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DO BIKE LANES ENHANCE SAFETY FOR CYCLISTS USING THE ROADS?

According Dr. Krista Nordback, transportation engineers don't know for sure.

Research & Strategic Partnerships

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Portland State
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Going Places

From my office window I see cars and trucks on I-5 crawling over the Markham Bridge in afternoon traffic, while immediately behind, buses, streetcars, light rail trains, and cyclists glide over the Tilikum Crossing Bridge. Few views juxtapose Portland's past, present and future so well.

Portland State University plays a central role in our city's transformation into the country's leading laboratory for transportation innovation. Starting over a decade ago, our engineering and urban studies researchers began receiving federal funding to study the connections between the ways people get around in cities and their quality of life. This issue of the *RSP Quarterly Review* highlights this growing body of work, focusing on the contributions made by the Transportation Research and Education Center, or TREC.

Transportation is an example of a research area that makes sense for PSU. While our scholars have expertise on hundreds of topics, some are particularly well suited to this place and time. PSU-based studies of climate change, entrepreneurship, green buildings, homelessness, urban agriculture, computer security, and social determinants of health all gain national recognition in part because they resonate with what people know or believe about our city, state and region. They also take advantage of the strong strategic partnerships we have with government agencies, companies, and non-profits. And as we've seen with transportation, when a research theme connects logically with our place and our partners, it tends to be rewarded with federal funds.

It was this exceptional synergy and brand, captured in our motto, "Let Knowledge Serve the City," which attracted me to PSU in 2010. In the past six years, my staff and I have strived to upgrade the university's research administrative infrastructure, open the doors wider to collaboration for our strategic partners, and improve the conditions experienced by our graduate students.

As a research scientist, I've longed for more time to take advantage of the administrative systems and partnerships we've been able to put in place at PSU. Over the past few years, I've worked with our transportation, computer science, and environmental faculty and a large contingent of public and private sector partners to position Portland as one of the world's leading "Smart Cities." As I write this, a team from PSU and Portland is heading to Washington DC to make a final pitch for the U.S. Department of Transportation's $40M "Smart City Challenge," the first of several major federal funding prizes being offered at the intersection of "Big Data," "The Internet of Things," and city services.

In order to help PSU capitalize on these emerging opportunities, I will be leaving RSP soon and returning to the faculty, first spending a year in the President's office and Institute for Sustainable Solutions.

It's been a great pleasure to collaborate with so many dedicated staff, faculty and administrators across PSU, building systems and connections that can make our university the hub for transporting Portland into a smarter, more livable future.

Jonathan Fink

Jonathan Fink,
Vice President
Research & Strategic Partnerships

The Transportation Research & Education Center

By Justin Carinci

Researchers in Oregon have long looked at transportation differently. Where most transportation research focused on highways and cars, we realized that the future would require different choices.

Ten years ago, a transportation center was established at Portland State University with a different view. Researchers and educators at this center would look at how transportation could help build healthy, sustainable communities. The center brought together like-minded researchers from four Oregon universities to find answers to questions like: "how does land use and transportation planning create the kind of places we want to live in"; "how can we get more out of investments we've already made in our streets and transit systems"; and "what will it take to make the most sustainable ways of getting around—walking, cycling and transit—also the safest and most convenient?"

This center, then called OTREC, launched with a $16 million federal grant and designation as a U.S. Department of Transportation national university transportation center. The center provided an increasingly assertive voice for a new approach to transportation.

Portland State and, increasingly, Portland became known for innovation in transportation. The research at the university transportation center helped inform decision-making to allow the region's vaunted livable communities to thrive.

Over the years, OTREC funded 237 research and education projects, as well as numerous presentations and publications. Eventually, the center expanded beyond the original OTREC grant and rebranded itself as TREC, the Transportation Research and Education Center at Portland State.

This center twice successfully competed for federal research funding and designations. TREC continues to house one of five national university transportation centers, the National Institute for Transportation and Communities program, but now includes an array of other programs in addition.

That shift in scope also aligns the goals of the center with those of Portland State. TREC's programs span multiple disciplines and approaches, all serving to use transportation to make our community more vibrant and resilient.

TREC builds on PSU's Center for Transportation Studies, which dates back to 1966. In 2007, with support from the OTREC grant, the Initiative for Bicycle and Pedestrian Innovation, or IBPI, was founded. Now a program of TREC, IBPI offers a full range of professional development activities, such as training workshops, webinars and seminars, to advance use and safety of walking and bicycling.

TREC also houses Portal, a data archive founded in 2001 that makes multimodal transportation data available and accessible to researchers and practitioners. The wealth of data stored provide an incomparable resource for making our transportation system better understood, more efficient and better aligned with our priorities.

As you will see in the following pages, the research portfolio of TREC continues to advance the role of transportation in our community. Our programs focus on, but are not limited to transportation system resiliency, expanding opportunities for walking and bicycling, enhancing safety, creating "smart" transportation systems, data storage, management and computer modeling, economic growth, education, and creating places where we can live, work and play by connecting communities through transit.

As you read this issue of RSP's *Quarterly Review*, TREC is again competing for federal support for its largest grant program. After ten years, the center continues to change the face of transportation locally, regionally and nationally. Whatever transportation challenges the future holds, TREC will be here finding answers.

TREC
Transportation Insight for Vibrant Communities

Safety in Numbers

Transportation engineer Krista Nordback explains why it's a big deal that we don't have accurate counts of how many people are riding bikes on our streets.

By Shaun McGillis

In 1966 federal legislation passed that required automakers to include seat belts in all automobiles sold in the U.S. A quarter century later, a similar bill mandating airbags became law. In both cases, overwhelming evidence indicating these measures saved lives and reduced injuries prompted government action.

As with seat belts and airbags, we know measures such as speed limits, prohibitions against driving under the influence, controlled intersections, highway construction standards and bike lanes reduce collision rates, fatalities, and injuries because decades of research has produced an abundance of data that reveal the case to be true.

Well, not exactly in every case, says Dr. Krista Nordback.

Dr. Nordback is a transportation engineer and research associate in PSU's Transportation Research and Education Center (TREC). She studies bicycle and pedestrian infrastructure: its use and efficacy, and the collection and analysis of cyclist and pedestrian count data. She also has expert knowledge of methods for estimating miles traveled and the relationships between vehicle traffic, pedestrian and cyclist volume and collisions.

According to Dr. Nordback, the tools researchers, planners, and transportation engineers have to evaluate the impact of bicycle infrastructure on crash rates are formulated using imprecise estimates of the number cyclists on the road. That's a problem because without precise data, it's very difficult to prove treatments such as bike lanes actually reduce collisions, injuries, and fatalities.

With currently available resources, it is possible to predict the cause and number of vehicle collisions to be expected at a given point on a road with a fair degree of accuracy. It is also possible to estimate how treatments such

as road signs, speed limits, and turn lanes will improve safety by reducing vehicle crash rates. Planners, engineers, transportation officials and researchers can make these predictions thanks to a cache of scientifically proven tools, published datasets and methods for safety analysis compiled in the Highway Safety Manual (HSM).

Unfortunately, similar tools for predicting bicycle crash rates and evaluating safety-enhancing countermeasures were not developed with the same data-driven rigor as those for vehicles. The reason, according to the Federal Highway Administration,

is that there isn't enough "good, quality information" on cycling mode share to develop mathematically sound functions capable of producing accurate predictions.

"The tools in the HSM work because of the quantity and quality of vehicle count data used to develop them," Dr. Nordback said. "We just don't have that kind of data when it comes to bicycle volumes and that's a problem. If we don't know how many people are using facilities like bike boxes and cycle tracks, how are we supposed to know if the infrastructure is making riding safer?"

Improving volumetric data collection and analysis is a theme of much of Dr. Nordback's research. In Minnesota, Colorado, and Oregon, she examined the states' counting activities and methods of data analysis in order to frame the state of the art in non-motorized traffic monitoring programs. In Washington she worked with the state's Department of Transportation developing facility-level methods to estimate annual pedestrian and bicycle miles traveled using data collected from over thirty cities.

In Boulder, Colorado, Dr. Nordback and colleagues evaluated counting methods and analyzed datasets determining best practices for producing the most accurate estimation of annual average daily bicyclists (AADB)—the annualized average twenty-four-hour volume of bicycles at a given location—a critical metric for the evaluation of safety enhancing measures. And by creating bicycle safety performance functions (equations that predict the average number of crashes per year) for the City of Boulder, she showed that given adequate count data equations could be developed on a city-by-city basis.

In Oregon, Dr. Nordback and fellow TREC researchers partnered with the Oregon Department of Transportation to evaluate the accuracy of pneumatic tubes used to count vehicles, bicycles, and pedestrians. The research team's findings indicate that the technology can produce data with a less than ten percent error rate. Improper deployment of the tubes, however, could result in undercounts with error rates as high as seventy percent. That's a gap substantial enough to impact a transportation agency's ability to assess demand for bicycle infrastructure, evaluate safety performance, or obtain federal and state funding for infrastructure projects.

Though accurate estimates of cyclists on the roadway are an essential metric for evaluating the safety impact of bicycle

infrastructure, cities that count riders frequently use a variety of methods, some more precise than others, which make it difficult to determine AADB. Portland, for instance, has a number of continuous counting devices located on the Hawthorne Bridge, Tilikum Crossing, the Eastbank Esplanade, and elsewhere. These devices collect data twenty-four hours a day, seven days a week, year round. Pneumatic tubes placed across roadways around town collect data in durations ranging from several days to a few weeks at each location they're placed. Much of the city's bike ridership data, however, comes from an annual two-hour count conducted by volunteers. During the last count from which data is publicaly available (2014), more than 100 people volunteered at 218 locations citywide and counted 41,590 cyclists.

"Lots of cities count cyclists this way," Dr. Nordback said, "and they use the data they collect to evaluate bicycle safety. But they're taking these two-hour counts and using them instead of AADB. That is why we don't have a good sense of how many riders are using the system—a two-hour count at specific locations doesn't necessarily reflect how many people might be riding at that same location in a week, in three months, or during different seasons. And cities often don't share and pool the data they collect. And without a large source of data from all over the country, it's impossible to create universal safety performance functions like those for vehicles in the HSM."

While organizations like the National Bicycle and Pedestrian Documentation Project (NBPD) do offer transportation agencies guidelines for data collection and repositories to compile data in, they do not aggregate and curate count data into a database available to transportation professionals, planners, policy makers and researchers. To provide such a service, Dr. Nordback and her TREC colleagues partnered

with organizations (including the NBPD) and cities across Oregon and the country to create the Bike-Ped Portal, a national archive for bicycle and pedestrian count data. The Bike-Ped Portal gives researchers, local agencies, policymakers, and transportation professionals the resources to turn their count data into knowledge and action.

"I entered this field because I wanted to know if the infrastructure we're building actually enhanced safety," Dr. Nordback said. "To answer that question I need to know how many people are using the system, and right now I don't have that information. But there's an explosion in bicycle and pedestrian counting going on across the nation, and as more cities sign on to use the Bike-Ped Portal and add their data, we'll be able to leverage that information to improve bicycle crash prediction, which will be a huge step forward in our ability to enhance safety conditions on the road."

We may be a long way from having enough evidence on the impacts of bicycle and pedestrian infrastructure to spur local, state, or federal action mandating safety enhancing measures. But as ridership in cities around the country has increased over the last decade and municipalities are encouraging residents to choose more active modes of transportation as a means to reduce single occupancy vehicle travel, investments in bicycle infrastructure and counting technologies has gone up as well. For Dr. Nordback and other transportation engineers, the renewed interest in cycling provides opportunities to close knowledge gaps and more accurately evaluate cyclist and pedestrian use of roadway systems and facilities. In time, the "explosion" of data researchers at PSU are funneling into the Bike-Ped Portal will lay the goundwork for a better understanding of what types of infrastructure save lives and reduce injuries among the population of cyclists and pedestrians sharing the roads with vehicles and their drivers.

Transit Agencies Ride Social Media

With so many public transit agencies on board with social media, PSU economist, Dr. Jenny Liu asks how they're using these platforms and to what effect.

By Shaun McGillis

> @shakatron BART was built to transport far fewer people, and much of our system has reached the end of its useful life. This is our reality.
>
> –SFBART (@SFBART) March 17, 2016

> @kettering Sugarcoating problems, especially ones obviously disrupting people's lives, isn't an effective or honest way to communicate.
>
> –SFBART (@SFBART) March 17, 2016

> @jalrobinson We don't consider successfully moving the equivalent of the population of Atlanta through BART on a daily basis a failure.
>
> –SFBART (@SFBART) March 17, 2016

G iven the cult of personality surrounding so many celebrities and politicians and the demand for content precipitated by the 24-hour news cycle, it's not surprising when famous or noteworthy personalities grab national headlines with a tweet or Facebook post. But when notable news outlets including *National Public Radio*, *The New York Times*, and *CNN* report on tweets posted by a regional transit agency, you might wonder what all the commotion is about.

The tweets in question are from the Twitter account of BART, the San Francisco Bay Area Rapid Transit agency. The person responsible for the media kerfuffle and behind the twitter handle @SFBART is Taylor Huckaby, a twenty-seven-year-old spokesperson for the transit organization. Huckaby's tweets made national news for their candor and the unusual way they

responded so frankly to criticism of the public agency. "It seemed like a peek behind the institutional curtain," wrote Jonah Bromwich of *The New York Times*.

The emergence of social media has provided new avenues of marketing and communication for public agencies and unparalleled access to the consumers of the goods and services they provide. Seventy-four percent of adults with access to the internet use social media according to the Pew Research Center. For transit agencies, that means millions of costumers are just a click, "Like," or "Follow" away.

At Portland State University, Dr. Jenny Liu, assistant professor in the Toulan School of Urban Studies and Planning and an environmental and resource economist, is interested in the ways transportation agencies use social media, what platforms they're on, and how they measure the effectiveness,

efficiency and value of their efforts to communicate with the online masses.

"I work at the intersection of public policy and economics," Dr. Liu said, "where transportation, planning, and sustainability meet. In that space, I investigate the potential economic effects of transportation-related issues."

Recognizing that social media use by transit agencies was "trending" and that there was scant research examining the practice, Dr. Liu, along with urban studies graduate student Wei Shi, and collaborators from the Rensselaer Polytechnic Institute in New York, approached PSU's Transportation Research and Education Center and poposed taking a look to see what they could learn from transit agencies around the country.

"Transportation agencies are increasingly using a number of social

media platforms to communicate with their riders," Dr. Liu said. "But what's missing from the data are the insights into what platforms agencies are using, what purposes they're using them for; whether or not they had a plan or strategy in place to achieve marketing and communications goals, or even if they had goals prior to engaging riders. There was nothing in the literature that suggested the kind of resources these agencies are investing in social media outreach. Nothing that indicated whether and how they measure the effectiveness of their efforts, and what they felt they needed to improve their social media programs. Our project aim was to fill in those blanks."

The research team surveyed twenty-seven transportation agencies from metropolitan regions and cities large and small throughout the U.S. They collected data on ridership, service area, operations, social media usage and related factors. Their analysis of the data showed both surprising and unsurprising correlations between social media use and the regions and populations served by transportation agencies.

Among the twenty-seven agencies Dr. Liu collected data from, a large majority have social media strategies in place, methods to measure effectiveness and target audiences. A smaller percentage, though still a plurality of agencies, approached social media programs with

clearly defined goals and measurable objectives. Perhaps not surprising, Twitter, Facebook, and YouTube are the platforms agencies use most.

In terms of investments of human resources into social media programs, the research team found that less than half of the agencies surveyed dedicated full-time positions to their efforts. Most agencies divided the responsibility among several employees.

So what do transit agencies do on social media? It seems they spend most of their time responding to riders' comments and updating friends and followers on transit system changes. Some agencies dabble in communicating the environmental benefits of riding public transportation and make the case for the ways transit improves quality of life. As you might expect, agencies evaluate the effectiveness of their social media programs in the same way many of us do: by tallying "Friends" and "Followers," tracking "retweets," "shares," and views, and by monitoring the volume of positive and negative posts, tweets, and comments they get.

While the research team found that the size of a city doesn't necessarily relate to whether and to what degree its transit agency participates in social media, the age of the populations does. No surprise here, agencies in cities with younger populations engage more with social

media than those where the population is older.

"I think one of the biggest takeaways we gleaned from the study was that transportation agencies really want a set of standardized social media practices and methods of measuring their effectiveness," Dr. Liu said. "We saw a clear need for a playbook of best practices to guide social media programs. And to a lesser degree we found that agencies are interested in comparing notes with colleagues in other cities. At this point, however, the lack of standardized procedures and policies make it really difficult to compare what agencies are doing and how effective their efforts are from one place to the next."

The recent hoopla in the news over the unusual @SFBART tweets highlights the fact that new media enables government agencies to communicate with the public through outlets still considered untraditional by many organizational standards. And in this burgeoning era of online communication, there are no formal rules or established decorum to dictate how the discourse should proceed. Nevertheless, Dr. Liu's research points out that various transit agencies are taking similar approaches to communicating with the public through social media and evaluating the effectiveness of their efforts. Though just an initial step, Dr. Liu thinks the research can help transportation agencies identify common themes, practices, and measures of success that will improve the way they use social media to reach their customers. The next step in the process, Dr. Liu explained, is to conduct similar surveys with universities and hospitals to see if there are any similarities to uncover in their approaches to social media strategy and evaluation. In the long run, she noted, the goal is to contribute to our understanding of the economic value social media adds to the operations of organizations whose mission it is to serve the public.

Attitude Adjustment

Exploring new avenues of research, Ph.D. student Tara Goddard partnered with Project Implicit to investigate how drivers' attitudes may impact safety for cyclists on the road.

By Shaun McGillis

In cities throughout the U.S. bicycling is experiencing a renaissance.

The resurgence is apparent from increasing numbers of cyclists on the road. Local governments keen on promoting the environmental and health benefits of riding are investing in innovative infrastructure projects and encouraging residents to engage more frequently in active modes of transportation. Since 2008, private sector partnerships with public agencies launched bike share programs in sixty U.S. cities, increasing public access to bicycles. Meanwhile, researchers at institutions like Portland State University are exploring the facets of cycling from new and creative angles.

Tara Goddard is an urban studies Ph.D. candidate affiliated with PSU's Transportation Research and Education Center. Last year, a paper Goddard coauthored with colleagues Arlie Adkin (University of Arizona) and Kimberly Kahn (PSU) garnered the attention of media outlets including *The Oregonian* and the *Huffington Post*. Conducted in Portland, the study found that African-Americans waited thirty-two percent longer than white people in crosswalks and linked that observation to implicit racial bias among drivers. Embracing a similar interdisciplinary approach as she did in the crosswalk study, Ms. Goddard's dissertation combines social psychology, urban planning, and transportation engineering in an attempt to understand conscious and unconscious factors that

influence drivers' behaviors where cyclists are involved.

"I'm interested in approaches cities take to planning for a sustainable and just future," Ms. Goddard said. "A critical component of those plans is reducing single occupancy vehicle travel and finding other ways to get people where they need to go. Cycling is one of the best options we have. But right now, safety is a major barrier to getting more people on bikes. I think it's possible that people's attitudes about bicyclists contributes to that."

Research shows that bicycling is disproportionately less safe than other transportation modes. While cycling accounts for one percent of all trips in the U.S., cyclists are twelve times more likely to be killed and three times more likely to experience serious injuries than passengers in an automobile in the event of a collision. That elevated risk of harm likely resonates with potential riders. In a survey conducted by the non-profit organization PeopleForBikes, three-quarters of Portland and San Francisco respondents who own bikes but do not ride frequently report feeling "very" or "extremely" concerned for their safety while riding.

"We need to explore ways to improve safety outcomes for cyclists," Ms. Goddard said. "And we need to close the negative feedback loop keeping people from active transportation options because of safety concerns. I'm looking to the intersection of transportation engineering, urban design, and social psychology in my approach to addressing these issues. I want to measure people's attitudes towards drivers and bicyclists to see how they influence safety behaviors. And I want to know if we can use that data to start thinking about different ways to intervene to reduce risky behavior."

In psychological terms, attitudes—explicit and implicit—are expressions of favor or disfavor toward a person,

place, thing, or event. Explicit attitudes are deliberately formed and tend to fall on one side or the other of a polarized construction: good/bad, right/wrong, true/false. Implicit attitudes are unconscious and shaped by experience and socialization processes. Both influence actions and choices. By identifying and evaluating attitudes, researchers like Ms. Goddard can, to a certain extent, predict individual and group behaviors. And if you can predict a behavior, you can intervene to change it.

Researchers use surveys and self-reporting to measure an individual's explicit attitudes. Methods for measuring implicit attitudes are more complex. Arguably the gold standard for measuring implicit attitudes is the Implicit Association Test (IAT), a number of versions of which anyone can take at the website of a group called Project Implicit. Project Implicit provides research and other services for the study of implicit attitudes, biases, and stereotypes. According to the organization's website, IATs "measure the strength of associations between concepts (e.g., black people, gay people) and evaluations (e.g., good, bad) or stereotypes (e.g., athletic, clumsy)" by asking participants to organize concepts into categories. The speed at which one categorizes concepts is a measure of how strong their implicit attitudes are.

Working with researchers at Project Implicit, Ms. Goddard developed the first IAT to measure an individual's attitudes towards bicyclists and drivers. Using Project Implicit's web platform and network of test respondents, Ms. Goddard is collecting data on participants' explicit and implicit attitudes, basic demographic and geographic information, and cycling experience.

"At this stage in my research, I'm not measuring attitudes on race, gender, or other identities that intersect with cycling and may affect driver behavior," Ms.

Goddard said. "I'm interested in what participants think about bicyclists as a group and if they distinguish between sub-types within that group."

Measures of participants' attitudes might help researchers recognize links between psychological phenomena and behaviors associated with collisions involving bicycles and vehicles. Attitudes, for example, may correlate to instances of inattentional blindness, a condition that leads one to not see an object or person in their field of view. Inattentional blindness is potentially a factor involved in a category of collisions called "looked but failed to see." Similarly, if Ms. Goddard's research contains evidence of favorable attitudes towards cycling in individuals without cycling experience, but who live in areas where cycling and bicycle infrastructure is prevalent, that might suggest exposure can influence attitudes and behaviors. Such insights might impact public policy, transportation planning, and infrastructure design.

"When it comes down to it, I'm a transportation planner and engineer interested in developing interventions we can deploy at the urban design level, or at the programmatic level to enhance safety and improve interactions between drivers and bicyclists sharing the road," Ms. Goddard said. "Applying the tools of social psychology to enhance bicyclist safety is something no one has done in this way before. I think it could help change the way we approach designing infrastructure."

At a time when Portland and other cities are envisioning a future in which traffic-related causalties are a thing of the past and reductions in the emissions of CO_2 and other greenhouse gases are slowing the pace of climate change, groundbreaking approaches to solving critical environmental and public health challenges like those proposed by Ph.D. candidate Tara Goddard will provide civic leaders new pathways to the sustainable solutions they'll need to accomplish those goals.

Cyclist
or
Good

Driver
or
Bad

Safe Crossing

Dr. Sirisha Kothuri's research enhances the efficiency of signalized intersections for all users.

By Shaun McGillis

"It's like an airplane falling out of the sky every other day."

Such was Scott Bicker's assessment of the 4,500 pedestrians killed on American streets every year. Bicker, the executive director of America Walks, was quoted in an article about the multi-national initiative to end roadway causalties called Vision Zero.

Last year, Portland joined fifteen U.S. cities that have embraced Vision Zero and dedicated resources to ending roadway fatalities and injuries within city limits. The Vision Zero Crash Map developed by the Portland Bureau of Transportation (PBOT) is one of the products of the city's investment. The map tracks traffic-related instances of serious injuries and deaths on Portland streets.

Although the map shows the number of pedestrian injuries pales in comparison with those of drivers and passengers of motor vehicles, the data reveals high pedestrian mortality rates. The reason: pedestrians, like cyclists, are more exposed and therefore more vulnerable to injury or death than a vehicle's occupants. So given the vulnerability of pedestrians walking the streets, what can Portland and other cities do to reduce collisions and and save lives?

Just up the road from PBOT's Southwest 4th Avenue offices, in the Maseeh College of Engineering and Computer Science, Dr. Sirisha Kothuri, a post-doctoral research associate, is working to increase the efficiency of signalized crosswalks, a project that may also help cities reduce deaths and injuries resulting from pedestrian/vehicle collisions.

An affiliate of PSU's Transportation Research and Education Center (TREC), Dr. Kothuri studies traffic operations and develops technologies to improve the experience of walking and cycling for pedestrians and cyclists using street networks. Specifically, her work aims to enhance the efficiency, safety and walkability of signalized intersections where motor vehicles have traditionally been prioritized.

Working with collaborators at Northern Arizona University, PBOT, and transportation agencies in the cities of Mesa and Flagstaff, Arizona, Dr. Kothuri and her fellow investigators are evaluating pedestrian crossing schemes at signalized intersections to try to understand how they might impact delays. Most pedestrian fatalities and serious injuries occur between 6 p.m. and 6 a.m. and many occur at intersections. One of the factors frequently involved in these incidents is pedestrian behavior: jaywalking, perception of risk, perception and speed of crossing devices, herd mentality, and so on. Dr. Kothuri and her colleagues think it's possible to change risky behaviors at crosswalks, increase compliance with traffic signals, and improve safety by shifting the prioritization of signals from vehicle to pedestrian traffic, thereby reducing pedestrian delays.

"Transportation agencies try to emphasize the prioritization of pedestrians at signalized intersections," Dr. Kothuri said. "And given their vulnerability, pedestrians should be accorded the highest priority, but in practice that doesn't always happen."

In order to test the hypothesis that prioritizing pedestrian crossing at signalized intersections could increase safety by reducing risky behaviors, Dr. Kothuri modeled several pedestrian crossing schemes on a simulation of a busy stretch of Portland's Southeast Division Street between 119th and 130th Avenues. Not surprisingly, she found that when traffic volumes were high and pedestrian volumes low, prioritizing vehicles to reduce overall delay is a best practice. The simulations, however, did suggest that during off-peak periods, the signals could prioritize pedestrians without adversely affecting traffic, which could reduce instances of jaywalking and other risky behaviors.

"Peaks in pedestrian volume are different from those in vehicle volume," Dr. Kothuri said. "So during the lunch hour, for example, when people are out walking to restaurants, parks, or running errands, and there are fewer cars on the road, we could switch the timing of signals so people aren't waiting as long to cross the street."

To move this idea out of the digital world of computer modeling and test it on actual city streets, the research team developed an algorithm that prioritizes pedestrian crossing when traffic volumes are low and is deployable in signal control software already in use. In partnership with PBOT, the research team is testing the algorithm at the intersection of SE 122nd and Division in Portland and on the streets of Mesa and Flagstaff in Arizona. And because pedestrian prioritization is appropriate for some but not all intersections, Dr. Kothuri is developing a user manual that will help transportation agencies identify places where they can implement the augmented signal scheme.

"It's a fine balance, trying to reduce delays for everyone," Dr. Kothuri said. "It's an art, really, and it's hard. Traffic engineers are up against difficult circumstances in their efforts to manage demand from everyone using the system. But we think the work we're doing here can help cities move everyone around more equitably and efficiently and maybe even decrease instances of pedestrian/vehicle accidents at some intersections by eliminating long waits that contribute to risky behavior when traffic volumes are low."

"Everyone is a pedestrian at some point each day and delays at signalized intersections impact pedestrians disproportionately compared to vehicles. Delays imposed by traffic signals could play a role in signal non-compliance, which in turn could impact safety negatively."

–Dr. Sirisha Kothuri

Revolution in Pedal Power

As bikes equipped with battery-powered motors hit the road, PSU's John MacArthur is there to ask how they might alter the transportation landscape.

By Shaun McGillis

In his 2011 State of the Union address, President Obama called for the U.S. to take a leadership role in developing technologies that would reduce our dependence on oil. To jump-start the program, he proposed putting one million electric vehicles ("EVs") on the road by 2015.

In support of large-scale adoption of EVs, the Obama Administration invested millions in research and development, provided billions in loans to manufacturers, and offered consumers a $7,500 tax credit for purchasing an EV. Four years later, as 2015 came to an end, just 400,000 EVs were on the road.

While growth in the EV market is strong year after year in the U.S. and abroad, thanks to lower fuel prices and the abundance of comparatively inexpensive gas-powered automobiles, EV sales pale in comparison to traditional cars and trucks. But that doesn't mean an electric revolution in transportation isn't taking place. You just have to look to another industry to find it.

For nearly a century innovations in bicycle design were largely structural and material. That changed in the 1990s when Chinese manufacturers began equipping bicycles with small, battery-powered motors and the "e-bike" arrived on the market. For over twenty year now, the demand for e-bikes has remained in high gear. The case in point: in 2013 worldwide sales of e-bikes reached nearly forty million.

Sales of EVs on the other hand topped out at roughly 200,000 that same year.

Compared to China and Europe where most e-bikes are sold, demand in the U.S. has been slow to develop. 2013 sales estimates put the number at nearly 174,000 units, or roughly 0.4 percent of the total market. But e-bikes are catching on nevertheless, as is evidenced by the increasing number of e-bike shops opening in Portland, Seattle, San Francisco, New York, Minneapolis, and other "bike-friendly" cities.

John MacArthur, the Sustainable Transportation Program Manager at PSU's Transportation Research and Education Center, has followed the e-bike trend for years. He is one of the few researchers around the country looking into e-bike use and asking how e-bikes might alter the transportation landscape.

"My research examines how the integration of technology and bicycles can break down barriers to cycling and get more people to ride more often," Mr. MacArthur said.

With an e-bike it's easy to coast by many of the typical obstacles that prevent people from cycling. The extra power provided by the motor means less legwork when climbing hills or riding longer distances. E-bikes make cycling accessible to individuals with prohibitive health conditions. And they are an attractive alternative to automobiles for short trips around town.

Evidence that e-bikes, unlike traditional bicycles, can help potential riders overcome barriers to cycling turned up in an online survey of e-bike adopters Mr. MacArthur conducted in 2013. Of 553 e-bike owners surveyed, sixty percent indicated they rode e-bikes because they lived or worked in hilly areas; fifty-nine percent said e-bikes helped them ride despite disabilities; and sixty-five percent said they used e-bikes to replace car trips.

"From what we've learned from people who ride e-bikes, it's pretty clear that issues like time, distance, health, and topography just aren't as difficult to overcome as they might be if we were talking about regular cycling," Mr. MacArthur said.

So why then, given the advantages of e-bikes, aren't they permeating the transportation landscape in the U.S.?

Figuring that outdated rules, regulations, and classifications may have something to do with the comparatively slow growth rate of the e-bike market in the U.S., Mr. MacArthur conducted a nationwide assessment of legislation covering e-bikes. He found a hodgepodge of federal, state, and local laws that may lean too heavily on the ecosystem in which e-bike retailers and distributors operate. The complexity of that regulatory environment is likely negatively impacting the nascent e-bike market and limiting the adoption of the technology by the American public to places where e-bikes and bicycles are regulated in the same way.

"The e-bike market in the U.S. is one we're really working to understand at this point," Mr. MacArthur said. "Along with the rules and regulations governing the market, we want to know who the consumers are, why they're choosing e-bikes, and what they're getting out of it."

To answer some of those questions, Mr. MacArthur recently partnered with Drive Oregon, a non-profit that supports the electric mobility industry in Oregon, and health provider Kaiser Permanente to evaluate a program in which Kaiser employees "test drove" e-bikes for ten weeks.

At the start of the trial participants were asked about their attitudes towards cycling, whether they had bicycles at home, how often they rode, for what reasons, and other questions. At the conclusion of the ten-week trial, participants were queried again, this time about their experiences using the e-bikes and whether those experiences had changed their attitudes.

"We definitely saw a shift in attitudes and behaviors after the Kaiser employees had the e-bikes," Mr. MacArthur said. "Some participants who had negative attitudes at the onset changed their opinions over the ten-week trial. People who didn't typically commute by bike reported giving it a try. Others commuted by bike more often. In fact, in all categories of use, participants reported riding more often with the e-bikes. And the reason people gave most frequently for the change in attitudes was that they thought it was fun. More so than saving money on gas or getting exercise, it was a sense of enjoyment that got them riding the e-bikes."

That particular insight could prove useful to Portland and other cities working to address urban issues such as traffic congestion, public health, and reducing greenhouse gas emissions. Portland's "Bicycle Plan," for instance, aims to increase the bicycle share of total trips taken within the city to twenty-five percent by 2030. That's a steep hill to climb, and to make it the city is going to have to encourage residents who don't typically ride a bike to jump on the bandwagon and pump the pedals. But as Mr. MacArthur points out, one way to get Portlanders to change their behavior is to show them that cycling can be fun, enjoyable, and accessible for all. And considering the cost point and potential health benefits of e-bikes, they're an excellent alternative to EVs for getting around town. So as more people begin to adopt e-bikes, the transportation landscape in Portland and other U.S. cities may begin to look much more like the cities of Europe and Asia where millions of people find traveling by bike to be a natural part of everyday life and not just an activity reserved for the ultra-fit.

BREAKING DOWN BARRIERS TO BICYCLING

Dr. Amy Lubitow works within communities to address transportation-related issues such as increasing bicycle ridership among women and marginalized communities.

By Shaun McGillis

Many Portlanders may recall the boastful "Welcome to America's Bicycle Capital" mural that adorned the exterior brick wall of a building on the corner of Southwest 2nd Avenue and Ash Street in downtown. Though the mural reportedly drew anonymous complaints from parties influential enough for the city to order its removal in 2014, Portland, nevertheless, has a reputation as one of America's best bike towns in terms of ridership, infrastructure, safety, and innovation.

But while Portland is ranked in the vanguard of bike-friendly cities by *Bicycle Magazine, Time, Forbes*, and the League of American Bicyclists and has one of the highest municipal ridership rates in the country, many of the city's residents lack access to the benefits of cycling.

At Portland State, sociology professor Dr. Amy Lubitow and graduate student Kyla Tompkins are working to better understand how Portland might expand the percentage of trips residents take by bike while also increasing the diversity of Portland's cycling population.

Tompkins, who earned her bachelor's at PSU, is interested in the intersection of cycling and gender issues. Dr. Lubitow, who mentored Ms. Tompkins as an undergraduate and graduate student, focuses her research broadly on issues of equity and justice in transportation. By interviewing and observing individuals and small groups within communities and literally putting their concerns on the map using G.I.S., she facilitates engagement and participation in transportation-related matters where race, gender, ethnicity, and socioeconomic factors are involved.

Recently, Dr. Lubitow joined the Institute for Sustainable Solutions' Portland Climate Action Collaborative, a partnership that matches PSU students and faculty to the goals and activities outlined in the region's Climate Action Plan. Contributing a sociologist's point of view to efforts underway in the city's Bureau of Planning and Sustainability, she examined the city's proposed "Green Loop" bike and pedestrian pathway from a social justice and equity perspective. As a part of that evaluation she conducted qualitative interviews and held focus groups with residents of North, Northeast, and Southeast Portland. As a result, the community's input was included in the conversation about the Green Loop and other efforts to increase active transportation in neighborhoods outside of the central city.

Expanding upon that work, Dr. Lubitow partnered with PSU's Transportation Research and Education Center (TREC) and the Institute for Sustainable Solutions to pilot a study intended to shed light on barriers to cycling faced by women and minority populations in Portland. Additionally, the project aims are to increase ridership by addressing those barriers, and improve access to the benefits provided by cycling.

"The share of ridership among minorities is increasing every year," Dr. Lubitow said. "And while male cyclists still out number their female counterparts by a large margin in Portland, there are modest increases in the numbers of women taking up cycling. We want to hear from folks in those cohorts, women and minorities, who are not so disadvantaged that they cannot access the benefits of cycling. They can. Perhaps they even want to, but there are barriers in their way. And we know some of those barriers. Some people aren't comfortable riding alone, but would ride in a group if they knew how to find one. Some don't know how to get around busy streets without bike lanes. And others would buy a bike and ride, but they don't have anywhere to keep one. If we can identify barriers like these through this project, we can start working with the community and organizations like the Community Cycling Center, whose previous outreach efforts are the foundation we're developing our research on, to find suitable solutions."

In the coming months, Dr. Lubitow and Ms. Tompkins plan to develop surveys and conduct qualitative interviews with women and members of Portland's minority communities who are also potential cyclists.

"We plan to meet with community members to learn about the positive and negative experiences they've had while riding," Ms. Tompkins said. "We would like to know their attitudes towards bicycling. Do they think they'd feel comfortable riding in their neighborhoods? Have they participated in events like Sunday Parkways? Would investments in bicycle infrastructure change their opinion? Are they uneasy about sharing the road with automobiles? Maybe they don't ride because they think cycling is child's play. Whatever the case may be, by sharing their thoughts and experiences, they can help us better understand what it would take to overcome barriers to cycling and encourage them to choose riding a bike over driving a vehicle to a friend's house, the grocery store, work or school."

The insights to be gained by the study could inform the city's efforts to meet the equity and social justice mandates established by the region's Climate Action Plan, increase participation in active modes of transportation, and achieve the goal of raising bicycle rideshare to twenty-five percent by 2030 as is stipulated in the city's Bicycle Plan. The study could also illuminate previously unknown or misunderstood conceptions about cycling held by participants.

"We have these potential cyclists that no one has paid any attention to," Dr. Lubitow said. "No one has asked them what it would take to get them to ride a bicycle as a means of transportation. As a result, no one has come up with a plan to encourage them to integrate cycling into their everyday lives. That is the gap we hope to fill with our study. Our aim isn't to get people to become the kind of cyclist that commutes seven miles to work every day. But if we could learn from groups like women—and I'm thinking of mothers in particular, and minorities what it would take to get them on bicycles, we could see a decrease in the number of single occupancy vehicle trips Portlanders take as more people choose more active modes of transportation in their everyday lives."

While year after year, Portland receives high rankings and kudos from cycling associations, publications, and the media, it is still a city in which the community of riders is not representative of the city's diverse population. Needless to say, there is much that needs to be done to expand participation in cycling throughout the city. One way to increase the number of cyclists on the road is to make it as easy as possible for residents—women, minorities, and anyone else facing persistent barriers—to overcome those obstacles and feel comfortable getting on a bicycle. By working with the community to make cycling more accessible to all Portlanders, Dr. Lubitow and Ms. Tompkins are inching the city ever closer to deserving the moniker "America's Bicycle Capital."

How Eco Driving Works

INTERSTATE 5

PSU's Donald Truxillo asks: Can organizations reduce fuel consumption by encouraging employees driving fleet vehicles to follow simple guidelines while behind the wheel?

By Shaun McGillis

SOUTH
99E

EcoDRIVE
Savings that make a difference.

Maintain

Use the Right Oil.
Improve fuel efficiency by using the recommended grade of oil.

Change Filers.
Improve mileage and prevent engine damage.

Inflate Tires.
Keep tires at proper PSI levels for better fuel economy.

Tune-Up.
Getting a tune-up can increase gas mileage by up to 4%.

Plan

Consolidate Trips.
Plan routes to save time and gas.

Lighten Your Load.
Unused racks, carriers and trunk items reduce fuel economy by up to 2%.

Perform

Speeding Costs.
Fuel economy decreases rapidly at speeds over 55 mph.

Steady it Up.
Steady speeds improve fuel efficiency and make roads safer.

Avoid Idling.
Thirty seconds of idling uses more fuel than restarting an engine.

Moderate AC.
Use AC sparingly to save 5 to 25% on gas mileage.

Over the last twenty years regulatory pressures and an increased public demand for greater fuel economy placed the onus on the automotive sector to improve gas mileage and reduce emissions. However, not all of the responsibility belongs to the automotive industry. Drivers must also help maximize fuel efficiency and reduce levels of deleterious pollutants entering the atmosphere.

In the 2000s, as the price of oil soared, and new hybrid and electric vehicle technologies were in short supply, a movement to encourage drivers to maximize fuel economy while minimizing emissions began to take shape. Eco-driving, a combination of vehicle maintenance and driver behaviors—keeping tires inflated, driving at optimal speeds, avoiding rapid acceleration, excessive braking, combining trips, and other simple techniques—was developed to save gas and reduce emissions.

In 2010 the state launched the Oregon Sustainable Transportation Initiative and developed a "Greenhouse Gas Reduction Toolkit" that provided educational materials that encouraged drivers to adopt eco-driving behaviors. When the state wanted to know whether the program could succeed in a workplace setting, it turned to PSU's Transportation Research & Education Center (TREC), where Jennifer Dill, the center's director, recruited Dr. Donald Truxillo and John MacArthur to lead the project. Dr. Truxillo is a professor of psychology at PSU and an organizational psychologist whose research examines employee training, workplace safety, recruitment, hiring, the aging workforce and, more recently, organizational transportation initiatives. Psychology doctoral students Layla Mansfield and Frankie Guros supported the project.

"What we found in our first evaluation of the eco-driving program," Dr. Truxillo said, "was that it works when employees are motivated to follow the program recommendations and supervisors support the adoption of eco-driving behaviors. Without those two factors, the program did not seem to have a significant impact on employee driving behaviors."

Building on their review of the state's efforts, Dr. Truxillo and John MacArthur, along with Dr. Talya Bauer (SBA), Dr. Leslie Hammer (Psychology), and doctoral student Grant Brady, are exploring the impact of supervisor support on the adoption of eco-driving behaviors and whether this actually affects fuel consumption in fleet vehicles driven by government employees.

"The eco-driving promotional materials don't necessarily actively encourage drivers to adopt eco-driving behaviors," says Dr. Truxillo. "There's a video that explains what eco-driving is. There are posters and flyers employers can put up around the workplace. There are static cling tags that can be placed in vehicles. But the program itself is pretty passive, and posters and flyers can easily be overlooked. We proposed that by providing supervisors with the materials along with training, supervisors would be more likely to express their support for the program. Due to their frequent communication with employees, supervisors can serve as champions for the program. It's a much more active approach to encouraging the adoption of eco-driving behaviors."

Employees and supervisors from Washington County, the City of Hillsboro, and the state are participating in the current study. The research team collected survey data to assess if and how driver behaviors changed as a result of the supervisor training. Vehicle data was also collected to compare self-reported behavioral changes against actual fuel consumption.

"This is a new approach to studying the efficacy of eco-driving programs," says Dr. Truxillo. "Other studies have simply provided employees some training and then checked to see if the training changed driver behavior. This study is seeking to achieve ecological validity. In other words, we're monitoring to see if the training we gave the supervisors translates to employee behaviors behind the wheel and if those changes reflect a reduction in fuel consumption."

If the research team's efforts show promise, they could be used by other organizations wanting to implement eco-driving programs. In the long run, sensible driving could result in reductions in gasoline and diesel consumption and greenhouse gas emissions.

A Glimpse into the Future

It's no crystal ball, but PSU's Northwest Economic Research Center developed a tool policy makers can use to peer into the future of the Portland metro region.

By Shaun McGillis

It's election season again, when politicians foretell of a brighter future for all, should, of course, they win the election. "Prosperity," Woodrow Wilson said, "is necessarily the first theme of a political campaign."

Campaign rhetoric and soothsaying aside, the future remains as much a mystery as prosperity is a point of view. That we cannot peer into the future, however, is becoming increasingly problematic for elected officials, government agencies, interest groups, utilities, and other public-service organizations for which long-term sustainability is integral to their missions.

The ability to peer into the future of the Portland metro region is now closer to a reality thanks to a team of economists from Portland State University's Northwest Economic Research Center (NERC) led by Oregon's former state economist, Dr. Tom Potiowsky. Working with data from a number of state and federal agencies, Dr. Potiowsky and his team have developed a population and economic forecast for the seven county region of the Portland-Vancouver-Hillsboro Metropolitan Statistical Area that extends as far as fifty years into the future. The forecast sheds light on how the region's population will grow by gender and age over the coming decades. It also predicts employment, personal income, housing starts, and the price index of goods and services through the middle of the century.

"There was a real need for a regional population and economic forecast that took into consideration the local nuances of the Portland metro region," Dr. Potiowsky said. "Sure, the Bureau of Labor Statistics provides estimates of monthly job numbers, but their data is removed from what's happening on the ground. And some local agencies have put together similar reports, but there are always questions about accuracy and uncertainties in their data and methodology. Our independent report avoids those shortcomings and frees up time for government agencies to devote to their core missions."

To create the regional population and economic forecast, NERC received the backing of the City of Portland, Metro, NW Natural, Clark County, and Portland General Electric, all of which expressed a need for just such a report.

"This report contains information essential to the long-term development and sustainability plans of government agencies and anchor institutions throughout the metro region," Dr. Potiowsky said. "It's a tool they can use to shape the way Portland and the surrounding area will grow in the coming decades."

Election years are excellent reminders that long-term growth and prosperity cannot be achieved through campaign slogans alone. With the Portland Metropolitan Regional Population and Economic Forecast, government agencies as well as other public and private organizations have a new tool at their disposal to help them peer into the future, and though it's no crystal ball, it certainly can help the region plan for prosperity.

Partnership for Climate Action

By Christina Williams

The first symposium of the Portland Climate Action Collaborative on February 26th drew more than sixty attendees—hailing from City and County offices, desks and labs at PSU, and nonprofits across the region. The common link? Their work to reduce carbon emissions and make the region more resilient in the face of climate change.

"Most of us who work on climate change experience cycles of optimism and despair," said Michael Armstrong, senior sustainability manager with Portland's Bureau of Planning and Sustainability (BPS). "Today is one of those moments of optimism."

Armstrong and Portland BPS co-hosted the symposium along with Portland State University's Institute for Sustainable Solutions (ISS).

ISS and BPS co-founded the Portland Climate Action Collaborative in 2013 as a way to engage students and faculty in supporting the goals of the region's Climate Action Plan. So far the Collaborative has attracted $400,000 in grant funding and engaged twenty-two PSU faculty and eighteen students working with close to two-dozen City partners.

"This is the first time we've had everyone in the same room and the energy is inspiring," said Fletcher Beaudoin, assistant director of ISS. "We've also invited people we would like to involve in future partnerships for climate action."

The Portland region is preparing for higher temperatures, drier summers, more intense rains and other changes as the climate changes. The City of Portland and Multnomah County 2015 Climate Action Plan calls for an eighty percent reduction in local carbon emissions by 2050 and addresses factors such as transportation, consumption of carbon intensive food, the role of urban trees in carbon sequestration, and strategies to cope with the effects of climate change residents are already experiencing. During the Portland Climate Action Collaborative symposium, City-PSU teams presented the findings resulting from eight active or recent projects, each created jointly by BPS and ISS. Additionally, ten community-based organizations that are employing interns to work on neighborhood-specific climate projects were invited to share their work.

Rose High Bear, executive producer with Wisdom of the Elders, discussed her organization's focus on storytelling, the intern-supported video project, and bringing a Native American perspective to the climate change conversation. High Bear represents just one of the organizations hosting paid student interns to work on Collaborative-related projects. Students are also working with APANO, OPAL Environmental Justice, the Coalition of Communities of Color, City Repair, KairosPDX, Rose Community Development, Ecumenical Ministries of Oregon, and the Community Cycling Center to assist with tasks ranging from curriculum development on cross-cultural communication about climate change to community organizing for transportation and housing issues.

The projects presented include the mapping of urban heat islands and air quality; community-based participatory mapping of neighborhoods in Cully and Lents; analysis of the equity considerations of a proposed six-mile Green Loop around downtown Portland that would provide park space and bike and pedestrian access; determining the value of Portland's green infrastructure assets such as bioswales and urban trees; an analysis of Portland's food economy; and projecting likely patterns for future flooding along the Willamette River in downtown Portland.

In addition, PSU's researchers from PSU's Northwest Economic Research Center presented an economic analysis of the Green Loop project's anticipated impacts on land use values and a report on the economic outputs of building deconstruction, where materials are conserved for reuse, as compared to demolition.

The economic values articulated in the deconstruction analysis were key in convincing the Portland City Council to approve a policy on Feburary 18th requiring deconstruction of unwanted buildings over one hundred years old. Deconstruction of buildings results in ninety percent of materials being diverted from the landfill. The analysis also found that the salvage revenue—through sales or tax-deductible donation—can offset the increased costs associated with deconstruction, which takes longer and requires more hours than demolition. In other words the policy could create as many as fifty new jobs while adding close to $1 million to the economy.

Such policy-relevant research meets the goals of the Portland Climate Action Collaborative. Similarly, the Portland food economy report is informing future policy decisions about zoning to support food-related businesses. Urban heat island maps are helping city planners understand which neighborhoods are most vulnerable to heat waves. Those working on plans for the Green Loop have data to share about increased property values and how to make the loop accessible to more residents. And the flood plain analysis is helping Portland City planners model future climate change scenarios.

For more details about the Portland Climate Action Collaborative and the projects and internships it comprises, see www.pdx.edu/sustainability/portland-climate-action-collaborative.

Searching for Heavy Metals in Portland's Air

By Christina Williams

Portland State University's Institute for Sustainable Solutions is partnering with the City of Portland and Multnomah County to conduct an in-depth look at heavy metals in Portland metro neighborhoods. This unprecedented research will include more than 600 samples for metals in air, soil, and from other surfaces over the next two years.

Linda George, professor of Environmental Science and Management and Fellow of the ISS, will lead the research, which will be funded by $62,500 from ISS, with matching funds of $31,250 from the City of Portland and $31,250 from Multnomah County.

The funding will purchase specialized X-Ray fluorescence analysis equipment for the project. George, along with faculty colleagues and students at PSU, will work with community groups and local, state, and federal agencies to set up six different research sites of approximately one-square-mile each across the Portland metro area to sample for metals. Results will help inform policy makers, public health agencies, and concerned neighbors about toxic metals air pollution.

"The quality of the air we breathe is critical for all Portlanders," said Portland City Commissioner Steve Novick, who sponsored the appropriation request for city funding. "PSU's research will provide the kind of real-time, neighborhood-level analysis that is important for policymakers to consider as we move forward."

The research project was prompted by recent concerns stemming from reports of elevated levels of heavy metals in the Portland metro area.

"Current air quality data from PSU will be vital to our public health agencies," said Deborah Kafoury, Multnomah County Chair. "The county is pleased to be able to partner with the Institute for Sustainable Solutions to help address our residents' concerns about our air quality."

Initial results of the study will be available in early 2017 and will include maps.

"Providing this kind of policy-relevant research is exactly the right role for PSU, an institution dedicated to serving its community," said Robert Liberty, director of the ISS. "I'm pleased that ISS has the means to react quickly and that our partners at the City of Portland and Multnomah County were able to join us in making this investment in our understanding of urban air quality."

More information about the project is available online at pdx.edu/sustainability/urban-air.

Did Chemical Networks Give Rise to Life on Earth?

By John Kirkland

Can lifeless chemicals cooperate with each other and form networks? And if they can, could this explain how life on Earth began four billion years ago?

Those are questions that Portland State University chemistry professor and NASA researcher Niles Lehman is seeking to answer. He recently received a $600,000 grant from the John Templeton Foundation as part of its mission to answer "Big Questions" in science—the basic forces, concepts, and realities governing the universe and humankind's place in it.

Lehman's approach is different from conventional thinking about organic evolution in which a single molecular accident became the spark from which all subsequent life flowed. He believes that certain chemicals are drawn to each other, and when they meet they begin forming networks with other chemical pairings in large, interconnected clusters. The attractions, the pairings and their ability to create more complex structures are all essential elements of life.

"The question is when and how do these chemicals become life?" Lehman said. "I think the key is network cooperation."

Lehman says the chemicals linking with each other at the dawn of life may have done so in increasingly efficient and less random patterns as they "cooperated" in ways that made their connections self-replicating.

Lehman is testing his theory on RNA molecules—which play an essential role in life, but only if they're paired with other molecules. His previous work demonstrated that RNA molecules could form simple triangles. His newest research will build on that—to see if they can create complex networks.

Lehman has been working on the science behind the origins of life for twenty-five years. He has been a chemistry professor at PSU since 2001. Before receiving the Templeton grant part of Lehman's research funding came from former Oregon scientist, businessman and politician, Harry Lonsdale, who in 2011 sponsored a research challenge to determine the origins of life on Earth.

A new protected intersection in Vancouver. (Courtesy of Dylan Passmore)

The Atlantic: Identifying the Safest Intersection Designs for Cyclists

By Laura Bliss

*Read the original story and see photos in *The Atlantic's City Lab*.

More than 125 years after their earliest appearances, bike lane designs can still be surprisingly arbitrary.

Nowhere is this clearer than with protected bike lanes, those cycling pathways that are separated from cars by some type of physical barrier, such as planters, curbs, parked cars or posts. Protected lanes are considered the gold standard for cyclist safety and comfort, but in most of the world, how and if they're implemented at all is largely up to local jurisdictions. Even where protected lanes are in place, when they meet up with busy intersections, those protections typically go away, and the logic behind their design can quickly fall apart.

Some North American cities have installed what's known as "protected intersections" (also referred to as the "Dutch approach"—pictured at top in Vancouver) which maintain lane separation through intersections via the use of concrete islands. Much more common are "mixing zones," where cyclists must briefly share space with cars. And then there are intersections that use

special signal timing to help keep people on bikes somewhat more separated from auto traffic.

Will more widespread standards for bike lane treatment at intersections ever emerge in the U.S.? The Transportation Research and Education Center at Portland State University aims to move that conversation forward with its newest study. Using pooled funds from eleven

counties, regional planning bodies, transit agencies and nonprofits around the country, researchers at Portland State will first create an inventory of all sorts of intersection treatments. Then they'll use computer simulations, video analysis, and cyclist surveys to determine the "critical thresholds that designers need to consider from one design to another," says Christopher Monsere, a professor of civil engineering at Portland State and the project's lead researcher.

What are those thresholds likely to be based on? "The volume of different traffic streams will be a key metric, as a way to estimate bike and car conflicts," says Monsere. "Speed will also be a design variable we look at because it influences both severity of conflicts and how much visibility you need to provide for cyclists using a protected bike lane." He and a team of researchers will look at how each design affects right and left turning, and how useful they are on different types of streets.

The eleven partnering agencies are eager for data-backed guidance. One of them, Cambridge, Massachusetts, is home to some of the earliest separated bike lanes in the country. But as Cara Seiderman, the city's transportation program manager, put it in a statement, "We've been using our best engineering judgment, and the best practices that exist. And we realized that that could be even stronger."

Portland's own regional transit authority, TriMet, is another partner. Jeff Owen, a transportation planner for TriMet, says he'll be looking for ways to ensure that buses can get to stops along protected bike lane intersections. "This is an attempt to make sure we're part of the conversation," Owen said in a statement.

Within the next eighteen months, TREC researchers and a design group plan to produce a standard tool that any transportation agency can use. The hope is that those agencies will translate the findings into safer, more useful infrastructure for cyclists and drivers alike.

Portland: Smart City, USA

By Shasta Kearns Moore
***Read the original article in the *Portland Tribune*.**

A city the size of Portland is almost like its own living organism: It has arteries of traffic, multiplication of buildings, and the respiration of buying and selling.

But could it also have a brain?

That's the new challenge that cities across the nation are scrambling to meet as technology described as the Internet of Things makes it possible to have "smart cities." The automation, sensors and data analysis could have huge impacts on citizens' daily lives in coming decades.

Imagine having a single smartphone app that would show you the fastest or most affordable route across any form of transportation—TriMet, Uber, bikeshare, car, walking, or a combination thereof—in real time.

Imagine walking alone at night and being able to shout "Help!" to a microphone in a lamppost and have a police car automatically routed to your location.

Imagine streets that could self-report potholes, or car crashes, or unusually high levels of air pollutants.

These are all dreams of the future, kernels of ideas that could be possible thanks to a new computer lab and data center being installed at Portland State University. Called FIWARE—for "Future Internet"-ware—this is the first time the open-source technology used all over the European Union for its smart cities will appear in the United States.

FIWARE is basically a group of standards, a platform for creating applications that would power a smart city. With it, nonprofit groups, private businesses, or teenagers in their garages can begin to build software that takes advantage of all the data being collected all around us. With the open-source and widely used FIWARE as the parameters, these ideas could then scale up across the nation and the globe.

"There is a very large potential market," says Portland State University research professor Wilfred Pinfold, who is leading the FIWARE Lab project. "Portland is incubating some very interesting businesses in this space. And not only at the big level, the Intel level, but all the way down to the start-ups."

Pinfold believes that technologists and city planners are on the cusp of something as big as the Internet, mother of Google, Amazon and Facebook.

"Something of a similar ilk is going to happen, and right at the heart of that is smart cities," he says. "This same opportunity is here, and as a city we want to be able to take advantage of it."

Smart Cities Challenge

Portland is a leader in this arena, jockeying with only six other cities in the final round of a $50 million prize to become the nation's first federally funded Smart City.

Skip Newberry, head of the Technology Association of Oregon, says the push to develop standards for smart city technology began about a year and a half ago.

"The standards that would be established as part of this work could really position Portland as a global leader in this space," Newberry says. The idea of the federal grant process, pushed by the Obama administration, was to bring a lot of players to the table to create a common language.

"The cities will start to come together and say: Here are some emerging standards. Private companies will then follow the needs of the cities," Newberry says.

There are several possible ways the standards could still go in this country, but FIWARE seems to be leading the pack so far.

"FIWARE has already received considerable investment in Europe and has the advantage of not being tied to a particular company that may be more interested in sales than service," Jonathan Fink, vice president of Research and Strategic Partnerships at Portland State University, says in an email. "Having Portland as the first U.S. city to implement FIWARE gives us some first-mover advantages in the highly competitive world of integrating big data with urban services."

With the new FIWARE lab, Portland has also bolstered its position in the federal grant process called the Smart Cities Challenge. The U.S. Department of Transportation has put up $40 million with billionaire Paul Allen of Microsoft fame offering another $10 million. The city is one of seven finalists, with the final round of plans having been submitted on May 24.

John Brady, spokesman for the Portland Bureau of Transportation, says even if the city doesn't win, the process of bringing together stakeholders for its grant proposal has already catalyzed change.

"It's fantastic in that respect," Brady says. "The hope is, win or lose, we're really laying the foundation for future collaboration."

If they do win the $50 million jackpot, PBOT's proposal is to build a "personal mobility platform" currently called UB Mobile PDX. The idea is to take all the different forms of transportation currently available in Portland and mash them into a single app that will calculate the best way to get from point A to point B, whether that's through TriMet, Uber, Lyft, driving, walking or biking.

The way to integrate all of that in a common network would be through Portland's FIWARE.

Surveillance state?

But as with any new technology, the potential for unintended consequences also exists. Critics of FIWARE say the technology could lead to a powerful government surveillance system and omnipresent law enforcement.

Pinfold, who is leading the new PSU lab, says the safeguard against that is to simply keep a priority focus on what the people of Portland want and what they don't.

"It's a matter of getting it right, and getting it right means we have to do what the people in Portland want us to do," he says, noting that technologists often don't understand cities in the way that city planners do — that they are a series of communities and neighborhoods. Solutions have to be unique because neighborhoods are.

"We think the (FIWARE-based) services need to be available really at a community level," Pinfold says.
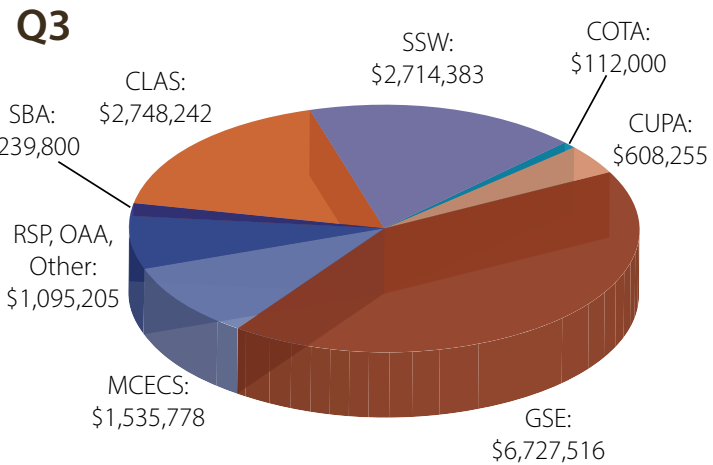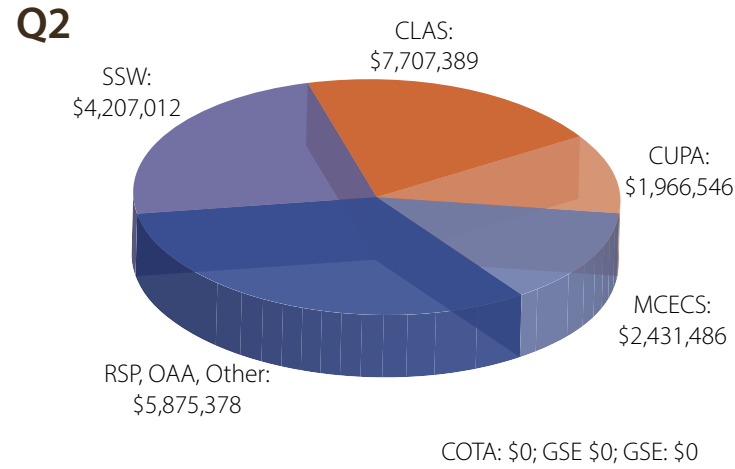
He says the new PSU lab also will include a "decision theater" that will help developers play with the data and see what's possible.

"When we talk about changing Portland," he says, "it's really about enhancing the things we love about Portland."
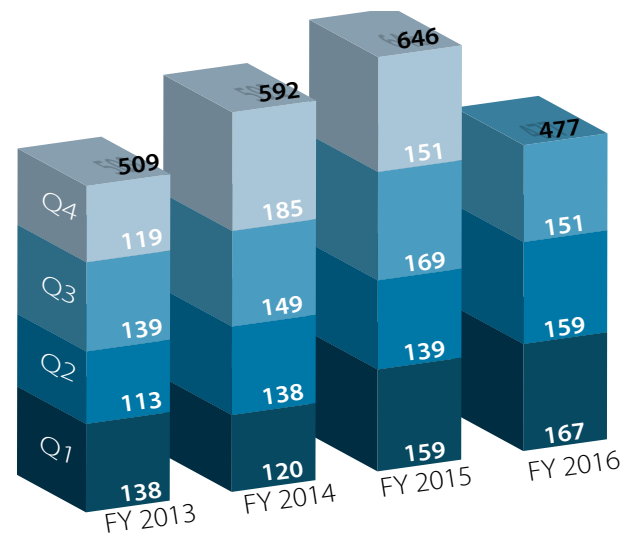
Awards by Quarter
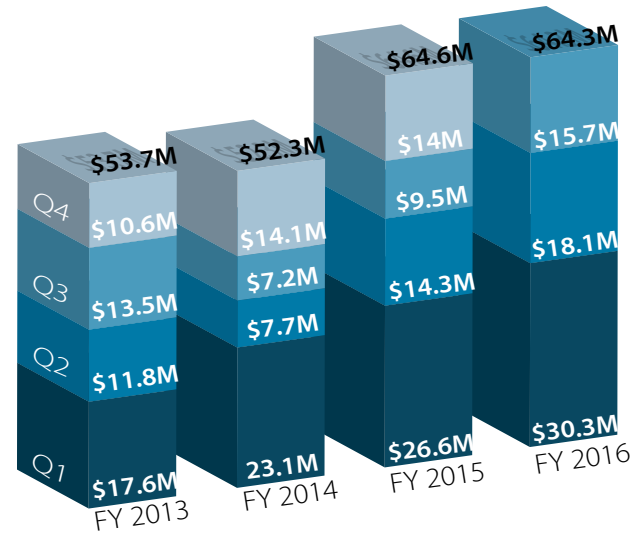
Partial List of Awards

Source: Sponsored Projects Administration.
View full list at: pdx.edu/research/university-research

Awards Received

Q2

CLAS: $7,707,389
SSW: $4,207,012
CUPA: $1,966,546
MCECS: $2,431,486
RSP, OAA, Other: $5,875,378
COTA: $0; GSE $0; GSE: $0

Q3

SSW: $2,714,383
COTA: $112,000
CLAS: $2,748,242
SBA: $239,800
CUPA: $608,255
RSP, OAA, Other: $1,095,205
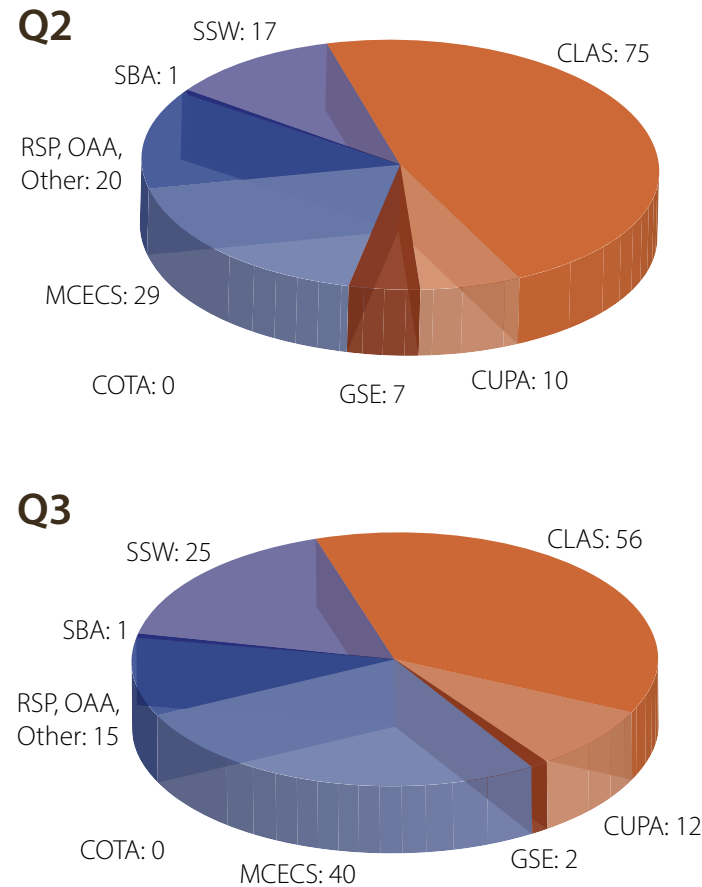MCECS: $1,535,778
GSE: $6,727,516

Anderson, Shelby; Butler, Virginia; Etnier, Michael. Collaborative research: Arctic horizons: Social science and the high north. National Science Foundation. $61,487. CLAS. New Award

Boyce, Steven; Shusterman, Gwen. Math in real life. Oregon Department of Education. $250,000. CLAS. New Award

Cahn, Katharine. Leadership academy for middle managers. Department of Health and Human Services. $512,127. SSW. New Award

Comer, William. The language flagship linkages: Secondary schools and community colleges. US Department of Defense. $171,054. CLAS. New Award

Deardorff, Pamela. Professional development systems, standards, support. US Department of Health and Human Services. $6,579,468. GSE. New Award

Dill, Jennifer. Bike and pedestrian guidebook. US Department of Transportation. $250,000. TREC. New Award

Dusicka, Peter; Griffen, Corey. Achieving sustainable urban buildings with seismically resilient core wall and floor system. National Science Foundation. $400,000. MCECS. New Award

Erickson, Brittany. Collaborative research: From loading to rupture - how do fault geometry and material heterogeneity affect the earthquake cycle? National Science Foundation. $241,759. CLAS. New Award

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Fergadiotis, Gerasimos. Assessment of Anomia: Improving efficiency and utility using item response theory. National Institutes of Health. $148,253. CLAS. New Award

Gelmon, Sherril. Phase III evaluation of PCPCH implementation. Oregon Health Policy and Research. $995,640. CUPA. Amendment

Green, Beth. Yoncalla early works project evaluation. Ford Family Foundation. $230,100. SSW. New Award

Iwata-Reuyl, Dirk. RNA modification: Structure and mechanism. National Institutes of Health. $114,806. CLAS. New Award

Jay, David; Talke, Stefan. Lower Passaic River and Newark Bay contaminant dynamics, task order #4. Tierra Solutions. $467,420. MCECS. New Award

Jhaj, Sukhwant; Andrews, Sona; Van Der Schaaf, Hans. Transformational change collaborative. Association of Public and Land-Grant Universities. $640,000. OAA. New Award

Jiao, Jun; Sanchez, Erik. REU site: Application of microscopy and microanalysis in multidisciplinary research. National Science Foundation. $297,857. MCECS. New Award

Kaufman, Keith. Preventing campus sexual assault: Developing and implementing a sustainable campus situational prevention approach. US Department of Justice. $750,000. CLAS. New Award

Kelly, Maura; Wilkinson, Lindsey. Evaluation of BOLI/ODOT highway construction workforce development program. Oregon Department of Transportation. $100,960. CLAS. New Award

Lehman, Niles. NetLife - experimental evolution of networks in abiogenesis. John Templeton Foundation. $139,398. CLAS. New Award

Luiz, Jessamyn. Oregon volunteers. Corporation for National and Community Service. $157,396. EMSA. New Award

MacArthur, John. Emergency recovery plan and TDM strategy. US Department of Transportation. $943,984. TREC. New Award

Mahmood, Reaz. PSU.tv student empowerment through video production program 2015. Mount Hood Cable Regulatory Commission. $101,500. EMSA. New Award

Miller, Thaddeus. STIR cities: Engaging expert performances of sociotechnical imaginaries for the smart grid. National Science Foundation. $145,542. CUPA. New Award

Nordback, Krista. Optimizing bike/ped traffic count collection. Washington State Department of Transportation. $140,285. TREC. New Award

Orellana, Edwin; Cellarius, Karen. Oregon prescription drug overdoes (PDO) prevention program evaluation. Centers for Disease Control and Prevention. $460,000. SSW. New Award

Pankow, James. Metals in electronic cigarette aerosol. National Institutes of Health. $252,848. CLAS. New Award

Proehl, Risa. Oregon coordinated population forecasts. Oregon Department of Land Conservation and Development. $570,000. CUPA. New Award

Rockhill, Anna; Nygren, Peggy. MIECHV competitive three (C3) grant evaluation. Health Resources and Services Administration. $1,520,000. SSW. Amendment

Roeser, Robert. Measuring teacher care in elementary and middle school classrooms: positivity, presence, and patience. Mind and Life Institute. $110,703. CLAS. New Award

Sailor, David; Hu, Huafen. Ozone and heat exposure in warming climate risks. Environmental Protection Agency. $999,635. MCECS. Amendment

Tufte, Kristin. PORTAL maintenance and enhancements 2016. Oregon Department of Transportation. $150,000. TREC. New Award

Walker, Janet; Koroloff, Nancy. Now is the time evaluation (NITT). Substance Abuse and Mental Health Services Administration $107,188. SSW. New Award

Wells, Scott. Food web structure of Kachess and Keechelus Reservoirs. Washington State Department of Ecology. $147,420. MCECS. New Award

Yatchmenoff, Diane. Adverse childhood events and trauma collaborative center (ACETCC). Oregon Health Authority. $1,346,667. SSW. New Award

Zaron, Edward. Combined estimation of tides and bathymetry from multi-satellite altimetry. National Aeronautics and Space Administration. $625,051. MCECS. Amendment

Proposals by Quarter

	FY 2013	FY 2014	FY 2015	FY 2016
Total	509	592	646	477
Q4	119	185	151	—
Q3	139	149	169	151
Q2	113	138	139	159
Q1	138	120	159	167

Proposals Submitted

Q2

SSW: 17
SBA: 1
RSP, OAA, Other: 20
MCECS: 29
COTA: 0
GSE: 7
CUPA: 10
CLAS: 75

Q3

SSW: 25
SBA: 1
RSP, OAA, Other: 15
MCECS: 40
COTA: 0
GSE: 2
CUPA: 12
CLAS: 56

Partial List of Proposals

Source: Sponsored Projects Administration.
View full list at: pdx.edu/research/university-research

Anderson, Ingrid; Hix-Small, Hollie; Lawson, Holly. Infant/toddler early intervention supports project (I/TEISP). US Department of Education. $615,152. GSE

Barbera, Jack. Collaborative research: Morphing TUES to TWOS: Technology, writing, overall scholarship. National Science Foundation. $495,259. CLAS

Bird, Jonathan. Investigation into the performance of magnetically geared devices for marine hydrokinetic & wind applications. National Science Foundation. $286,646. MCECS

Comer, William. Russian Flagship Center: 2016-2020 funding cycle. US Department of Defense. $1,299,624. CLAS

Deardorff, Pam. Professional development systems, standards, support. Department of Health and Human Services. $6,665,268. GSE

De la Vega, Esperanza. Bilingual teachers' professional development-schools (BTPD-Schools) project. US Department of Education. $2,495,615. GSE

Etnier, Michael. Collaborative research: Coastal ecosystem dynamics of the north Pacific. National Science Foundation. $279,789. CLAS

Faaleava, Toeutu. Ronald E. McNair post-baccalaureate achievement program. US Department of Education. $231,000. OAA

George, Linda. Fine resolution air quality framework (FRAQ): Leveraging high resolution monitoring to support fine resolution AQ forecasting. National Oceanic and Atmospheric Administration. $360,729. CLAS

Gopalakrishnan, Jay. New approaches to accelerate space-time computations. National Science Foundation. $544,548. CLAS

Granek, Elise; Cal Santiago, Raul B; Chang, Heejun; Gonzales, Kelly; Izumi, Betty; Johnson, Gwynn; McClintock, Nathan; Shandas, Vivek; Yeakley, Alan. NRT-INFEWS: Widening interdisciplinary scholarship and engagement for resilient river basins (WISER): Food, energy, water systems supporting human and ecosystem health. National Science Foundation. $1,799,881. ISS

Harrison, Warren. New Beginnings II: Rebooting careers for underemployed college graduates. Oregon Department of Education. $485,782. MCECS

Izumi, Betty; Green, Beth. Preventing early childhood obesity through evidence-based home visiting programs. National Institutes of Health. $2,191,775. CUPA

Jay, David; Talke, Stefan. Task order #3: Lower Passaic River & Newark Bay sediment and contaminants. Tierra Solutions, Inc. $337,645. MCECS

Johannson, Erik. Metal chalcogenide nanocrystals for solar-energy conversion. National Science Foundation. $331,708. CLAS

Koenenkamp, Rolf. Coupled plasmonic and photonic nanosystems. Department of Energy. $524,370. CLAS

Lawson, Holly; Botsford, Kathryn. Project COMET: Certified orientation and mobility educators in training. US Department of Education. $623,726. GSE

Lee, Junghee; Bank, Lewis; Donlan, Ted; Yang, Lui-Qin. Strong and healthy immigrant children (SHIC) and families. National Institutes of Health. $1,534,576. SSW

Liu, Feng. RI: Small: Tutorial video analysis, enhancement, and interaction. National Science Foundation. $498,290. MCECS

MacArthur, John. Transportation electrification public education and outreach support for the Portland metro area. Oregon Department of Transportation. $200,000. TREC

Mackiewicz, Marilyn. A High-throughput assay for repurposing drugs that inhibit of reverse AB oligomers. Bright Focus Foundation. $300,000. CLAS

McCollum, Gin. Ultricular pathway symmetries support the dynamics of human balance and gait. National Institutes of Health. $1,113,750. CLAS

Nicolaidis, Christina. Buprenoorphrine versus prescription opioid management guidelines for improving chronic pain. Patience Centered Outcomes Research Institute. $1,065,863. SSW

Nordback, Krista. Walking and cycling toward better transportation. US Department of Transportation. $221,430. TREC

Orellana, E. Roberto. A translational study of HIV self-testing among Hispanic/Latino MSM. Centers for Disease Control and Prevention. $1,200,000. SSW

Peyton, David; Pankow, James; Strongin, Robert. Chemistry and toxicology of waterpipe smoke. National Institutes of Health. $450,791. CLAS

Raghavan, Rahul. Elucidating the evolution of virulence in Coxiella to uncover new drug targets. National Institutes of Health. $445,500. CLAS

Reichow, Steve. Structure and dynamics of the CaMKII activation mechanism. National Institutes of Health. $429,115. CLAS

Reysenbach, Anna-Louise. Collaborative research: Biosensors for biogeochemical processes: Tracking photosynthesis and methane oxidation in the warming Arctic. National Science Foundation. $237,210. CLAS

Saber, Mostafa. OMI Project: Nanostructured Ni-based/Co-based coatings; alternatives to hard chromium plating. Blount International, Inc. $43,098. MCECS

Sharma, Rajiv; Garcia-Alexander, Ginny; Messer, Lynne. Racial/ethnic, sex, and insurance based disparities in access to primary care physicians for obese and diabetic patients. National Institutes of Health. $1,103,589. CLAS
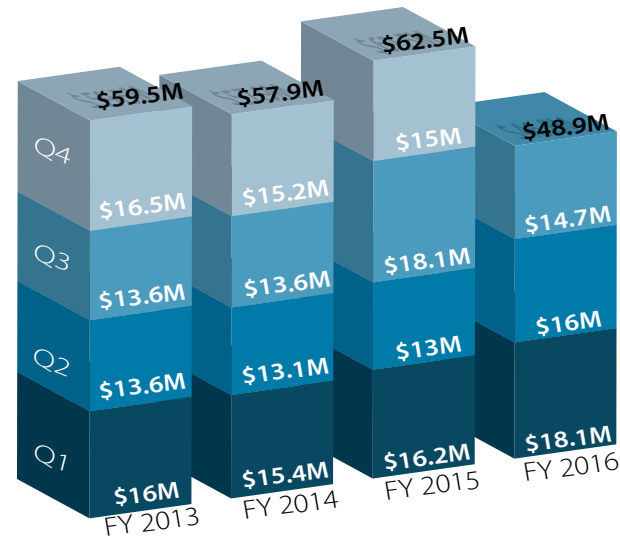
Teuscher, Christof. E2CDA: Type I: Collaborative research: Hierarchical resistive switching architectures for energy-efficient reservoir computing. National Science Foundation. $567,401. MCECS

Townley, Greg; Shelton, Rollin. Community integration specialists for recovery outcomes (CISRO project). Robert Wood Johnson Foundation. $319,985.00. CLAS
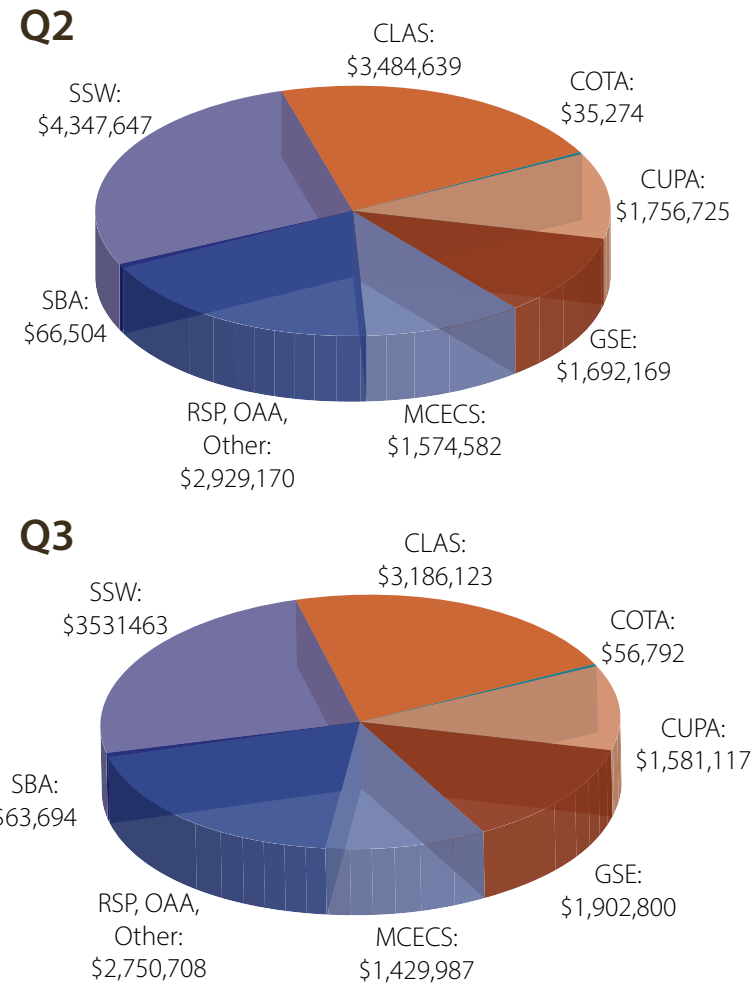
Walker, Janet. Now is the time – technical assistance. Center Substance Abuse and Mental Health Services Administration. $880,385. SSW

Xie, Fei TWC: Small: Plug-and-play concolic testing of binaries for internet of things. National Science Foundation. $494,936. MCECS

Expenditures by Quarter

	FY 2013	FY 2014	FY 2015	FY 2016
Total	$59.5M	$57.9M	$62.5M	$48.9M
Q4	$16.5M	$15.2M	$15M	$14.7M
Q3	$13.6M	$13.6M	$18.1M	$16M
Q2	$13.6M	$13.1M	$13M	$16M
Q1	$16M	$15.4M	$16.2M	$18.1M

Research Expenditures

Q2

- CLAS: $3,484,639
- COTA: $35,274
- CUPA: $1,756,725
- GSE: $1,692,169
- MCECS: $1,574,582
- RSP, OAA, Other: $2,929,170
- SBA: $66,504
- SSW: $4,347,647

Q3

- CLAS: $3,186,123
- COTA: $56,792
- CUPA: $1,581,117
- GSE: $1,902,800
- MCECS: $1,429,987
- RSP, OAA, Other: $2,750,708
- SBA: $63,694
- SSW: $3531463

Partial List of Publications

Source: PSU Library.
View full list at: pdx.edu/research/university-research
Faculty authors in bold.

Adenuga, A. A., M. E. Wright, & **D. B. Atkinson**, (2016). Evaluation of the reactivity of exhaust from various biodiesel blends as a measure of possible oxidative effects: A concern for human exposure: *Chemosphere*, v. 147, p. 396-403.

Armoogum, J., & **Dill, J.** (2015). Workshop synthesis: Sampling issues, data quality & data protection. *Transportation Research Procedia*, 11, 60–65.

Barve, A., Lowry, M., Escobedo, J. O., Thainashmuthu, J., & **Strongin, R. M**. (2016). Fluorescein tri-aldehyde promotes the selective detection of homocysteine. *Journal of Fluorescence*, 1-7.

Burger, J., Goudarzi, A., Stefanovic, D., & **Teuscher, C.** (2015). Computational capacity and energy consumption of complex resistive switch networks. *AIMS Materials Science*, 2 (4), 530–545.

Creutzburg, M. K., R. M. Scheller, **M. S. Lucash,** L. B. Evers, S. D. Leduc, & M. G. Johnson, (2016). Bioenergy harvest, climate change, and forest carbon in the Oregon Coast Range. *Global Change Biology Bio*energy, v. 8, p. 357-370.

Daim, T. U., Anderson, T., & Kocaoglu, D. (2015). Technology analytics: Enhancing technology assessment with technology intelligence. *Technological Forecasting and Social Change,* 97, 127.

Faber-Hammond, J., Samanta, M. P., Whitchurch, E. A., Manning, D., Sisneros, J. A., & Coffin, A. B. (2015). Saccular transcriptome profiles of the seasonal breeding Plainfin Midshipman Fish (*Porichthys notatus*), a teleost with divergent sexual phenotypes. *PloS One*, 10 (11), e0142814.

Freed, S., Dujon, V., & **Granek, E. F**., & Mouhhidine, J. (2016). Enhancing small-scale fisheries management through community engagement and multi-community partnerships: Comoros case study. *Marine Policy*, 63, 81–91.

Godschalx, A. L., Stady, L., Watzig, B., & **Ballhorn, D. J**. (2016). Is protection against florivory consistent with the optimal defense hypothesis? *BMC Plant Biology*, 16(1), 32.

Greenwood, G., Podhradsky, M., Gallagher, J., & Matson, E. (2015). A multi-agent system for autonomous adaptive control of a flapping-wing micro air vehicle. In 2015 *IEEE Symposium Series on Computational Intelligence*

Hansen, C., **Daim, T**., Ernst, H., & Herstatt, C. (2016). The future of rail automation: A scenario-based technology road-map for the rail automation market. *Technological Forecasting and Social Change*.

Jaffee, D., & Howard, P. H. (2015). Who's the fairest of them all? The fractured landscape of U.S. fair trade certification. *Agriculture and Human Values*, 1-14.

Jetter, A., & Albar, F. (2015). Project management in product development: Toward a framework for targeted flexibility. *Management of Engineering and Technology (PICMET), 2015 Portland International Conference on*, 1562-1575. IEEE, 2015.

Kahn, K. B., M. Barreto, C. R. Kaiser, & M. S. Rego, (2016). When do high and low status group members support confrontation? The role of perceived pervasiveness of prejudice. *British Journal of Social Psychology*, v. 55, p. 27-43.

Lee, J., **Donlan, W., Clark-Shim, H.**, Kim, J., & **Bank, L.** (2016). Learning to navigate the new world: Korean-immigrant parental expectations and challenges in the United States. *Journal of Immigrant & Refugee Studies*, 14, 1, 26-45.

Mahaffy, S. D., Baird, R. W., McSweeney, D. J., Webster, D. L., & Schorr, G. S. (2015). High site fidelity, strong associations, and long-term bonds: Short-finned pilot whales off the island of Hawaii. *Marine Mammal Science*, 31 (4), 1427–1451.

Mashburn, A., Justice, L. M., McGinty, A., & Slocum, L. (2015). The impacts of a scalable intervention on the language and literacy development of rural pre-kindergartners. *Applied Developmental Science,* 20 (1), 61–78.

McClintock, N., D. Mahmoudi, M. Simpson, and J. P. Santos, (2016), Socio-spatial differentiation in the sustainable city: A mixed-methods assessment of residential gardens in metropolitan Portland, Oregon, USA. *Landscape and Urban Planning*, v. 148, p. 1-16.

Norton, A., **Boyce, S.** (2015). A written instrument for assessing students' units coordination structures. *Mathematics Education*, 111–136.

Obi, M., and **R. Bass,** (2016), Trends and challenges of grid-connected photovoltaic systems - A review. R*enewable & Sustainable Energy Reviews*, v. 58, p. 1082-1094.

Pejcinovic, B. (2015). Using systematic literature reviews to enhance student learning. In 2015 *ASEE Annual Conference and Exposition*, 26.1685.1–26.1685.13.

Raghavan, R., Kacharia, F. R., Millar, J. A., Sislak, C. D., & Ochman, H. (2015). Genome rearrangements can make and break small RNA genes. *Genome Biology and Evolution*, 7 (2), 557–66.

Scheller, R. M., & Swanson, M. E. (2015). Simulation modeling of forest landscape disturbances: vegetation dynamics and biogeochemistry (Chapter in *Simulation Modeling of Forest Landscape Disturbances* (A. H. Perera, B. R. Sturtevant, & L. J. Buse, Eds.). Cham: Springer International Publishing.

Thompson, M., Newell, S., & **Carlson, M. J**. (2015). Race and access to mental health and substance abuse treatment in the criminal justice system. *Journal of Offender Rehabilitation,* 1-26.

Wakeland, W., **Nielsen, A.**, & **Geissert, P.** (2015). Dynamic model of nonmedical opioid use trajectories and potential policy interventions. *The American Journal of Drug and Alcohol Abuse*, 41 (6), 508–18.

Wang, J., **Sibrian-Vazquez, M., Escobedo, J. O.**, **Wang, L.**, **Chu, Y.-H.**, Moore, R. G., & **Strongin, R. M**. (2015). Templated polymers enable selective capture and release of lysophosphatidic acid in human plasma via optimization of non-covalent binding to functional monomers. *The Analyst*, 140 (22), 7572–7.

Yang, L. Q., Chang, C.-H. D., & Lim, V. K. G. (2016). Introduction to the Special Issue of New Methods in Work and Organizational Health Psychology. *Applied Psychology*, 65(2), 185–189.

Yoon B. S., Jetter, A. J. (2015). Connecting customers with engineers for the successful fuzzy front end: Requirements of tools. *Management of Engineering and Technology (PICMET)*, *2015 Portland International Conference on*, 1585-1595. IEEE, 2015.

Research & Strategic Partnerships

Quarterly Review, Volume III, Issue 2, Spring 2016

Mustafa Sulaiman Abbas, Ph.D.
MCECS Dissertation Chair: **Dundar Kocaoglu**
Dissertation title: *Consistency Analysis for Judgment Quantification in Hierarchical Decision Model*

Fahad Abdulaziz Aldhaban, Ph.D.
MCECS Dissertation Chair: **Tugrul Daim**
Dissertation title: *Exploratory Study of the Adoption and Use of the Smartphone Technology in Emerging Regions: Case of Saudi Arabia*

Bonnie Heather Bartos, Ed.D.
GSE Dissertation Chair: **Stephen Isaacson**
Dissertation title: *An Investigation of School-Based Specific Learning Disability Identification*

Joseph Paul Broach, Ph.D.
CUPA Dissertation Chair: **Jennifer Dill**
Dissertation title: *Travel Mode Choice Framework Incorporating Realistic Bike and Walk Routes*

Tiphaine Dickson, Ph.D.
CUPA Dissertation Chair: **David Kinsella**
Dissertation title: *On the Poverty, Rise, and Demise of International Criminal Law*

Allison Boyce Duncan, Ph.D.
CUPA Dissertation Chair: **Sy Adler**
Dissertation title: *Cyclist Path Choices Through Shared Space Intersections in England*

Sandra Lee Duty, Ed.D.
GSE Dissertation Chair: **Dannelle Stevens**
Dissertation title: *The Impact of Daily 5 and CAFE Literacy Framework on Reading Comprehension in Struggling Fourth Grade Readers: A Case Study*

Jennifer R. Grove-Heuser, Ed.D.
GSE Dissertation Chair: **Micki Caskey**
Dissertation title: *Women as Transformational Leaders: Learning to Lead in the Community College*

Nancee Hunter, Ph.D.
CLAS Dissertation Chair: **Teresa Bulman**
Dissertation title: *Assessing Sense of Place and Geo-literacy Indicators as Learning Outcomes of an International Teacher Professional Development Program*

Patricia Kenney-Moore, Ed.D.
GSE Dissertation Chair: **Janine Allen**
Dissertation title: *Like Drinking Water Out of a Fire Hydrant Medical Education as Transformation: A Naturalistic Inquiry Into the Physician Assistant Student Experience*

James Jeffrey Kline, Ph.D.
CUPA Dissertation Chair: **James Strathman**
Dissertation title: *Star Academics: Do They Garner Increasing Returns?*

Anabel Lopez Salinas, Ph.D.
CUPA Dissertation Chair: **Jack Corbett**
Dissertation title: *Exploring Transnational Economic, Social, and Political Participation of Mexican Immigrants in Oregon*

Neera Malhotra, Ed.D.
GSE Dissertation Chair: **Randall De Pry**
Dissertation title: *Desirable Conversations: Sexuality and Women with Intellectual Disabilities*

Barry S. Oken, Ph.D.
CLAS Dissertation Chair: **Wayne Wakeland**
Dissertation title: *A Systems Approach to Stress and Resilience in Humans: Mindfulness Meditation, Aging, and Cognitive Function*

Cynthia Jakes Stadel, Ed.D.
GSE Dissertation Chair: **Stephen Isaacson**
Dissertation title: *Exploring the Impact of an LD Diagnosis on the Self-Determination of Women in Poverty*

Arron Richard Steiner, Ph.D.
CLAS Dissertation Chair: **Martin Streck**
Dissertation title: *Field Geology and Petrologic Investigation of the Strawberry Volcanics, Northeast Oregon*
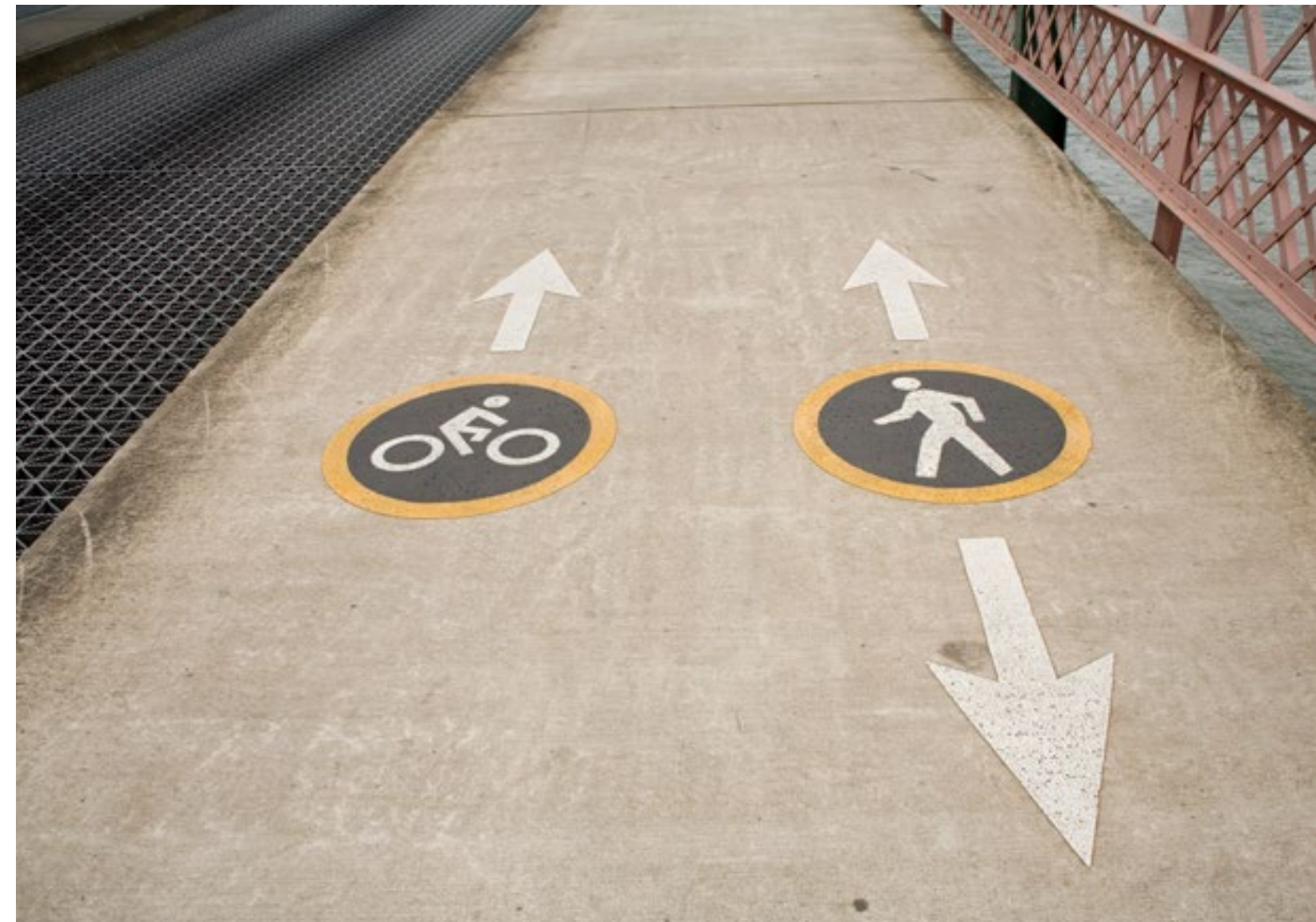
Krista Lynn Strand, Ph.D.
CLAS Dissertation Chair: **Eva Thanheiser**
Dissertation title: *An Investigation into Intermediate Grades Teachers' Noticing of the Mathematical Quality of Instruction*

Hoang Anh Tran, Ph.D.
CLAS Dissertation Chair: **Shankar Rananavare**
Dissertation title: *One-Dimensional Nanostructure and Sensing Applications: Tin Dioxide Nanowires and Carbon Nanotubes*

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