Celebration of ideas

Student researchers get a foot in the door at the annual Denman Forum.

By SAMARA RAFERT

On a single day in March, Ohio State's Recreation and Physical Activity Center was filled with student presentations in every imaginable field, from cancer genetics to playwriting.

The Richard J. and Martha D. Denman Undergraduate Research Forum, now nearly two decades old, has grown from a small initiative aimed at improving Ohio State's programming for top students to a 560-poster juggernaut. While other universities have similar forums, Ohio State's is one of the largest of its kind.

More than a competition for the cash prizes awarded by faculty and corporate judges, the Denman is the first opportunity many students have to situate themselves in a research community.

Caroline Whitacre, vice president for research, said it's an essential part of undergraduate education. “Today, science is much more team-oriented. It's gotten very collaborative and very complicated,” she said.

“It's easy, when a bigwig in the field visits the lab, for [an undergraduate] to be part of the team but not the person answering questions,” Whitacre said. “The Denman peels those other people away, and the student's part of that project has to stand alone. The presentation forces them to think about how their work fits into that context.”

Richard Denman ’57 has seen the forum that bears his name develop from its beginning as a conversation between him and then president E. Gordon Gee at a meeting of the foundation board in 1995.

He also met with Mabel Freeman, Ohio State's former assistant vice president of undergraduate admissions.

“As I listened to her, I got excited about student research and how it could be expanded into a program to bring national recognition to the university while showcasing outstanding work,” said Denman,
whose perspective stems from a career in the medical field with a background in biomedical development.

“The entire Ohio State community respects and values the Denman Forum that has now come to fruition, and my wife, Marte, and I are proud to be associated with it,” he said.

One of the most gratifying aspects of their participation, Denman said, is the enthusiastic letters he and Marte receive from presenters.

According to Helene Cweren, assistant director of the Undergraduate Research Office: “In other areas, you have athletics, you have a pep rally. Research can often be so isolating. This is a chance to see what’s really happening and celebrate that on campus.”

Building audiences

LAUREN BEDAL ’14 combined her dance major and design minor with neuroscience to approach a problem that she says is one of the most pressing facing arts organizations today: how do you get people off their couches and out to performing arts events?

“I was interested in how interdisciplinary research could promote sustainability within the performing arts industry,” she said.

Bedal’s project won first place in the Denman’s arts and architecture division. She designed branding strategies for three dance companies: Columbus Moving Company, YinMei Dance in New York City and Zero Visibility Corporation in Oslo, Norway.

She began by attending neuroscience and consumer psychology classes and researching how the brain responds to visual stimuli. Each company’s needs called for a different approach. She retooled YinMei’s website to better balance text and images and reduce information overload. She created a promotional film for Columbus Moving Company, and she focused on print for Zero Visibility Corporation.

Teaming with EyeQuant, an eye-tracking software company, proved valuable. “[The software] was a great informative tool. Even a slight shift of placement [of an element] could affect how the viewer was looking at it, and it was really fascinating to see that,” she said.

While Bedal doesn’t yet know whether the three companies will implement her ideas, her next step builds on her research. In May, she moved to Berkeley, Calif., to work as a video editor for Rapt Productions, which provides video and photography services for performing arts organizations.
Improving solar cell efficiency
ANNA DORFI ’14 has equal affinities for the environment and science. When the opportunity arose to work for Yiying Wu in the Department of Chemistry on his quest to develop more efficient solar cells, she took it.

For her chemical engineering honors thesis, which won second place in engineering at the Denman, Dorfi investigated alternative semiconducting metal oxides for dye-sensitized solar cells. Such solar cells are characterized as either n-type or p-type based on the types of semiconductors they use. Most dye-sensitized solar cells used today are n-type, which operate at about 20 percent efficiency, while p-type cells are less efficient. Wu’s group is interested in the potential to combine the two types to create a more efficient hybrid.

“Not a whole lot of people are working on this right now, especially in the semiconductor area,” Dorfi said.

P-type cells use nickel oxide as a semiconductor. Dorfi’s task was to test different types of metal oxide to see if any were more efficient than nickel. None were; however, the alternatives still have potential if their use is fine-tuned to maximize their short-circuit currents.

Dorfi designed her project with Wu’s guidance and worked with a graduate student, but her research was largely independent.

“Chemical engineering is a great basis for anything else I’d want to pursue,” she said. That means continuing to investigate ways to improve alternative energy technology. This fall, Dorfi will make good use of her minor in German as a Fulbright grantee at Johannes Gutenberg University in Mainz, where she’ll be developing superconducting materials for better energy conversion in electronics.

Geography and technology come together
MIKE LEMON ’15 uses gundruk, a traditional Nepalese dish, to illustrate the importance of his Denman project. “Food Preservation System Research in Rural Nepal” received honorable mention in agriculture and environmental science.

Gundruk is a mix of roots and leafy greens that is wilted, fermented, then sun-dried. The food is an important source of vitamins and minerals, and its singular flavor, Lemon said, is inextricable from the methods that go into its creation.

“The cultural meaning behind the flavor of a cuisine is really important. The key point is finding technology that would work in Nepal but introducing it to people so it fits with their frame of reference and melds with their cultural tradition,” said Lemon. His attempt to alleviate Nepal’s food insecurity through implementing better preservation methods is part of a growing subfield: socially conscious, or human-centered, design.

Lemon, with a major in industrial design and a minor in geography, focused his efforts on Nepal after learning about the country’s problems with malnutrition.
“Right now, Nepalese people spend 70 cents on the dollar for food. By contrast, we spend 10 cents per dollar in the U.S.,” he said. Nepal also falls short in diet diversification—another measure of a nation’s health—with most calories coming from grains.

By stabilizing the ebb and flow of food availability for Nepal’s subsistence farmers, better food-preservation techniques—that is, allowing farmers to save surpluses during good crop years so they don’t need to spend as much on food at other times—can free up cash for other needs, such as education.

In 2013, Lemon took an exploratory trip to Nepal, where he stayed with a family of subsistence farmers. “I wanted to understand the system. It’s the market, it’s how the government comes in, how [nongovernmental organizations] and aid money come in, intervillage relations, the family,” he said.

Lemon returned in December to conduct the bulk of his interviews and observations, and again in May to distribute technology prototypes. He has partnered with two organizations—Volunteers Initiative Nepal in Kathmandu and the U.S.-based Mountain Fund—and will continue his research for his undergraduate honors thesis next year.

**Online health resources for the disabled**

As people increasingly go online for health information, the need for resources to be accessible to the more than 4.6 million Americans with intellectual or developmental disabilities is acute. Adults with such disabilities disproportionately suffer from secondary health problems, including obesity and mental illness, said **Becca Monteleone ’14**. For her senior thesis research, which won second place in the Denman’s social and behavioral sciences division, she assessed how useful government health websites are for the disabled. For example, are sites compatible with technology that converts type to braille or audio?

Monteleone evaluated sites addressing 10 health areas, including nutrition and obesity (choosemyplate.org), substance abuse (drugabuse.gov), and injury and violence (cdc.gov/injury). “Most sites did pretty well, technologically speaking,” she said. “Errors were generally in converting images to text. The aesthetics were not well translated.”

In the second part of her research—defining trends—Monteleone found that across the 10 sites, which comprised some 1,000 web pages, the terms “intellectual disability” and “developmental disability” appeared only 68 and 82 times, respectively. “That was surprising to me because these issues have already been identified as particularly important to this population, and [information leads] to improved quality of life,” she said.

Monteleone concluded that although the sites on the whole were accessible, the information itself was not effectively pre-
sented. “A lot of the language was pretty advanced for an individual with intellectual disabilities,” she said.

Monteleone, who wants to conduct a follow-up study, plans to earn a master’s degree in intellectual disability studies as a Fulbright recipient at the University of Kent in England.

A prison dance program

TYISHA NEDD ’14 became interested in prison recidivism after watching a documentary in a social work class at Ohio State. She found her approach to the problem in her own major: dance.

Nedd, who placed second in the arts and architecture division, designed and led an arts education program for women at a correctional facility in Columbus.

She began by teaching a dance class to a pilot group and then invited community members to teach classes in other art forms. The project culminated in May with a dance performance by five of the women.

“From the beginning, there was a sense of self-consciousness, which is natural if you haven’t taken a dance class before,” Nedd said. “But [during the program] people have taken ownership over the prescribed movements I give, over the forms I teach. There is a sense that this is my body and it’s valuable. I stressed [the idea that], yes, I’m giving you this movement, but how do you find your voice within the phrase, within the group?”

While many participants were hesitant at first, Nedd saw engagement grow as the program continued.

“I can’t give a grand statement that I changed the rate of recidivism, because the ladies I worked with are still in prison,” said Nedd, who modeled her project on Keeping the Faith, a program run by a Seattle choreographer. “[But over time], even if women weren’t in the class, they wanted to help with the show, be backstage. From that observation alone, I think there was a shift in values.”

After graduating in May, Nedd headed to South Africa to audition for dance companies, teach dance to at-risk girls through a nonprofit organization and explore starting a similar prison program there. “I don’t believe in making dance in a vacuum,” she said.

When inclusive is exclusive

Sometimes tolerance is not what it seems. That was the uneasy sense DEVIN OLIVER ’14 got when he picked up LGBT tourism brochures at a bar in Rio de Janeiro.

The materials played up the creative, fun-loving nature of the city, but Oliver, a geography major with a minor in Portuguese, wondered who might be left out of the narratives of inclusivity that were part of Rio’s growing gay tourism industry and anti-homophobia initiatives.

The resulting project unfolded over several trips to the metropolis. Oliver examined old and contemporary tourism
materials, interviewed LGBT leaders and attended demonstrations led by Rio's gay community.

“At first glance, the city is very friendly and tolerant of LGBT people—at least on paper and in the literature and branding campaign materials,” he said. “I’ve come to learn it means a certain type of person based on certain social markers like race, class and gender expression.”

Along with its party-hearty image, Rio is known for its urban poverty. When Oliver visited shantytowns to interview low-income LGBT residents and investigate how class plays into the equation, the marketing efforts seemed even more disingenuous. Even as leaders were touting the city's openness, enclaves of low-income housing were being razed to build facilities for the World Cup (held this June) and the 2016 Olympics.

Oliver believes it’s important to distinguish between image and reality when it comes to inclusivity, especially in a city as diverse as Rio de Janeiro. “The tourism campaigns are diverting attention away from the ways in which city government is actually devaluing other types of history and culture,” he said. “It’s not as rosy and clean as what is being portrayed.”

**A new way to measure the cornea**

As a member of Jun Liu's biomedical engineering lab, MARTIN SPANG ’14 worked toward refining a noninvasive ultrasound method Liu had developed to characterize the physical properties of the cornea.

Spang helped examine the correlations between the cornea's acoustic and biomechanical properties and therefore shed light on the microstructure of the eye. Specifically, he looked at the interplay of collagen fibers as a factor in how various properties correlate.

Once fully developed, the ultrasound method has the potential to improve diagnosis and treatment of vision problems. “It can be part of a screening process for surgery; [and] it can be used to characterize or track disease progression, particularly corneal thinning,” said Spang. His portion of the project was his honors thesis, which he presented in the Denman’s engineering category.

“The current methods are also noninvasive, but these lack the ability to measure mechanical properties independent of other factors. There are a lot of confounding variables in current devices,” Spang said.

Next, Spang will travel to Cardiff University in Wales on a Whitaker Fellowship (which recognizes young biomedical engineers) to continue investigating corneal properties. Rather than quantifying the collagen structure, he will assist in the attempt to visualize it, ultimately by creating a 3-D model of the cornea. “The model will help us figure out how the eye will react to certain types of force, such as laser surgery,” he said.
More from the Denman

What do hundreds of undergraduate researchers come up with when given the opportunity to present their work? Here’s a sample of additional projects from this year’s Denman Forum.

Fatalism in post-revolution Egypt
Social and behavioral sciences, honorable mention

Can a cultural impulse such as fatalism be quantified? Basem Rashwan, a neuroscience major, traveled to Egypt to gauge levels and types of fatalism—the belief that events are predetermined—in the wake of the 2011 uprising there. He surveyed some 130 individuals at protests, universities and other settings and learned that a strong thread of fatalism does run through Egyptian culture.

Designing vaccination strategies for rabies in raccoons
Biological sciences

West of Ohio’s Appalachian Ridge, raccoons are rabies-free. The state of Ohio, along with federal agencies, vaccinates raccoons via bait traps, but funding has been cut. Elaina Gonsoroski tried to determine the minimum vaccination level required to hold the Appalachian front steady by keeping raccoon rabies, and its public health risks, from spreading west.

How rising ethnic diversity shapes attitudes toward welfare
Social and behavioral sciences

Alexandra Mayorga wanted to suss out whether a causal relationship exists between ethnic diversity and a society’s attitudes toward welfare. She used Denmark, a historically homogenous country, as her test case. Denmark has long embraced social welfare, unlike the more diverse United States, where conversations about welfare are often inextricable from those about race. Her initial results indicate that recent Danish wariness toward the welfare state does indeed correspond with increasing diversity.

Do dog owners have a higher incidence of dangerous staph infections than non-dog owners?
Health professions—clinical

Staphylococcus aureus and methicillin-resistant Staphylococcus aureus are causes of potentially very dangerous staph infections. Rhiannon Marcello wanted to determine whether dog owners contract the bacteria at higher rates. She found higher incidences of both MRSA (3.9 percent versus 1 percent) and SA (62.9 percent versus 37.1 percent) in dog owners, indicating a possible need for revised sanitation standards.
The effect of graphic cigarette warning labels on long-term memory

Psychology, third place

Several countries have introduced graphic images on cigarette packages. (The move is tied up in court in the U.S.) Tomas Moreno-Vasquez used a variety of image/text combinations to test whether, by provoking an arousal response, unpleasant images make anti-smoking warnings more likely to stick in consumers’ memories. He found they did not, but subjects did attribute more credibility to those warnings paired with the images.

Environmentally conscious extraction of gold on a small scale

Mathematical and physical sciences

When a nonprofit organization seeking to open a recycling center came to her lab for advice on how to reclaim gold from electronics, Katherine Wehde was eager to explore greener ways to do the job, along with the commercial feasibility of those methods. Current efforts rely on cyanide, which can then escape into the environment. Wehde’s use of a sugar complex instead—a possibility discovered last year at Northwestern University with gold alloy scraps—has potential applications for treating gold ore in mining as well as retrieving the metal from old computers and stereos.

What determines student college debt?

Social and behavioral sciences, honorable mention

Lu Zheng examined a number of variables, from state appropriations to institutional demographics, to figure out their influence on student loan debt, which has increased notably since 2008. Her sample included 66 four-year public colleges and universities and 82 two-year community colleges. Among her findings: part-time students in two-year colleges are more likely to take on debt.

After the Denman

As these previous winners show, undergraduate research and participation in the Denman resonate long after graduation.

After taking second place in biological sciences in his senior year, Matthew Borths ’08 received a Fulbright grant to continue studying early mammalian evolution at a fossil library in Germany. Now a doctoral student in anatomical sciences at Stony Brook University, he researches creodonts (large primitive carnivores) and helps run the university’s field school in Kenya. “As an undergrad working on a project with grad students or a professor, it’s easy to just be a helper and not participate fully in the science. One of the most basic benefits of the Denman is it creates an opportunity for students to take possession of their work,” Borths said.

First-generation college student Tyler Merz ’11 credits undergraduate research with expanding his education in unexpected ways. As a member of Leonard Brillson’s lab, he won first place in the mathematical and physical sciences division in 2010 for his efforts to characterize the defect structure of zinc oxide, a transparent conducting oxide that has applications for heads-up displays such as Google Glass or computerized windshields in development for high-end cars. He spent a year at Cambridge University as a Churchill Scholar and is now pursuing a doctorate in applied physics at Stanford. “Neither graduate school nor traveling internationally were things I had seen for myself, and undergraduate research gave me the opportunity to do both those things,” Merz said.

Adrienne Strong ’10 investigated barriers to maternal health care use in Tanzania. Her research placed first in the social and behavioral sciences in her senior year. Strong went to Tanzania on a Fulbright and continues to study prenatal health care access at Washington University. She is now conducting field research in Tanzania for her dissertation, which examines how medical facilities in the region may be contributing to high rates of maternal death. “The opportunity to discuss my research with other students and the judges at the Denman was excellent practice for talking about the main questions and results in a way that people can engage and learn from,” Strong said. “This has served me well, particularly when I presented my Fulbright findings at the U.S. Embassy in Dar es Salaam in 2011.”

After winning first place at the Denman in her senior year for her evaluation of public service delivery in two slums in India, Surili Sheth ’11 spent a year in that country working for MIT’s Abdul Latif Jameel Poverty Action Lab. After a stint at the Affordable Housing Institute, she began studying toward her master’s in public administration and international development at Harvard’s Kennedy School of Government. An internship with the Busara Center for Behavioral Economics took her to Nairobi in June. The Denman was valuable, she said, because “I had the chance to present my work to a wide variety of people whose questions helped me further refine my research.”

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