

---

# Lessons from the Magic Planet

by Lee Sherman  
Photos by Jim Folts

**Researchers are engaging the curious  
in meaningful inquiry**

---

*The rockfish tank captivates Newport first-grader and oceanography buff Noah Goodwin-Rice during a visit to the Visitor Center at the Hatfield Marine Science Center.*

---

From their oceanfront timeshare in Newport, Oregon, Jerry and Diane Plante were enjoying the view one September morning when they spotted an unusual vessel. Peering seaward through their high-powered binoculars, the retirees could make out a black trawler named Pacific Storm. Tethered to it was a yellow, donut-shaped buoy. Poking out of the buoy was some kind of cylindrical shaft.

Intrigued, the Plantes watched and wondered as the boat and buoy bobbed on the distant swells for four days. “We couldn’t figure out what they were doing,” says Jerry, a former fraud investigator from Sherwood, Oregon. Adds Diane, a retired schoolteacher: “I don’t know why we thought the boat was so fascinating, but we did.”

Then, soon after the mysterious boat and buoy disappeared from their picture window, they happened to spot the Pacific Storm tied up near the Yaquina Bay Bridge. Excited, they buttonholed a man working on the dock behind a sign reading “authorized personnel only.” He told them they had been armchair witnesses to a floating wave-energy experiment conducted by OSU researchers. He was a member of the science team and suggested they could learn more at the nearby Hatfield Marine Science Center. And that’s how the curious couple wound up in the Visitor Center raptly studying an exhibit about OSU’s pioneering work in wave energy, oblivious to crowds of school kids jostling around them.

Jerry and Diane Plante are what social scientists these days call “free-choice learners.”

## Choosing To Learn

“Much of what we learn, we learn because we want to, because events in our lives intrinsically motivate us to find out more,” explain Lynn Dierking and John Falk, Oregon Sea Grant professors in OSU’s Science and Mathematics Education Department in the College of Science. “Under these conditions, we learn not only what we want, but also where, when, and with whom we want. This is free-choice learning, learning that is guided by learners’ needs and interests — the learning that people engage in throughout their lives to find out more about what is useful, compelling, or just plain interesting to them.

The Plantes are great examples of free-choice learners in action.”

Free-choice learning, a term coined a decade ago by Falk and Dierking, is a new addition to OSU’s graduate degree programs and research agenda in science and math education. The initiative launched by Sea Grant and the College of Science is designed both to teach and to study how people learn — particularly about science and math — outside formal school settings. Such learning is “incremental” (gathered in bits and pieces, here and there) and “idiosyncratic” (filtered through the learner’s one-of-a-kind lens), research tells us. Driven by intellectual curiosities and practical needs for information,

are designing ways to enhance free-choice learning environments such as museums, science centers and Boys and Girls clubs. Along the way, they hope to forge stronger links among the myriad players in education’s “invisible free-choice learning infrastructure,” a web of institutions and information sources that includes zoos, aquariums, botanical gardens, libraries, national parks, natural history museums, Web sites, TV shows and after-school programs. Other research is delving into how this infrastructure intersects with schools, universities and workplaces.

“Research strongly suggests that the more the separate influential spheres of family, school, work and elective



Six-year-old Noah and his mom, Cait Goodwin, peer at tide-pool organisms in a wildly popular exhibit, which Rowe is videotaping as part of a study to better understand how people interact with touch tanks.

most science and math learning happens not as we sit in a classroom, but as we explore the world around us.

Unique in the United States, OSU’s Free-Choice Science and Mathematics Learning program gives graduate students a theoretical grounding in the cultural, social and physical contexts that influence learning. Kids and adults alike build knowledge actively using their highly individualized prior knowledge and experience, the scholars say. With this “constructivist” theory as a foundation, the researchers

learning overlap in people’s lives, the more likely people are to become successful lifelong learners,” note Falk and Dierking, international leaders in this new discipline. In short, it’s the synergy among spheres that counts.

Before coming to Oregon State, Falk founded and directed the Institute for Learning Innovation in Annapolis, Maryland, a private, nonprofit organization devoted to understanding and facilitating free-choice learning. Dierking was the institute’s associate director.

## Touching You Back

At the Hatfield Marine Science Center, a bucket of brine shrimp makes you a rock star.

That's because the Visitor Center's touch tanks — shallow-water exhibits where you can stroke a real sea star or interact with a giant Pacific octopus — are the most popular spots. When it's time to feed the organisms inhabiting the simulated tide pool — that irresistible spectacle of phantasmagorical forms in hi-def color — Hatfield's volunteer docents get mobbed as visitors jockey for position and crane their necks to see abalones lunch on tiny shellfish and anemones munch on chunks of squid.

Shawn Rowe wants to know why humans go wild over touch tanks and petting zoos. "Hands-on exhibits are ubiquitous, but they're usually inanimate — you can pull a lever or push a button, maybe make them light up," says the researcher. "But when you touch a live animal, it gives a very different kind of response. It's almost like it's touching you back. Emotionally, it's very powerful. There's not a lot of research out there to help us understand that experience."

Rowe, an assistant professor in both Sea Grant Extension and the College of Science, is leading a study to reveal the touch-tank magic. Drawing on his background in linguistics and psychology, the researcher and his team of graduate students are videotaping visitors as they interact with the rainbowed dwellers of the briny tank — the spiky and the spongy, the clawed and the tentacled, the soft-bodied and the hard-shelled. He's also recording visitors' interactions with one another. By analyzing the give-and-take among parents and children, husbands and wives, docents and visitors, teachers and students, Rowe hopes to improve learning outcomes from these beloved exhibits.

"People spend so much time at the touch tanks," he says. "Our research question is, 'How can we help make their learning deeper?'"

Research questions like these that engross Rowe and his students are real-world puzzles that "bubble up" out of the science center itself, he says. "Here

at Hatfield there's a rigorous proof-of-concept and prototyping phase for every exhibit," explains Rowe, whom Sea Grant originally hired to bring educational rigor to the Visitor Center. "We do focus groups, interviews, pre- and post-visit questionnaires, as well as observation and videotaping of visitors."

This real-world cauldron is a hallmark of the free-choice learning graduate program, Falk and Dierking assert. "From the start, students are encouraged

---

## "How can we help make learning deeper?"

Shawn Rowe

---

to generate questions as they do projects in real settings," Dierking adds. Hatfield is only one of the program's living free-choice learning laboratories. In Oregon, others with active research include the Oregon Museum of Science and Industry (OMSI), Oregon Public Broadcasting and the Oregon Zoo in Portland; the Oregon Coast Aquarium in Newport; the Science Factory in Eugene; and the Boys and Girls Club in Corvallis.

### Revealed by Fingerprints

Among the exhibits Rowe and his team are studying is the interactive Magic Planet, a giant "digital video globe" —

a spherical computer screen showing such planetary dynamics as wind speed, cloud movements, ocean depths and currents across Planet Earth — actual data that's collected by National Oceanic and Atmospheric Administration and NASA satellites. "There are fewer than 50 of these on public display in the world," Rowe says, gesturing toward the giant glowing globe. "Visitors can't make heads or tails out of a lot of it, so we're helping NOAA turn it into a better exhibit."

Then there's Our Active Earth, an interactive "touch to explore" machine depicting real-time earthquake activity worldwide. The researchers are working with the manufacturer, IRIS (Incorporated Research Institutions for Seismology), and the OSU-based EarthScope program to make it more user-friendly and accessible for all sorts of people, including parents pushing strollers and visitors using wheelchairs. Describing this as "hands-on" research couldn't be more literal: It turns out that smudgy fingerprints on the touch screen revealed some confusion among users about how to access the data.

Another exhibit under investigation is Hatfield's popularity runner-up: the "chaos wheel," a transparent waterwheel that spins continuously, first clockwise, then counter-clockwise, in shifting and unpredictable patterns. Designed to illustrate order hidden in systems that seem

random — the ever-shifting shape of Oregon's coastline, for instance, or the uniqueness of individual snowflakes — the exhibit nevertheless fails to convey the intended message to most viewers, Rowe and his students have found. Despite its mesmerizing attractiveness, "people usually come away with the opposite idea it was intended to convey," admits Rowe. "It's a well-loved but poorly understood exhibit."

### Making Meaning

All of the findings feed into the larger questions around self-directed learning. Hatfield's resident octopus can be a metaphor for today's educational landscape: many outward-reaching arms



*Hatfield displays hold fascination for seven-year-old Kyrallyn Pickner of Waldport and her grandmother Lynda Sweeden of Newport.*



*The Magic Planet, a spherical display for digital data about planetary dynamics, is one of the exhibits being tested and refined by OSU free-choice learning scientists.*

offering learning opportunities for free-choice learners of all ages. Hoping to better coordinate this multi-limbed beast, OSU is partnering with several organizations — the Association of Science-Technology Centers, the University of Pittsburgh’s Center for Learning in Out-of-School Environments (UPCLOSE), and the Visitor Studies Association — to create a new national Center for the Advancement of Informal Science Education (CAISE). Funded by the National Science Foundation, the center will extend the scope and awareness of out-of-school learning. OSU’s free-choice-learning researchers want people to know that a science educator isn’t just the biology teacher at the high school but also the aquarist who gives “pond classes” for adults raising koi in their backyards. Or that a learning environment isn’t only a college engineering lab but also a wave-energy exhibit at the coastal visitor center.

Just ask Jerry and Diane Plante, as they interact with the exhibit that lured them to Hatfield. “Oh, look at this!” Diane exclaims, pushing a button that activates an up-close mechanical demonstration of the wave-energy device they had observed from their oceanfront window.

“The electricity is made between the magnet and the coil,” Jerry says as he reads the explanation of the direct-drive mechanism. “It’s such a big idea and such a small piece of equipment.”

Early in the last century, museums filled display cases with objects — arrowheads, dinosaur bones, stuffed birds, human skulls — and hoped visitors would absorb useful information from viewing them. “Cabinets of curiosity” is one scholar’s characterization. But that turned out to be a flawed model. Simply “sticking people in a science-rich environment” doesn’t ensure learning, Rowe notes. So, just

as weaponry, reptiles, birds and humanoids have evolved over time, so have the museums that display the evidence and tell the stories of those transformations.

“Recently, we’ve moved to the idea that museums should be a public forum where people come to make meaning,” says Rowe. “We’re taking visitors seriously as self-directed learners and investigating whether their goals and interests match the museum’s goals and offerings — and if not, where do we make the shift?”

“Visitors have to be partners in that process.” **terra**

---

See more about OSU Sea Grant’s free-choice learning initiative at [seagrant.oregonstate.edu/freechoice/](http://seagrant.oregonstate.edu/freechoice/)

---

## Learning about Oregon

---

### Students scrutinize the state's most popular learning centers

OSU's unique graduate program in Free-Choice Science and Mathematics Learning draws students from around the country and abroad. In partnership with science centers, zoos, aquariums, public broadcasting organizations, after-school programs, scouting and museums, master's and Ph.D. candidates conduct research, design and evaluate educational programs and develop innovative free-choice curriculum.

"My colleagues Shawn Rowe, John Falk and I are helping to transform the Science and Mathematics Education Department toward understanding and supporting science and math learning across the entire lifespan," says Oregon Sea Grant Professor Lynn Dierking. "Our goal for the department is to approach science and math learning very broadly, embracing K-12 and university levels as well as free-choice learning. It's the first program in the country to take such a comprehensive approach."

Here's a look at the motivations and investigations of several current Free-Choice Learning students:

**Jennifer Bachman**, a doctoral student, is interested in the role played by learner choice and learner control in a variety of educational settings (classrooms, science centers, community programs and the home). "I was attracted to the Science and Mathematics Department specifically because of its Free-Choice Learning program," says Bachman. "Here, I'm able to combine my two diverse interests:

working with families that educate their children at home and the rich, science-learning experiences in daily life. There's no other program where I could do this." Specifically, she is using ethnographic methods to study socio-cultural dimensions of learner choice and control during free-choice, science-learning experiences.



**Michele Crowl** came to OSU from the South Florida Science Museum where she was assistant director of education. She

is investigating how personal identity informs and shapes free-choice learning through observing and interviewing visitors at Hatfield Marine Science Center, the Oregon Coast Aquarium and the Science Factory. For another study, she is helping to document the long-term effects of free-choice science activities designed specifically for girls on their later interest, engagement and participation in science education, careers and hobbies. "In Florida, I really enjoyed the informal atmosphere and creativity of teaching and learning in a museum venue," Crowl says. "Then I discovered there's a whole field of study around exactly the kind of thing I was doing at the museum. When I looked into OSU's graduate program, I found that it was full of familiar names from the free-choice literature. It's a truly supportive learning community."



**Laura Dover**, an international student from the United Kingdom, is pursuing her dream career in K-12 marine education.

"Through OSU's program in marine resource management and free-choice learning, I have a great opportunity to link my two passions: the oceans and K-12 informal education," Dover says. She is developing ocean-science curriculum and organizing an ocean-science challenge for underserved students at the Science and Math Investigative Learning Experiences (SMILE) Program. "Children need to know more about the oceans," she says. "OSU is helping me to make sure they do."

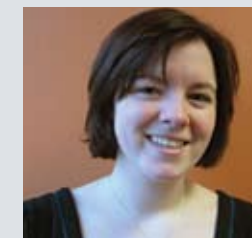
**Katie Gillespie** came to OSU from Chicago's Lincoln Park Zoo, where she collected data for a project on visitor behavior in an African ape exhibit. "I spent a year tracking more than 450 visitors, and although I was able to say how much time they spent watching gorillas versus chimpanzees or which signs they were most likely to read, I felt that I was only looking at one small piece of the puzzle," she says. "I became interested



in whether these experiences were meaningful for visitors, and if so, in what way." At OSU, she is studying the emotional

aspects of free-choice learning, particularly people's relationships with animals in zoos and aquariums. The California Science Center in Los Angeles, the Hatfield Marine Science Center and the Oregon Coast Aquarium are her living laboratories. "OSU's free-choice learning concentration is the only academic program dedicated specifically to understanding how people learn in contexts such as zoos and aquariums," Gillespie says. "I'm excited to be working with world-renowned researchers in the museum field."

**Devan Lewis**, who teaches at Corvallis's Linus Pauling Middle School, is an OSU master's student participating in a study for a planned exhibition — the Red Ape Reserve — at the Oregon Zoo in Portland. Before the exhibition opens in 2009, the zoo's conservation department will evaluate visitors' interest in and knowledge of orangutans and



white-cheeked gibbons, as well as expectations and reactions before and after the exhibition opens. "Since starting my master's

degree, I've learned a lot about myself," Lewis says. "I've found a passion for exhibit design and zoos. My goal is to work as an education consultant for an exhibit design firm. This program will get me there."

**John Falk, Lynn Dierking and Shawn Rowe are Sea Grant professors of free-choice learning at Oregon State University. Falk and Dierking — national leaders in free-choice learning who headed the Institute for Learning Innovation in Annapolis, Maryland — joined the Department of Science and Mathematics Education in OSU’s College of Science as tenured professors in 2006. Take a closer look:**

**Professor John Falk**, a specialist in free-choice learning and science education, focuses on museums and other settings such as zoos and aquariums to understand the role of “situated identity” in leisure decision-making and learning. He investigates the long-term impact of free-choice educational institutions



on individuals and communities, as well as new business models for museums and other cultural institutions. Another study looked at wildlife-based leisure experiences in supporting visitors’ adoption of environmentally sustainable practices. His research has been supported by the National Science Foundation (NSF), Noyce Foundation and the Australian Research Council, among other agencies. He and Dierking are currently engaged in research for the Center for the Advancement of Informal Science Education, a national resource center housed at ASTC (Association for Science-Technology Centers).

**John Falk**  
**Dept. of Science & Mathematics Education**  
**541.737.1826**  
**falkj@science.oregonstate.edu**

**Professor Lynn Dierking’s** research focuses on understanding the socio-cultural factors in free-choice learning among young children, families, youth and community-based efforts. She is particularly interested in those factors that contribute to meaningful engagement for under-served communities, such as girls, low-income groups and people from diverse racial and/or ethnic backgrounds. Currently, she and a colleague



at Franklin Institute Science Museum in Philadelphia are collaborating on an NSF-funded project investigating the long-term impact of gender-focused, free-choice science learning experiences on girls’ interest, engagement and involvement in science communities and careers. Her research has been supported by the NSF, the Noyce Foundation and other funders.

**Lynn Dierking**  
**Dept. of Science & Mathematics Education**  
**541.737.1823**  
**dierkin@science.oregonstate.edu**



**Assistant Professor Shawn Rowe** is a marine education specialist who uses the tools of social science for analyzing how groups make sense of what they say and do. He has conducted research in history and science museums both in the United States and Ukraine, mostly focused on families as learners. His practice-based research in the OSU Hatfield Marine Science Visitor Center in Newport involves graduate students seeking master’s degrees and Ph.D.s in free-choice science learning programs for environmental science and marine resource management. The National Oceanic and Atmospheric Administration, IRIS (Incorporated Research Institutions for Seismology) and NSF are among Rowe’s research funding agencies.

**Shawn Rowe**  
**Oregon Sea Grant Extension**  
**541.867.0190**  
**shawn.rowe@oregonstate.edu**



**OTHER CONTACTS:**

**Oregon Sea Grant**  
**541.737.2714**  
**sea.grant.web@oregonstate.edu**

**Sherman Bloomer**  
**Dean, College of Science**  
**541.737.4811**  
**sherman.bloomer@oregonstate.edu**

**OSU Foundation**  
**800.354.7281**  
**OSUFoundation@oregonstate.edu**