orchard managers with clipboards and briefcases from Bear Creek,

Green Solutions

Farming that fosters ecological balance and biological diversity is the goal of OSU's Organic Agriculture Program in the Department of Horticulture. The program's 29 researchers are investigating sustainable solutions for everything from weeds and soil-borne diseases to beetle infestations and livestock waste management. Here is a sampling of studies under way:



ANITA AZARENKO The head of OSU's horticulture department has overseen organic farming methods courses and led organic certification for land at OSU's Lewis-Brown Horticulture Research Farm near Corvallis. Azarenko and OSU Extension scientist Alexandra Stone received awards from the Oregon Organic Coalition in September.



VAUGHN WALTON Entomologist Vaughn Walton studies environmentally sustainable, low-impact strategies such as mating disruption to manage filbertworm and other insects that threaten Oregon's filbert industry. With the University of California, Washington State University and USDA, he is also working on vine leafroll virus, an emerging disease in vineyards.

Naumes (one of the nation's largest pear growers), Associated Fruit, and the Church of Latter-Day Saints. A small landowner in red suspenders. A couple of "field men" (chemical company consultants). A packinghouse rep. A visiting entomologist from the U.S. Department of Agriculture. Two horticulturists — one from Harry & David and the other from Suterra, a Bend-based manufacturer of pheromone monitoring and control systems — round out the group.

OSU's 10-decade legacy of industry cooperation shows in the easy synergy among these sun-burnished men and women. Hilton, raising his voice to cut through the chatter, displays a graph pinpointing peak egg-laying and larvae-hatch days. Quickly, the banter segues to shop talk. The group parries over "bio-fix" dates derived from two competing weather models. They trade info on the latest trap designs and bio-lures. They debate labeling on sprays with formidable names (Intrepid, Assail, Centaur). They weigh in on mite management. They invoke a litany of lesser pests (blister mites, stink bugs, Oriental fruit moths, leaf rollers). An innovative transparent trap that lures moths with acetic acid and pear ester — two natural chemical compounds

given off naturally by ripening fruit — gets a lot of interest. That's because these volatile compounds lure the female moths as well as the males. A USDA patent on the design is pending.

Data fly around the room like mate-seeking moths.

As the meeting breaks up, a mysterious green worm is passed to Hilton in a test tube. "We found this in the Dugan orchard when we were scouting for OBLR (oblique-banded leaf roller)," says Kathleen McNamara, pest control adviser for Harry & David's 28 orchards. "Can you identify it for us?" The orchardists cluster around to peer at this potential new pest.

One more worry to take back to work.

Between brown-bags, the group stays in touch over the Net instead of, as in days gone by, over the fence. E-mail lists and OSU's interactive "pest-alert page" give growers and researchers a place to post time-sensitive messages and data to maintain their competitive edge. The mystery worm, for instance, turned out to be a pyramidal fruitworm, a "fairly minor pest," Hilton assured the growers in a posting shortly after the brown-bag.



A Cartridge in a Pear Tree

If you walk the rows of Bear Creek's organic orchard east of Central Point, plump pears destined for gourmet gift boxes and grocery store bins aren't the only objects hanging in the cool boughs. Look closely, and you'll see the fruits of science and technology, as well.

Entomologist Richard Hilton demonstrates a cartridge that sprays pheromones to disrupt codling moths. (Photo: Lynn Ketchum)



BERNADINE STRIK OSU's Berry Research Program, led by Bernadine Strik, has established the world's largest certified organic blueberry trial at a research facility. She also is evaluating weed management, organic fertilization and bed system methods on growth, yield, soil biology, weeds, diseases and profitability of organic blueberry production.



MICHAEL GAMROTH Helping organic dairy farmers grow more nutrient-rich grasses is a goal of Mike Gamroth's current research. Cool-season grasses, high in natural sugars, can improve traditional forages which growers supplement with expensive nutrients. In a national USDA-funded study, Gamroth also is comparing organic with conventional milk production, animal health and animal care.



Southern Oregon owes its thriving pear industry to a 100-year partnership among growers and OSU scientists. (Photo: Lynn Ketchum)

Matt Borman walks beneath a bower of boughs so green they seem like something out of a touched-up photo. Stopping at Row CFI-100, the Bear Creek hort technology manager reaches into the branches and takes down an orange plastic trap shaped like a tiny pup-tent. One moth and a soldier beetle are stuck on the sticky base.

“We hang one every seven acres to lure moths with pheromones and pear ester,” Borman explains. “Our scouts check the traps once a week, and enter the numbers in a database. Along with GIS mapping and microclimate weather monitoring, we can keep tabs on moth populations and decide whether and when to spray.” As one of a mere smattering of certified organic orchards in the valley, this 34-acre plot is sprayed with a biologically based insecticide, the granulovirus pathogen (CpVG), a natural enemy of the codling moth, and with a natural clay-based product called Surround, which drives other pests from the orchard.

“We’re learning things in our organic blocks that are bleeding into our conventional

blocks,” says Borman. “We’re always trying to match the site with the most sustainable and soft system we can. We’re looking for that perfect balance between effectiveness and environmental friendliness.”


Borman then points high into the tree to reveal the most dazzling of novel moth technologies — the Suterra “puffer.” When a researcher at the University of California created the first puffer from a bathroom deodorizer dispenser in the 1980s, he couldn’t have imagined where his invention would lead. The device has evolved with the revolution in electronics. In the guts of today’s battery-operated model — which looks like a nesting house for birds — a miniature computer runs software designed to trigger bursts of pheromones from an aerosol cartridge, precisely timed with biological cycles.

Here’s how it works: As moths start to emerge, but before they mate, the puffers — placed in one tree per acre — begin burping out female pheromones every 15 minutes at night when the insects are active.

The male moth picks up the scent and flutters off to find the faux female. He gets confused. He flies here, he flies there. He wastes time. Meanwhile, the window for fertilization is closing. If the phony seduction can fool the male for three or four days, the females’ odds of laying fertile eggs drop steeply.

Nature Bats Last

In the Rogue Valley’s pear orchards, new science constantly drives innovation. Solutions shift as knowledge grows and as nature adapts. European growers, for instance, are scrambling to fight a new strain of codling moth resistant to overused viral sprays in Germany. Despite ever-better methods for managing pests, nature remains — will always remain — one step ahead of human ingenuity. As Richard Hilton observes, “We will never fully understand the life of an insect.” **terra**

Learn more about OSU research in organic grains, fruits, vegetables, dairy and livestock at organicag.hort.oregonstate.edu 

A Bracero's Story

Farm labor is a family affair



Mexican farm workers pose in camp, Hood River. (Photo: Braceros in Oregon Photograph Collection, University Archives, OSU Libraries)

It started with Salvador, the patriarch. In 1959, he left his wife and children near Guadalajara, Mexico, to work the fields of California. Salvador Castillo was a Bracero — one of more than 4 million who came to the United States from Mexico under an agricultural worker program that lasted from 1942 to 1964.

Salvador's journeys would continue for the next 10 years, some under the Bracero program, some not. Although the first trip would remain the most profitable and his absences tore at his family's fabric, Salvador left an impression of the U.S. that would forever change his family's path.

"Salvador went back to Mexico the first time and told his children that this was the golden land of opportunity, that it was a unique place where, if they worked hard enough, they could carve out a better life," says Tasha Galardi, a senior in sociology who interviewed Salvador and three generations of his family.

Using the Castillos as a case study, Galardi explored the long-term effects of the Bracero program on Mexican families and how their experience fit with immigration theories.

"I was studying the Bracero program as a starting point for the whole family's migration to the U.S.," says Galardi. She found that most of Salvador's family members who live in the U.S. still maintain strong ties to Mexico, so much so that they lead full lives in both countries. "Everyone who has legal status here spends part of the year here and part of the year in Mexico. It's as though they have one foot in each country."

She also found that such close ties create a sense of obligation to family back "home." The Castillos still send money to relatives and friends in Mexico. And often, as in the case of Salvador's son, Raul, they bring family members to the U.S. to work and help sponsor them for citizenship.

"Raul came here, moved to Alaska, bought a fishing boat and has employed many of his family members over the years. He came with the expectation that he would work hard and be financially supportive. And his success has cascaded to the rest of his family," says Galardi.

Galardi's project began with a trip to the Valley Library's University Archives. There, she met archivist Larry Landis,

who maintains a collection of 102 photos of Bracero workers in fields and camps. Landis needed an oral history to accompany the images and asked Galardi to interview a Bracero in his late 80s — Salvador Castillo.

"I love doing life history interviews. Everybody has a story, and those collective experiences make up who people are and why they do what they do," she says.

The interviews were emotional for Salvador's family, particularly for his children. They told Galardi about what it was like to wait for his letters. The first thing they did when they opened them was to look for money. "They were incredibly poor," says Galardi. "It was so hard for all of them."

Galardi plans to apply for OSU's graduate program in human development and family studies. "This project was interesting to me because it was an example of how immigration policies have fractured families. I'm interested in studying ways to strengthen families of many underrepresented groups and finding out which programs work."

— CELENE CARILLO



The Littlest Among Us

Research points the way to high-quality childcare

BY LEE SHERMAN
PHOTOS BY
KARL MAASDAM

Clutching a book about Clifford the Big Red Dog, 4-year-old Alexis clambers onto a sofa in the Library Corner. Her mom, Tiffani Bowen, jots the child's name on a sign-in sheet at the Child Development Laboratory in OSU's Hallie Ford Center and then sits down beside her. Bowen's sheltering arm, sun-bronzed and tattooed with a delicate blue butterfly, folds around "Lexi" as they page through the storybook. Clearly, both mother and child relish this quiet moment stolen from a hectic morning. Soon, Bowen will kiss Lexi goodbye and hurry off to her 10 o'clock class at Linn-Benton Community College.

Leaving her daughter is never easy. Yet Bowen knows that the little girl in the gray pleated

skirt and snow-white bobby socks will get top-notch care at the Child Development Lab, a model preschool and research facility where more than half the slots are reserved for low-income families. The Oregon Head Start Prekindergarten Program pays for Lexi's care and education at OSU, and also helps Bowen with daycare expenses — including babysitting at her sister's house for Bowen's 10-year-old twins — while she earns her college degree. The lab preschool helps out, too, with scholarships and social services.

"I couldn't afford to bring Lexi to preschool otherwise," the young mother says. "I'm watching my little girl advance. Her vocabulary is like night and

day since she started last year. Something's clicking."

Plenty of Oregon parents aren't so lucky. Childcare that is both excellent and economical is hard to come by. Kids who receive high-quality care in settings staffed by well-educated, well-paid teachers have a running start on critical language and social skills. Kids who don't will face an uphill climb. In fact, studies show that the quality of early childhood experience can affect the trajectory of an entire life, says OSU researcher Roberta "Bobbie" Weber.

"If children's needs are not met appropriately in the first four years, we know for sure that they come to kindergarten widely disadvantaged," says

Weber, a research associate in the Family Policy Program of the Department of Human Development and Family Sciences. “For healthy development, children need to be in a consistent relationship with a nurturing caregiver.”

That’s where OSU comes in. Researchers in the College of Health and Human Sciences are delving into topics across a wide spectrum, from soaring costs and teacher shortages to worker compensation and child wellness. With support from the Barbara Emily Knudson Endowment, Weber and her colleagues are helping inform and guide better outcomes for Oregon’s children on the policy level by examining topics such as subsidies for parents, incentives for teachers and childcare gaps in rural communities.

Launching a Life

Tiffani Bowen exemplifies the power of programs that give parents and kids a leg-up to fiscal and emotional security. At 27, Bowen has already been a mom for a decade. She left high school early to raise her twin girls. Six years later, Alexis came along. The single mom, without a dependable partner to rely on, was determined to find independent financial footing. So she enrolled full-time at Linn-Benton. With comprehensive support from the OSU lab preschool — including home visits from family services workers and regular meetings with a family advocate — Bowen has hit her stride. She regrets falling short of the 4.0 GPA she has doggedly pursued in her dental assistant program. But she concedes that a 3.8 isn’t all that bad.

“I rely on myself now,” she says with a note of defiance. “I don’t need a man. I’m mom,

dad, everything to my children.”

For a college student raising three kids alone, self-reliance means shouldering the roles of breadwinner, bottle-washer and babysitter.

“The last three years have been extremely tough,” Bowen admits, dropping her bravado. “Some nights, I’ve cried myself to sleep.”

Stories like this are what drive Bobbie Weber’s commitment to research-based policymaking. By discovering the factors that impede vulnerable families, she says, well-designed studies can suggest workable solutions. As lead researcher or co-investigator on nearly 30 studies conducted over the past 15 years by the OSU-based Oregon Childcare Research Partnership, Weber has captured national, state and local data on everything from system accountability to supply and demand. This statistical lens on Oregon’s three key childcare benchmarks — affordability, availability and quality — gives legislators the hard numbers they need to make sound laws in support of children and families.

“The OSU Family Policy Program provides invaluable guidance and support to policymakers and program administrators,” says Tom Olsen, administrator of the Oregon Child Care Division in Salem. “In particular, Bobbie Weber’s original research and exhaustive knowledge of the literature has been critical in the development of Oregon’s early-childhood care and education system. Her contributions to the well-being of children and families, in Oregon and nationally, can’t be overstated.”

Today’s No. 1 issue is affordability, Weber reveals in the partnership’s 2008 report, Child



Tiffani Bowen drops her daughter Alexis at OSU’s laboratory preschool before heading off to class at Linn-Benton Community College.

Delving Into Wellness

Children’s physical well-being is critical to their academic and emotional growth. Yet for an alarming number of preschoolers, too much sitting and too much snacking has led to premature weight problems.

OSU researchers are working on ways to intervene.

Joanne Sorte, director of the OSU Child Development Center, and her colleague Inge Daeschel, a nutrition expert, have developed a research-based toolkit for boosting activity levels in childcare settings. Called “Health in Action: Five Simple Steps to Better Health,” the paired nutrition and activity strategies have been adopted in Head Start and other childcare centers and programs across the state and beyond.

Another researcher, Professor Stewart Trost in the Department of Exercise and Nutrition Sciences, is designing a related intervention for home-based childcare settings. Based on a study of diet and activity levels in 60 family childcare homes, the obesity prevention program will train participants in proper nutrition and activity levels for young children.

To learn more, visit the OSU Family Policy Program, hhs.oregonstate.edu/hdfs/hdsf-family-policy-program



Mother and daughter catch a few precious moments together after the morning rush of getting off to school.

Care and Education in Oregon and Its Counties. Astoundingly, in 2008, a year of childcare cost more than a year of public college in most parts of the state — an average of about \$9,800 for a toddler in a childcare center versus an average of \$5,900 for a college student in the Oregon University System. Between 2004 and 2008, childcare costs increased about 20 percent.

Families in the lowest income bracket spend nearly 30 percent of their income on childcare. More daunting still is the chunk for a single, minimum-wage worker: almost 60 percent of total income.

Despite the staggering cost, many poor parents fail to use state subsidies. To find out why, Weber has studied Oregon's subsidy program for low-income parents. Too much red tape discourages eligible families from seeking financial assistance, she found. One big hang-up: Families were forced to reapply every three months, filling out a mountain of forms and handing in tons of documentation. In fact, Oregon had the shortest subsidy spells in a five-state study of subsidy duration. Findings such as this led the Legislature to revamp the

program in 2007. Now parents submit paperwork every six months, cutting the hassle factor in half. And the payoff for participants has improved, as well. Oregon ranked in the bottom three states for generosity of subsidies. That, too, has been rectified in Oregon law. Now the state ranks near the top.

Another recent report, a 2008 literature review funded by the Oregon Community Foundation, looked at the education and training patchwork for childcare workers — a crazy quilt of workshops that are poorly integrated from place to place. Too, credits often don't transfer across colleges and universities. Facing a "crisis-level shortage" of childcare workers, especially in rural areas, Oregon is in dire need of more "articulation" across higher-ed programs to pave an easier path for early-childhood educators seeking degrees, Weber argues.

Meanwhile, her studies of successful programs in other states recently contributed to creation of a system to encourage childcare workers to gain more education and advance professionally — an educational award program.

Aptly named EQUIP (Education and Quality Investment Partnership), this new public-private program builds on the Oregon Registry, a repository of documents for education and training of childcare and early-education professionals. EQUIP also provides incentives to achieve educational milestones in the childcare field. With federal stimulus and foundation dollars, it issues cash awards to workers as they attain professional-development benchmarks.

"We're quite excited," says Weber. "Oregon has never done anything like this."

Seeding Self-Reliance

Tiffani Bowen is mere months from launching a new life for herself and her girls. Without family-friendly programs and policies, the epiphany that awakened her drive for autonomy would have been a pipe dream.

"When I was in high school, I never considered going to college," Bowen says. "Education's important in my life now. I want that for my daughters, too. I want them to be confident. I want them to be able to rely on themselves." **terra**



RESEARCHER PROFILE

As a member of the OSU Family Policy Program and coordinator of the Oregon Childcare Research Partnership, Bobbie Weber has helped shape policies and programs serving families in Oregon and elsewhere in the nation. She has served as an adviser to several Oregon state agencies, including the Child Care Division of the Oregon Employment Department, the Department of Human Services, the Legislature, the Oregon Progress Board and the Oregon Commission on Children and Families.

No More Dentures

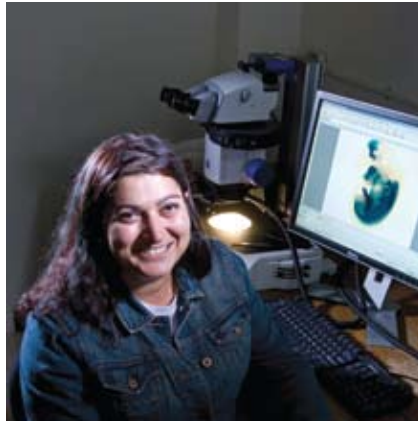
Discovery could lead to growing spare teeth

As soon as the story was out last winter, Chrissa Kioussi's phone started to ring. More than 50 callers from Europe, South America, Australia and the United States offered to send her their teeth or even to come to Corvallis to volunteer in her study of tooth development.

Though grateful for their interest, Kioussi turned them all down. "It was unbelievable," she says. "I was not prepared for something like that."

The calls followed the news that, in trials with laboratory mice, a team of scientists at Oregon State University and a French research institute (Institut de Génétique et de Biologie Moléculaire et Cellulaire) had found one of the keys to building healthy teeth. They reported in the *Proceedings of the National Academy of Sciences* (PNAS) that a gene called Ctip2 acts as a kind of conductor, directing tooth-building cells to make enamel at the right place and time.

Nicknamed the "tooth fairy gene" by *Discover* magazine, Ctip2 could eventually help researchers grow natural teeth and replace those damaged by injury, disease or poor diet. The PNAS report was the first to pinpoint the importance of Ctip2, known as a transcription factor, for developing teeth. "This is the first transcription factor ever found to control the formation and maturation of ameloblasts, which are the cells that secrete enamel," says Kioussi.



There's more to healthy teeth than brushing and flossing. Chrissa Kioussi and Mark Leid in the College of Pharmacy want to know how we make teeth from scratch. (Photos: Kioussi by Frank Miller; Leid by Rick Rappaport)

Matter of Survival

A developmental biologist in the OSU College of Pharmacy, Kioussi calls the discovery an accident.

She and her colleagues — including post-doctoral scientist Olga Golonzhka and faculty members Mark Leid, Michael Gross and Brian Bay at OSU — were studying mice that lack Ctip2 altogether or have only one copy. Two copies are needed for healthy development, and the researchers observed that about 30 percent of mice with one copy, she says, had malformed incisors that would have been too soft for chewing. Mice are omnivores, but nuts and grains are common in their diet. "They would not have survived," Kioussi adds.

The question was, How did these proto-teeth get that way? As early as the 10th day after a mouse embryo begins to develop, Kioussi and her colleagues reported, Ctip2 is active in the tissues that will become jaw and teeth. Without this gene, which also regulates development of nerves, skin and immune cells, the process goes badly awry.

From Cell to Tooth

OSU scientists are well prepared to investigate this genetic maestro. During a sabbatical in France in 2001, Leid developed a unique strain of mice that does not have the Ctip2 gene. Now, with financial support from the National Institutes of Health and College of Pharmacy, the OSU researchers have established a mouse genetics facility that is yielding insights into human health.

The tooth discovery could have far-reaching benefits. A British company that makes tooth implants, says Leid, has shown interest in replacing them with natural teeth, possibly developed from adult stem cells. And because enamel is one of the hardest biological compounds in nature, engineers are experimenting with its use in industrial design. Kioussi is now working with dental researchers at the University of Southern California to examine the entire development process from adult stem cell to mature tooth.

— NICK HOUTMAN



Leading Man

Jon Lewis explores the art and business of American film

BY TODD SIMMONS | PHOTOGRAPHS BY FRANK MILLER

NR

NOT RATED

THIS ARTICLE HAS NOT YET
BEEN RATED

Moreland Hall faces the picturesque Memorial Union in the heart of a historic college campus straight out of central casting. Rounding a corner on the way to film Professor Jon Lewis' modest office, you'd encounter a poster that makes it clear he thinks in Technicolor and speaks in terms just as vivid:

"REAL SEX: The Aesthetics and Economics of Art-house Porn."

Ahem. Well, then. Not your usual promotional piece for an academic presentation, but then Lewis is not your usual academic.

One of America's foremost authorities on censorship and regulation, film history and movie industry institutions ranging from Francis Ford Coppola to the Motion Picture Association of America, Lewis would be at home at UCLA, NYU or any number of other campuses known for their connections to Hollywood.

That he has had such a recognized impact from his modest home base at Oregon State University, which has no film program, is both a tribute to the importance of his work — he's written seven influential books and has two more in process — and to his ability to make the most of his circumstances.

Straight Talk

"There is a kind of common-sense savvy in Jon's work about the business, political and cultural aspects of the art form — he is really quick minded — but common sense in that he's not approaching it as a economist or cultural critic," says *Oregonian* film critic Shawn Levy, who has worked with Lewis on screenings and film discussions in Portland. Lewis' writing portrays wisdom and insight, but readers can get it, adds Levy, while they're "eating

their eggs at a diner, too."

A Baby Boomer who grew up on Long Island, New York, Lewis tried his hand at fiction writing at Hobart College before getting inspired at a campus showing of *Out of the Past*, a film noir with Robert Mitchum, Jane Greer and Kirk Douglas.

Suddenly, everything came into focus. "I got it. And I knew this art form was something special," he says.

It was the renaissance of film as art, and when Lewis published a paper in a peer-reviewed journal, *Quarterly Review of Film Studies*, he became a film student with a reputation. During his doctoral program at UCLA, he worked part-time for a marketing company allied with Columbia Pictures and read scripts for an independent producer, "providing coverage," as industry insiders say. This meant he would write a sort of CliffsNotes version so that the producer could give the appearance of being intimately familiar with the piece.

Hardcore Ratings

While researching an essay on "the new Disney" media empire, Lewis' interest in the movies changed, as he began to see film as equal parts art and business. It's a perspective that has informed his career deeply, manifesting in work such as the book *Hollywood v. Hard-Core: How the Struggle over Censorship Saved the Modern Film Industry*, which became the basis for the 2006 documentary, *This Film is Not Yet Rated*. Lewis appears significantly in the film, alongside directors John Waters and Kevin Smith and the chair of the MPAA rating board.

Filmmaker Kirby Dick (*Outrage and Sick: The Life &*

Death of Bob Flanagan, Super-masochist) sought out Lewis after reading *Hollywood v. Hard-Core*. Unfettered by any need to stay on the right side of studio chiefs or other industry players, Lewis provides some of the most insightful commentary in the film, which has proven to be a cult favorite in Hollywood. "The common assumption is that censorship in films is all about morality," he says. "The real story" — one that he has documented through archival research in libraries and Hollywood — "is that it's about the market. It's about making money.

"I was among the first film historians to insist on following the money. Most film history is about major films and directors, but it's much more complicated than that. The real story is behind the scenes," says Lewis.

With support from OSU's Center for the Humanities, he scoured media archives and delved into records at the Academy for Motion Picture Arts and Sciences in Beverly Hills for evidence of how ratings affected major studios and independent producers. He documented the relationship between industry regulations and market forces. "For a film to succeed, it has to play everywhere," says Lewis.

One source that remained unavailable to him was the Motion Picture Association of America ratings board. The board's deliberations are closed. Even the names of its members are kept secret.

"The MPAA is a PR outfit," Lewis said in 2006 interview around the film's release. "It was started as a way to make nice with Washington, D.C. The current rating system was devised as a business proposition," one that enables major studios to remain in control of theater offerings nationwide.

The MPAA is a PR outfit. It was started as a way to make nice with Washington, D.C.

Jon Lewis

Accolades

As one might expect, Lewis' subject matter is one that students gravitate toward, but it's Lewis the teacher who captivates undergraduates and graduate students alike. Leading courses such as "The New American Cinema" and "History of the Documentary," Lewis is an engaging classroom performer — equal parts Woody Allen and Ken Burns, delivering historical facts, insightful context and illustrative anecdotes with a good humor that prompts even the shyest 20-something to engage in the conversation.

The *Oregonian's* Levy has known many former Lewis students. "Everyone I've ever talked to loves him, particularly on a campus where engineering and the sciences often get the lion's share of attention," says Levy. "Humanities students in particular are just overjoyed to find a guy like Jon. That's why you go to college, to be engaged by that kind of a professor."

In 2007, "that kind of a professor" published his most ambitious project yet through W.W. Norton, *American Film: A History*. The sprawling, 575-page work includes more than 250 images and traces the evolution of U.S. film through the work of early pioneers like Edwin S. Porter to current filmmaking, or "The End of Cinema As We Know It," as he titled the book's final chapter.

But don't be fooled by that chapter title. Lewis is a believer in the film business. Try to engage him in the usual chatter about how lousy American movie making is these days, and Lewis responds with an endorsement of the quality he

sees in such current pictures as *Sugar*, the compelling story of a Dominican baseball player recruited to play in the U.S. minor leagues, and *Girlfriend Experience*, director Steven Soderbergh's provocative portrait of five days in the life of a high-priced Manhattan prostitute.

Two Thumbs Up

Paul Turner, owner of Darkside Cinema, Corvallis' art house theater, has known Lewis for some 15 years, since the days when he, Lewis and Lewis' two sons would sit in the projectionist room of Turner's former theater and watch films together. "One of the things they say about Roger Ebert is that he's been a champion of independent film, and that will be his legacy. Jon's legacy will be in championing films that are even more esoteric and leading people to them," said Turner, adding, "He has a heart the size of a small planet."

Independent films (see sidebar) interest Lewis, not only because they break, often interestingly, from the Hollywood formula; they illustrate the structure of the business.

"The studios are doing what they always do, working to limit output, focusing on fewer, bigger projects," he says. "But boutique film companies, which by the way are usually owned by big studios, are doing well and producing interesting movies."

In 2010, the British Film Institute will publish Lewis' study of Coppola's 1972 magnum opus, *The Godfather*.

This and other projects are indicative of Lewis' belief in the enduring power of films well-made and the enduring

JON LEWIS ON FIVE FAVORITE INDIE FILMS

Stranger than Paradise Composed entirely of awkward long-takes ... a low-key, black-and-white film that captured everything that was cool about off-Hollywood movies, circa 1984.

Repo Man Also 1984. Punk aesthetics, extraterrestrials in urban LA, something about a plate of shrimp ... and it all ends in a radioactive car floating above downtown LA ... a unique sensibility at the very moment dumb blockbusters were about all Hollywood could muster.

Big Lebowski The Coen brothers' funniest and best film ... at once a lampoon of the classic detective story and a celebration of the slacker generation in which "the Dude," who "just abides," is a hero.

Sugar A simple premise: a pitcher from the Dominican Republic lands in rural Iowa ... what follows defies expectation at every turn ... a baseball film that isn't really about baseball.

Pi So much style, such a crazy plot (featuring killer rabbits trying to corner the stock market!) ... Darren Aronofsky's unique jump cut style is relentless and unsettling.



worth of film as a means of communication that deserves to be placed in appropriate context, analyzed, understood. And while film has long since escaped from the theaters that once were its only home, showing up today in such once unimagined places as iPods and mobile phones, Lewis has a soft spot in his heart for the movie-going experience.

"There's a different dynamic of watching it alone or in a theater," he smiles. "I hope that never goes away. It's an American pastime."

terra

Online: a digital version of Jon Lewis' 2002 celebrated book, *Hollywood v. Hard Core*, is available at books.google.com

Cells for Solar

Ocean plankton grow potential for solar technology

The diatom — an ancient form of single-celled algae — may hold the key to a new generation of cheap, clean solar technology.

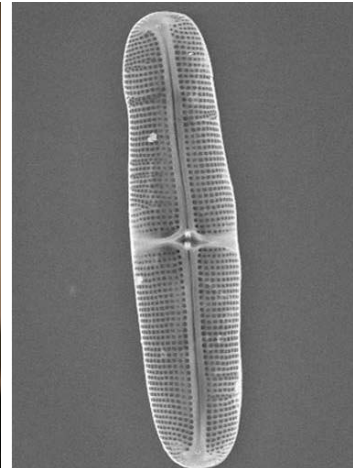
Teeming in Earth's oceans for nearly 200 million years, diatoms have hard silica shells intricately patterned with tiny pinholes and latticework. These nano- and micro-scale pores are super-efficient harvesters of sunlight. Now, a team of researchers at Oregon State and Portland State universities has discovered a way to exploit the diatoms' solar-energy prowess through "bio-mineralization." Organisms use this process to produce hard compounds such as silicates (in shells) and carbonates (in bones), which they incorporate into their structures.

In the marine environment, where they drift in large colonies, diatoms build shells from silicon dioxide. In the lab, the microorganisms grow in photo-bioreactors, illuminated vessels for cultivating algae. Lead researcher Gregory Rorrer has coaxed them to use titanium in addition to their usual minerals. As a result, their shells contain titanium dioxide, the active semiconductor in a new type of solar cell scientists call "dye-sensitized."

Such solar cells are made of thin films of titanium oxide nano-crystals that have been infused with light-absorbing dyes. They imitate the way algae and other plants convert sunlight into energy.

When incorporated into these films, the lab-altered diatom shells trap light at a remarkable rate. That's because photons (particles of light) "bounce around more inside the pores of the diatom shell" than they do when striking the titanium-oxide nano-crystals alone, explains Rorrer, a professor in the OSU School of Chemical, Biological, and Environmental Engineering.

In laboratory studies, the ability of the titanium oxide-coated diatom shells to



Greg Rorrer checks bubbling photo-bioreactors, whose greenish glow originates with the pigmented single-celled diatoms growing within. (Photo of Rorrer: Justin Smith; Pinnularia diatom photo courtesy of Greg Rorrer)

trap light tripled the conversion of light to electricity relative to titanium dioxide nano-crystals alone. Therefore, there is significant potential to enhance the efficiency of existing dye-sensitized solar cells for commercial prototypes.

Viewed under electron microscopes, diatoms reveal an astonishing array of geometric forms. Of the roughly 100,000 species, some have radial symmetry, resembling antique coins, buttons, thimbles or Swedish rosettes. Others are axial, their shapes suggesting peapods, cigars, peanut shells, hair combs, zippers and other familiar objects. Each species is uniquely patterned. As his model diatom, Rorrer used a species called *Pinnularia*, chosen for its nanoscale "rectangular lattice" whose "concentric array of fine features" lines the base of each pore (see photo).

Today, most solar cells are made from highly refined silicon by a complicated and expensive process. In contrast, diatoms can be easily grown on a mass scale at room temperature, needing only light, air, water and nutrients to perform chemical

conversions. So far, dye-sensitized solar cells, while easier to manufacture than silicon solar cells, have lagged behind at only about a quarter of the efficiency. But the promise of semiconductor-enriched diatoms could change that.

"There is tremendous interest in bio-inspired approaches for synthesis of semiconductor and metal oxide nano-materials," Rorrer and his team of fellow researchers noted in the American Chemical Society publication *ASC Nano* in 2008. This is the first reported study, the team says, of using a living organism to fabricate titanium dioxide semiconductor nano-structures that could be scaled up for potential commercial use.

The research is funded by a \$1.3 million National Science Foundation grant to Rorrer, OSU chemical engineering professor Chih-hung (Alex) Chang and Jun Jiao, a physics professor who directs PSU's Electron Microscopy and Microanalysis Facility. All are affiliated with the Oregon Nano-science and Microtechnologies Institute (ONAMI).

— LEE SHERMAN



Guarding the Data Bank

Business professor works to protect online privacy

BY NICK HOUTMAN
ILLUSTRATION BY
ROB DUNLAVEY

In the age of Facebook, MySpace and Twitter, the notion of personal privacy seems as quaint as the typewriter. Millions of us lay out our lives on the Web in neon, sharing details that used to stay in the familiar light of friends and family. Online retailers monitor our shopping preferences down to the size, style and color of the clothes we buy. So-called “data aggregators” mine and sell information on individual real-estate transactions, credit histories, criminal records, purchasing behavior and insurance claims.

While personal data consti-

tute a mother lode for the Web economy, legal loopholes pose privacy risks for consumers, such as identity theft, unwanted surveillance and computer spam. Nancy King, associate professor in the Oregon State University College of Business, is helping to define the legal landscape of online privacy. At stake, she says, is consumer trust in an expanding business model worth billions.

The United States lacks the kind of broad privacy protections in existence elsewhere, King has shown. She argues that it is in the best interests of businesses to take strong volun-

tary steps to assure consumers that personal data will not be misused. Her analysis of privacy laws and the risks of new technologies comes as Congress, the Federal Trade Commission (FTC), consumer advocates and industry debate proposals for regulatory reform.

Among the issues are emerging mobile technologies that offer new business opportunities but carry additional privacy risks: cell phones equipped with a service provider’s “adware” and with radio frequency identification (RFID) tags that trigger ads based on a person’s location.

Surf at Your Own Risk

"I think as consumers, we just become used to whatever is happening to us," King says. "We may not know everything that is going on, but over time, as we buy things online and we visit sites and we give a lot of information out, we become more accustomed to sharing that information. It doesn't mean that it's a secure, safe or good thing for us to do."

Increasing consumer acceptance may help explain the growth in online business. In 2008, while the economic downturn led to a 2.3 percent decline in U.S. retail sales, online sales grew nearly 6 percent, reaching \$134.8 billion, according to Citi Investment Research. Not surprisingly, businesses see an opportunity to ride a wave. Between 2004 and 2008, Internet advertising revenues rose 140 percent, from \$9.6 billion to \$23 billion, according to the Interactive Advertising Bureau, an industry trade group. Mobile advertising is close behind. In 2010, ads targeted at cell phones and other wireless devices are expected to generate revenues similar to what was spent on all Internet ads in 2004.

What online shopping makes possible is "behavioral advertising," a practice that targets individuals through data on their purchases and Web browsing habits. Consumers could benefit by seeing ads tailored to their interests. And retailers could see a greater "conversion" (sales) rate. Still, says King, privacy could be compromised if consumers aren't aware of what personal data businesses are collecting.

Fair Information Practices

Since mobile advertising and privacy are global concerns,

King is helping to conduct an international evaluation of online privacy regulation. In collaboration with researchers at the Aarhus School of Business in Denmark, she is focusing on U.S. laws, starting with the basis for privacy protection in the Constitution. She is also advising an Aarhus graduate student, Evelyne Beatrix Cleff, in a study of mobile advertising practices in the European Union and the U.S.

American laws regulate privacy as it relates to such activities as telemarketing, computer spam and civil rights. But in contrast to Canada and the EU, where citizens have "broad-based privacy regulations that protect their privacy and personal data, no analogous broad-based consumer privacy regulations exist in the U.S.," King wrote in a report published after a Fulbright-funded research sabbatical in 2008 at the Research Centre in IT and Law, University of Namur, Belgium.

"What is lacking in U.S. law is broad protection for personal data consistent with fair information practices that have been imposed elsewhere in the world where personal data is regarded as a fundamental human right," she concluded.

While U.S. law does not significantly restrict businesses from collecting and selling personal data, other safeguards exist. Corporate privacy policies can impose tighter rules, and firms can be held liable for violating them. Moreover, companies that operate in global markets must follow more protective policies in places such as the European Union, says King.

A philosophical basis for an implied right to privacy exists in the U.S. Constitution, she

adds, but the Supreme Court has not defined this right beyond narrow circumstances. For example, information about highly personal decisions (family relationships, birth control, child rearing and education) is protected from government data collectors, but such regulations do not apply to businesses. Moreover, the courts have ruled that government can intrude when a compelling public interest is at stake. And once government has made personal data part of a public record, with or without an individual's permission or awareness, other people and businesses face few legal restrictions in getting access to it or using it.

Confident and Secure

To reduce risks to privacy, the FTC has proposed that businesses voluntarily adopt new data collection and behavioral advertising rules. While King sees a need for new government standards ("The FTC and the European Commission are strongly hinting that that's where they're heading"), she agrees that self-regulation could help business stave off onerous legal requirements.

Accordingly, King has worked with business associations on

What is lacking in U.S. law is broad protection for personal data consistent with fair information practices that have been imposed elsewhere in the world.

iWatch

Web bugs, cookies, pop-ups and opt-in — if you don't know what such terms mean, you may not understand how to protect your online privacy. To improve information for Web users, OSU engineer Carlos Jensen has created iWatch, software that scans top Web sites and reports on their privacy practices. "Our goal is to provide information to users surfing the Web, so they can make more informed decisions," says Jensen.

The assistant professor in Electrical Engineering and Computer Science presented iWatch at a Federal Trade Commission hearing in 2007. Download his report at eecs.oregonstate.edu/research/hci/publications/index.html.



RESEARCHER PROFILE

Nancy King's law career has led her from the boardroom to the factory to the classroom. Because she taught seminars on dispute resolution and workplace discrimination, she earned the nickname "The Professor" at the Portland law firm of Bullard Smith Jernstedt and Wilson. "I was always teaching somebody," she says.

She once gave a sexual harassment prevention workshop at 1 a.m. in a plywood mill. "I might have been the first female they ever heard talk about that," she says. "They would listen because I was quite earnest about the topic, and I really wanted them to get it."

She attributes her interest in privacy to two things: her focus on workplace law, including rules about monitoring and searches by employers; and her hectic life as a lawyer and as a mother of four daughters. "I have very little personal time of my own," she adds. "At its core, privacy is about freedom to grow as a person, which is a very important individual right in a democracy."

In the College of Business, King teaches courses on legal issues in technology and e-business and on the business legal environment. She has written on topics such as Web access, sustainable buildings and employee monitoring.

WHAT DO SHOPPERS KNOW?

Online clothes shoppers can buy just about everything from suits to sunglasses, but how much do they know, or care, about online privacy policies? Tunmin "Catherine" Jai will survey shoppers this year to find out. The native of Taipei, Taiwan, is working with Leslie Burns and Minjeong Kim in the Department of Design and Human Environment and with Nancy King in the College of Business. A Ph.D. student in DHE with a business minor, she plans to complete her study next spring.



privacy policies that require consumer consent to receive mobile ads and to share personal data with other businesses. She has proposed notices that can be displayed clearly on cell-phone screens and include opportunities for consumers to opt in or out of data sharing arrangements.

The viability of this new model of commerce depends on consumer trust, she adds. "Consumers' mobile phones are the portal for mobile commerce — a convenient new form of doing business anywhere and anytime. Mobile advertising is an important component of this new business environment that is expected to fuel the growth of m-commerce."

Point and Click

Emerging cell-phone technology can do a lot more than send information and receive ads. Imagine walking down the street in an unfamiliar city and seeing a poster for a new movie. As you pass it, an ad appears on your phone and, in a few clicks, you order your ticket and download directions to the theater from your current location. And to save time, you make a reservation at a restaurant from a list that appears along with a map. Everything is charged to a credit card number on file in the phone's database or listed on your phone bill.

By 2010, industry observers predict that nearly all new cell phones will be equipped with RFID tags to enable location-based services that link to personal profiles. But there's a potential hitch. The technology can operate round-the-clock, whether or not the phone is on. Thus it could lead to constant surveillance and potential privacy intrusion, King has pointed out. She advises busi-

nesses to get ahead of these concerns by developing the devices and related privacy policies in ways that leave consumers in control.

Surveys suggest that consumers already have mixed feelings about mobile advertising and tracking. In its annual behavioral advertising survey TRUSTe, a Web-based privacy certification service, found that about half of 1,147 respondents were uncomfortable with businesses monitoring their behavior. Nevertheless, the survey concluded, "consumer discomfort with tracking has declined by six percent (sic) points year over year," suggesting that "although consumers worry about protecting their private information online, they're getting used to behavioral targeting."

These new information technologies are well ahead of the law, says King. They present problems that did not exist when current policies were developed. Thus they challenge the legal and business communities to find solutions. When new issues arise, lawyers can't "just go and look up statutes and say this is the rule," she adds.

Giving consumers control over their personal data is necessary to avoid a world in which individual anonymity would be just another quaint tradition. "In fact," says King, "it is very easy to pinpoint individuals even with data that is anonymous. You can categorize them to the point where you know who they are. It's possible to be digitally tracked by computers with no human intervention at all. And that data can be kept indefinitely and combined with other data. Pretty soon you have no privacy, no space where you are free from tracking online." **terra**

“Freakishly Excited To Learn”

Kids grasp English skills and subject-area content in tandem

Something about César Chávez grabbed Gabriel’s imagination and wouldn’t let go.

The shy third-grader from Mexico exhibited an uncharacteristic boldness when studying Chávez, the famed champion of farm-worker rights. He became so engaged — so eager to discuss his newfound hero — that he lost his usual discomfort with English. Gabriel’s sudden loquaciousness fascinated his classroom teacher at Corvallis’ Lincoln K-12 School.

“He doesn’t even notice he’s using English,” observes Kinsey Martin. “He’s more confident and willing to take risks with the language because he loves César Chávez and wants to talk about him.”

Others saw the change, too. “At first, he felt anxious about trying,” says ELL (English Language Learner) specialist Holly Berman. “Then one day he blurted, ‘Teacher! I’m learning English!’” She laughs at the recollection. “It just killed me.”

A year-long OSU study suggests that non-native speakers like Gabriel do best when English skills are embedded in content areas instead of taught separately. Kathryn Ciechanowski, assistant professor in the College of Education, led the investigation, which wove linguistic concepts into science and social studies as well as language arts. These building blocks of communication were reinforced over and over across the curriculum.

“The students had seamless days of instruction,” says Ciechanowski. “They focused on particular language forms and functions — such as modal or past-tense verbs — across a wide range of contexts.”

Lessons on *-ly* adverbs, for example, were folded into a unit on rocks and minerals. Before doing a chemical experiment with calcite and acetic acid, third-graders wrote captions for pictures of scientists pouring liquid onto a rock. The assignment was to describe the scien-



Kathryn Ciechanowski is helping kids learn English by blending language instruction into science and social studies lessons. (Photo: Karl Maasdam)

tists’ actions using *-ly* words. “Slowly,” “nicely” and “quietly” were common choices. Students then performed the experiment themselves, drizzling vinegar onto chunks of calcite and recording their observations. During the lesson, the teachers emphasized the precise nature of science, as captured by *-ly* words brainstormed by the students. By lesson’s end, several students’ lexicon had expanded dramatically. Sammy, for instance, crafted the scholarly phrase “observing the acid closely” on his post-test. Alonso penned this poetic observation: “The geologist is peacefully writing what’s inside the cup and thoughtfully leaving it alone.”

Martin was astonished by the students’ zeal. “They were freakishly excited to learn,” she reports.

Language lessons also crossed traditional placement boundaries. Rather than pulling kids out for separate English instruction — the usual approach —

specialists worked with students in their regular classroom. This “push-in” model avoids the stigma and disruption of pull-outs. It also steeps students in academic lingo, essential as they move into middle school. Mastery of “school” language always lags behind mastery of “street” language, the everyday vocabulary of home and neighborhood, which children typically pick up quickly.

Ciechanowski’s preliminary results reveal strong gains in science and moderate gains in social studies. She attributes the disparity between science and social studies to the more abstract nature of topics like immigration, social justice and community activism and to the subtlety of certain linguistic distinctions tackled in class, such as “few” versus “some” and “many” versus “most.”

The study was funded by the Oregon Department of Education.

— LEE SHERMAN



Stimulating Research

Oregon State University research projects are receiving a stimulus boost through the American Recovery and Reinvestment Act of 2009 (ARRA). As of September 11, OSU had received more than \$12.4 million in ARRA funds for projects in public health, climate change, mathematics education and ocean science.

"These are competitive, highly ranked projects for which funding would not have been available otherwise," says John Cassady, OSU vice president for research. "They employ our students, research technicians and faculty and enable us to purchase services and supplies, stimulating the economy even further."

Economic stimulus funds contributed to OSU's best ever \$252 million in research grants and contracts last fiscal year. According to the Association of Public and Land-grant Universities, ARRA provided the largest single increase in funding for basic research in history, \$21.5 billion nationwide.

See more on OSU's ARRA grants at oregonstate.edu/research/ARRA/.

Redrawing the Map

Scientists and fishermen team up to find seafloor hazards and habitats

Maps of Oregon's territorial sea are due for an upgrade. Only 5 to 6 percent of the state's near-shore seafloor has been cataloged and described in detail with modern instruments. Up-to-date nautical charts include data from lead-line sounding surveys going back as far as 1858.

Now, with help from the fishing industry, hydrographic contractors (David Evans and Associates and Fugro), the State of Oregon and the National Oceanic and Atmospheric Administration, Chris Goldfinger is leading a \$7.3 million mapping project that will pinpoint rocky reefs, depressions and navigational hazards. The Oregon State University associate professor of oceanic

and atmospheric sciences says the new images will help fishermen, scientists and coastal managers who need to manage marine habitats and to develop better tsunami models.

Over the next two years, two vessels out of Newport — OSU's Pacific Storm, captained by Bob Pedro, and the Michele Ann, captained by Bob Eder and Geogon Lapham — will help researchers collect detailed images over more than 34 percent of the seafloor out to the state's three-mile limit. The project will expand existing coverage with a half-meter resolution, including 75 percent of rocky reefs, depressions and boulders.

Goldfinger led an earlier effort to map Oregon's territorial sea, using existing data on seafloor habitats identified in thousands of bottom samples and soundings. The map and many other marine spatial layers are available online at pacoos.coas.oregonstate.edu/MarineHabitat-Viewer/viewer.aspx. New products from this project will be distributed through the same Web site.



Agricultural Sciences Welcomes New Dean



Sonny Ramaswamy, an agricultural leader from Purdue University, became dean of the Oregon State University College of Agricultural Sciences in August. He directs the Oregon Agricultural Experiment Station and succeeds long-time OSU dean Thayne Dutson, who retired from the position in 2008.

An entomologist, Ramaswamy has studied the reproductive biology of insects and plant-insect interactions, conducting applied research on insect pests affecting wheat, cotton, beans, other row crops and trees.

OSU's nationally top-ranked programs support

Oregon's agricultural industries, which last year posted record sales of \$4.9 billion. Overall economic activity is estimated at \$25 billion annually from cattle, dairy, nursery crops, fruits and berries, wheat, grass seed and other sectors.

Ramaswamy is a fellow of the American Association for the Advancement of Science and the Entomological Society of America.

See Terra on the Web at Oregonstate.edu/terra



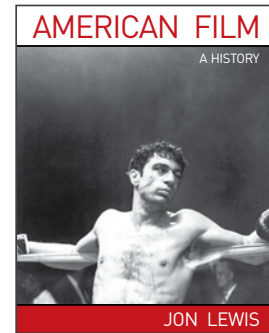
Early Morning Harvest

Up before dawn, Dave Brown and his crew cut, pack and ship vegetables at Mustard Seed Farms. Through the lens of Portland photographer Jan Sonnenmair, watch the early morning harvest that fills grocery coolers and graces restaurant tables in Portland and beyond.



Braceros in Oregon

In the 1940s, Mexican workers lined up at train stations to get their work assignments. Music and meals marked life in the farm labor camps. OSU Cooperative Extension staff captured these and other activities in images that are now available through University Archives' Braceros in Oregon Collection. See images of this world gone by and listen to OSU archivist Larry Landis and undergraduate Tasha Galardi describe their oral history project.



Talking about Hollywood

The film business is changing radically, creating dramatic pressure on filmmakers and distributors. But Jon Lewis sees light at the end of the tunnel. Hear why in this podcast with OSU's "Leading Man."

Two Business Startups Get Boost from OSU Fund

An innovative tax credit program aimed at fast-tracking commercialization of university research stands as a bright spot in Oregon's sputtering economy. It is enabling two Oregon startup companies to receive funding that will help them grow faster and employ Oregonians sooner.

Both companies have licensed Oregon State University technologies and are benefitting from OSU's University Venture Development Fund (UVDF). Launched by the Oregon Legislature in 2007 to stimulate research commercialization, the UVDF gives Oregon residents a 60 percent state tax credit for their gifts.

Inpria, one of the startups, has developed a new way to create thin films for displays and other large-area electronics using low-cost printing processes. OSU professors Douglas Keszler and John Wager are among the company's co-founders.

According to Andrew Grenville, Inpria co-founder and president, UVDF money helped the company leverage funding to explore new markets for its landmark LCD display technology.

Life Microsystems is capitalizing on research by two scientists in OSU's Linus Pauling Institute. Carole Jubert developed a low-cost method for isolating pure chlorophyll from Oregon spinach. George Bailey has shown that chlorophyll can bind with toxins in the body, reducing DNA damage and potentially preventing disease.

Life Microsystems has isolated a more stable crystalline form of ultra-pure chlorophyll, which typically sells for more than \$100 per milligram due to its susceptibility to degradation.

Scott Gustafson, a veterinarian and CEO of Life Microsystems, is partnering with OSU professor John Mata to isolate and concentrate other beneficial compounds from Oregon agricultural products, such as black raspberries.



Radical Defense

Advertisers promote them. The American Heart Association recommends eating foods that contain them. Without antioxidants, you may be more prone to cancer and neurological or cardiovascular problems. While antioxidant science is far from settled, OSU researchers have identified sources and are learning how these micronutrients promote health by curbing “free radicals.”



BERRY GOOD SOURCES

In 2002, a highly cited paper by an OSU research team led by Ron Wrolstad and Balz Frei documented antioxidant concentrations in 107 varieties of blackberries, red and black raspberries, blueberries and currants. Top-ranked for antioxidant pigments (anthocyanins): black raspberries (*Rubus occidentalis*)



FIRST LINE OF DEFENSE

In a paper that has become a citation classic, Balz Frei reported that vitamin C acts as a powerful antioxidant in human plasma. He showed that it quickly disarms lipid-damaging “free radicals,” thereby preventing “bad cholesterol” from going rancid and contributing to heart disease.



ONE-TWO PUNCH

In a series of papers, Maret Traber and OSU colleagues have shown that in humans, vitamins E and C team up to pack more antioxidant punch than either does alone. They also showed that when taken as a supplement, vitamin E must be accompanied by fats to be absorbed by the body.



GENE REGULATOR

Lipoic acid acts as a powerful antioxidant in laboratory experiments (*in vitro*), but it plays other roles in the human body. Tory Hagen has reported that it regulates genes that stimulate production of glutathione, one of the body’s own antioxidants, and the transport of antioxidants into cells. It thus provides a long-term means of staving off oxidative and toxic stresses.



HEAVY METAL

Zinc is the most abundant intracellular trace element in the body, contributing to immune function, reproduction and oxidative stress response. In 2009, a team led by Emily Ho reported that a lack of zinc induces single-strand DNA breaks and leads to oxidative stress in otherwise healthy men. The findings confirm that zinc plays a crucial role in the body’s own antioxidant defenses

FOR MORE INFORMATION

See the Micronutrient Information Center at OSU’s Linus Paul Institute, lpi.oregonstate.edu/infocenter/. LPI, one of the nation’s first two NIH Centers of Excellence for Research on Complementary and Alternative Medicine, specializes in the study of micronutrients. Researchers above are affiliated with LPI and the colleges of Science, Agricultural Sciences and Health and Human Sciences.

FUNDING

Funding support comes from:

- National Institutes of Health
- U.S. Department of Agriculture
- Collaborators’ home institutions, including OSU

Solar Gain

Photovoltaic advances lead to business development



More electricity from sunlight is the goal for Alex Chang, right, and his thin-films student research team of (left to right) Nate Edwards, Debra Gilbuena and Wei Wang. (Photo: Karl Maasdam)

Since coming to Oregon State University a decade ago, Chih-hung “Alex” Chang has made research his passion as well as his profession. The associate professor in chemical engineering has two patents and six more pending. With other OSU faculty and students, he has helped to create two companies, Nanobits LLC and CSD Nano LLC. His work on what scientists call thin films — nanometer scale chemical layers laid down with drill-team precision — holds the promise of new coatings for eyeglasses and a new generation of power producing solar cells.

In 2004, the National Science Foundation recognized Chang with a prestigious Early Career Award. He has received additional NSF research grants and support from the Department of Energy, Sharp Laboratories of America, ONAMI and Oregon BEST.

OSU’s University Venture Development Fund has also been critical to his research. The fund supports technology with commercial potential while providing a hefty Oregon tax credit to donors. It delivers a direct shot in the arm for research leading to new products.

Alex Chang’s dad was an engineer, but Alex nearly took another direction as an undergraduate at the National Taiwan University. He considered becoming an artist.

In fact, art runs in the family. His brother Chih-wei followed in their father’s footsteps with a bachelor’s degree in electrical engineering, but he decided not to continue that career. After gradu-

ating, he moved to New York City and studied fashion illustration.

For Alex, research held stronger appeal. At the University of Florida, he studied an emerging alternative to silicon for photovoltaic cells known as CIGS thin films. He collaborated with fellow graduate student B.J. Stanbery, a CIGS photovoltaics pioneer who recently founded a new company, HelioVolt.

At OSU, Chang and a student research team envision electricity generating solar collectors built into windows, roofs and other building parts. Debra Gilbuena, a double master’s student in business and chemical engineering, puts it this way: “How cool would it be if you could put solar cells on all the windows in all the skyscrapers in a city and collect energy?” Gilbuena, who co-holds a patent for an electrochemical sensor, works in Chang’s lab and serves as a chief technology officer for CSD Nano.

Thin-film solar cells — whether made of silicon or the CIGS metals copper, indium, gallium and selenium — typically consist of six or more layers to maximize light absorption and sustain an electric current, says Chang. His team is developing printing techniques to replace more expensive vacuum production methods. Chang has already used an inkjet printing-based process to make high-mobility thin-film transistors.

With new techniques, Chang’s goal is to lower cost and chemical use while maintaining high efficiency. Based on a market analysis by Gilbuena, Chang expects demand to be high. “We need to demonstrate good efficiency. There’s no doubt there will be commercial interest,” he says.



For more information about supporting research with commercial potential and receiving an Oregon tax credit, visit CampaignforOSU.org/venturefund/

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Lisa Hereford makes a Mustard Seed Farms delivery to People's Food Co-op in Portland. Research by OSU Extension Agent Nick Andrews helps farm owner Dave Brown feed Portlanders through distributors Organically Grown Company and Charlie's Produce, grocery chains (Whole Foods, New Seasons, Fred Meyer, Albertson's), co-ops and restaurants. See "From Margin to Mainstream," Page 2. (Photo: Jan Sonnenmair)

Listen to OSU researchers, follow their stories and see more photos, at oregonstate.edu/terra

