

CALIFORNIA
STATE UNIVERSITY
LONG BEACH

Quest

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Pursuing Innovation Through Research



earth
Surface

Discovering the impact
of invisible chemicals
in our environment

Contents

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04

Preserving Cambodian Literature

TERI YAMADA
College of Liberal Arts

07

Building Blocks in Health-Related Research

LAURA KINGSFORD
College of Natural Sciences and Mathematics

CHI-AH CHUN
College of Liberal Arts

10

An Alternative Way of Funding Freeways

SHAILESH CHANDRA
College of Engineering

16

Closing the Opportunity Gap in STEM Learning

AVERY OLSON
DON HAVILAND
College of Education

22

Battling Diabetes in the Latino Community

MELAWHY GARCIA
College of Health and Human Services

25

Undressing Hollywood

HELEN HOOD SCHEER
College of the Arts

28

Spotlighting Research

PAUL BAKER PRINDLE
College of the Arts

XIANHUI BU
College of Natural Sciences and Mathematics

RUTH PIKER
College of Education

CHRISTINE BEYER
Innovation Space

JELENA TRAJKOVIC
College of Engineering

HOJONG SHIN
College of Business

SARVENAZ HATAMI
College of Liberal Arts

SCOTT DUCHARME
College of Health and Human Services

37

Fiscal Year 2020 Funding Summary

ON THE COVER: Zebrafish are studied to determine the effects of neurotoxicants found in common household products.

RIGHT: The neural development of zebrafish exposed to invisible toxins is studied by student researchers.

Feature Stories



18

Exposing Toxins

Dr. Erika Holland's research seeks to identify the invisible contaminants affecting our health

ERIKA HOLLAND
College of Natural Sciences and Mathematics

12

A Cautionary Tale of Covid-19

Dr. Yanling Qi's early research during the pandemic strengthened the understanding of virus transmission

YANLING QI
College of Health and Human Services



PHOTO: A student gets a deeper look into her research with visual images in the new virtual reality lab.

MESSAGE FROM THE PRESIDENT

Welcome to Quest!

Faculty and students on our campus are hard at work, stretching the boundaries of knowledge and creativity, and generating research of regional, national and international importance. We are proud to share some of those stories with you in this issue of Quest.

We remain, as always, a student-centered institution. But today this means that our faculty seek to cultivate a community of active learners who will question, imagine, discover, create and innovate — and, in so doing, lead us all to a better future.

My thanks go out to all of those who continue to pursue research, scholarly work and creative activity at Cal State Long Beach, sometimes in the face of daunting challenges, and to all of you who support and encourage their fine work.

Go Beach!

Jane

Jane Close Conoley

Beyond the killing field,
 A quarter of a century after the genocide
 After 2 million people murdered
 The other 5 million survive.
 The fabric of the culture,
 Beauty drips the texture.
 I find myself in Long Beach
 The next Cambodian mecca.

-PraCh, art of fact

Prach Ly is a Cambodian American rapper and Cambodian Student Society supporter from Long Beach, famous for using rap poetry to expose the stories of the genocide to a young Cambodian diaspora and those remaining in Phnom Penh.



ABOVE: The mural by artist Guillermo Ivan Avalos is one of several in Long Beach's Cambodian Town. His artwork depicts the integration of Cambodians into the fabric of the city.

PRESERVING CAMBODIAN LITERATURE

Dr. Teri Yamada is dedicated to revising, protecting country's rich heritage

COLLEGE OF LIBERAL ARTS

WORDS: Jordan Gibler

In the four decades since the Cambodian genocide, the country's literary culture has undergone a slow re-emergence from the shadow of authoritarianism.

Under the brutal reign of Pol Pot and the Communist Party of the Khmer Rouge, traditional art and literature were considered anti-government. Artists and writers became potential dissidents and were made enemies of the state. The toll of the genocide was nearly a quarter of the Cambodian population and the near extinction of a culture that cherished folktales and poetry. Though the Vietnamese invasion of Cambodia in 1979 ousted Pot's dictatorship, few voices were left to carry on the country's rich literary traditions.

For nearly 20 years, the Nou Hach Literary Association (NHLA) has been steadfast in its mission to revive and amplify those voices.

Named for influential Cambodian author Nou Hach, the NHLA was co-founded in 2002 by **Dr. Teri Yamada**, department chair and professor of Asian & Asian American Studies. Yamada has dedicated her career to the preservation and rekindling of Cambodia's literary culture. Her work has been instrumental not only to the revival effort in Cambodia, but also in helping the Cambodian diaspora connect with their roots.

After the fall of the Khmer Rouge, thousands of Cambodian refugees sought asylum in the United States, and many joined friends and relatives who had arrived in Southern California decades earlier. Long Beach became the nation's largest Cambodian community, making Cal State Long Beach the ideal institution to support Yamada's work.

When Cambodia reopened in the 1990s, Cal State Long Beach participated in a teacher training project at the Royal University of Phnom Penh. There, Yamada collaborated with fellow researchers to seek out and cultivate new writers, creating the Cambodian-based Nou Hach Literary Association.

The Nou Hach Literary Association project includes an annually published journal, literary awards, writers' workshops, a conference on modern Cambodian literature and translations of Cambodian literature into English.

Through the NHLA, writers and students connect in workshops held in schools and coffee shops, nurturing the seeds of a short story tradition that had been planted in the late 1960's and left fallow through the Khmer Rouge regime. The effort has sought to address literacy rates, develop infrastructure to support creative writers, and help acclimate the culture with modern literary conventions.

Yamada and the NHLA continue to promote the ability to be socially critical – taboo for the previous generation.

As contemporary voices have emerged, the NHLA serves as a bridge between Cambodia and Long Beach. As the faculty mentor for Cal State Long Beach's Cambodian Student Society, Yamada has sponsored students' travel to Cambodia to attend literary festivals and workshops. The students have published plays, poetry, presentations and short stories. Tuon Bunkong, who received his B.A. in Comparative Literature in 2000, credits Yamada and the 2004 Nou Hach Literary Conference for his eventual career in academia.



ABOVE: Dr. Teri Yamada's work has helped the Cambodian diaspora connect with its roots.

"I was inspired by the talents and tenacity of the Cambodian writers and poets I met on this trip," said Bunkong, now an associate professor of English at Union College in New York. "I developed a deep sense of pride in Cambodian culture and love for the Cambodian people. I still wonder what would happen if they were given the same opportunities that I had."

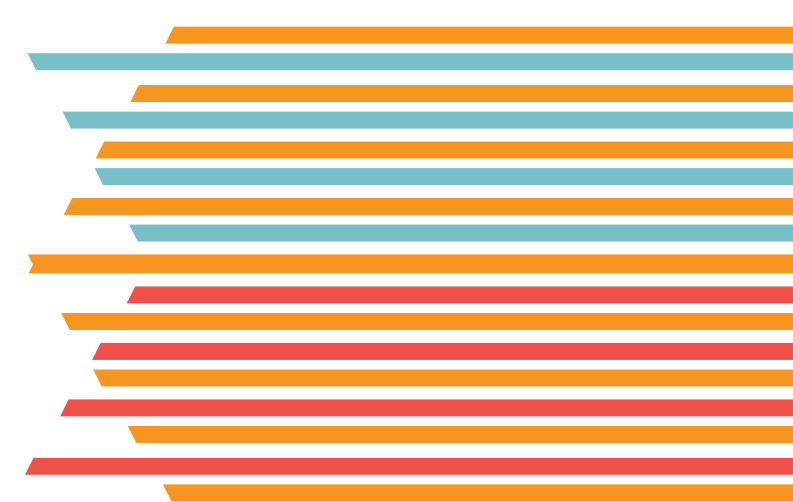
From the 1990s through the 2010s, independent, non-government-controlled newspapers were popping up, stories were appearing in newspapers, writing was becoming a more viable profession for journalists and Cambodia's college-educated population reached a historic high.

The shadow of authoritarianism has returned to the region and these worries have come again to the fore under the current government, whose draconian laws suppress free press and free speech on social media, which has caused the decline of the NHLA.

With this in mind, Yamada says she is unwilling to swear the loyalty oath required by the Cambodian People's Party so she can return to the country, but she continues to publish and support Cambodian writers. She looks back on a career of accomplishment – from the nurturing of Cambodia's literary culture and short story tradition to the establishment of the only minor in Khmer language in the United States.

As the NHLA fades into history, Yamada said she is hopeful that the writing will outlast the authoritarian political wave. ■

BUILDING BLOCKS IN HEALTH-RELATED RESEARCH



Establishing a vibrant undergraduate research program for biomedical sciences and engineering

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

COLLEGE OF LIBERAL ARTS

WORDS: Janis Carr

Drs. Laura Kingsford and Guido Urizar had just received a \$24 million five-year award from the National Institutes of Health (NIH). But how were these Principal Investigators going to implement a program that would ultimately serve hundreds of underrepresented Cal State Long Beach students who wanted to be a scientist or researcher?

They, along with a team of faculty and staff, would *build* it.

The strategies for this new program were based on the results of a 2013 NIH planning grant (the Alliance for Health Opportunities Research Advancement Initiative). The initiative, Building Infrastructure Leading to Diversity (BUILD), identified important themes to inform strategic planning for engaging and retaining underrepresented students in behavioral health sciences and biomedical sciences and engineering.

During the first year, the team developed the infrastructure for the programs that would prepare these underrepresented students for doctoral programs at some of the nation's top universities and entry into the research workforce. The NIH funding allowed Cal State Long Beach to establish one of only 10 comprehensive and transformative BUILD research training programs in the country.

"I felt like we were launching an aircraft carrier and pushing it with a tugboat," Kingsford said of the initial days in 2014. "During the first year of BUILD, we



DESTINATIONS FOR BUILD SCHOLARS

Duke University
Columbia University
UC San Diego
Notre Dame
Indiana University
Purdue University
Case Western Reserve University

PAGE 7: Graduated student Kenya Alfaro said BUILD helped prepare her to earn a doctorate in neuroengineering.



had to develop all the components we had proposed to NIH and hire the staff to help.”

The BUILD team first created three central components – the undergraduate research training programs, faculty mentor training programs, and infrastructure for research, including pilot/equipment awards for faculty. Simultaneously, BUILD recruited student trainees and faculty research mentors from the four participating colleges -- Engineering, Health and Human Services, Liberal Arts and Natural Sciences and Mathematics to start in the summer of 2015.

NIH had defined a need to get more underrepresented people into research careers in areas that would address health disparities. Over the next four years, more than 280 undergraduates were trained in health-related research. They gave 1,072 research presentations and co-authored 71 publications with their faculty mentors. Of the 140 who had completed the BUILD program by Spring 2019, 66% of them matriculated into graduate/post-baccalaureate programs.

“For me, the challenge was keeping up with what was happening across all

the program components and making the progress expected by us and NIH,” Kingsford said.

“The amount of the award was also a challenge in developing what was expected. It wasn’t some small project. Getting it off the ground and everybody putting together all the pieces was a big undertaking.”

Cal State Long Beach's BUILD program was so successful in preparing the next generation of researchers that NIH awarded a second grant in 2019, a \$19.8 million award that would fund BUILD II. The goal for BUILD II, according to lead investigator **Dr. Chi-Ah Chun**, is to make the program a permanent part of Cal State Long Beach, fully integrated into the university, and disseminate evidence-based best practices for student training and faculty development to other universities.

“BUILD was supposed to do everything in five years, from development and testing interventions to their institutionalization and dissemination,” Chun said. “We knew two years into BUILD I that it would not be feasible... I think



ABOVE: Drs. Chi-Ah Chun (left) and Laura Kingsford (right) have been instrumental in creating a multifaceted program that trains students in health-related research.

LEFT: The annual poster session gives students the opportunity to display their research in various research fields.

around year three, there started to be the possibility of being a second phase.”

Chun said the new five-year NIH funding would allow BUILD II to be intentional about how they worked through the institutionalization process.

“We’ve had time on campus to make ourselves known; our entity became more familiar to the various stakeholders on campus,” Chun said. “We identified various offices and centers that could be collaborators, so they already were partners by the time we wrote up the BUILD II proposal.”

Another important development with BUILD II was the formation of the system-wide CSU BUILD Alliance, with its sister BUILD programs at Cal State Northridge and San Francisco State, which allowed for CSU system-wide dissemination.

The BUILD program also became a known entity with students. Alumna Kenya Alfaro, who started as a lower division trainee in the Associate Program and then completed the two-year upper division

Scholars Program, said BUILD introduced her to research in a variety of fields.

“I had recently transitioned into a double major of electrical engineering and biomedical engineering, and I was thinking about how I could combine them,” Alfaro said. “When I heard what BUILD was about, I became intrigued with the opportunity that my circumstance could create.” Alfaro is now a doctoral student in neuroengineering.

Chun said Cal State Long Beach faculty are committed to supporting the university’s underrepresented students.

“They are so very dedicated to helping these students achieve their educational, professional and life goals,” Chun said. “It’s a very comprehensive approach to education. It’s not just to get them their degrees, but really fulfill their dreams, and I believe we are here to support them.” ■

AN ALTERNATIVE WAY OF FUNDING FREEWAYS

Sharing the cost of travel by the mile rather than the gallon

California's highways, streets and bridges are lifelines for the state. From Northern California to Southern California, residents and visitors rely on modern, safe roads to get them where they need to go.

Getting there and back with ease requires building and maintaining roads and highways funded for decades mainly by tax dollars paid at gas stations.

These taxes, which were once again raised by the state legislators in 2017, will be used for the next 10 years to maintain California's transportation infrastructure. In 2019, the state average for a gallon of regular gas was \$3.24 and in Los Angeles it was \$3.58, according to the Auto Club.

Fuel taxes have traditionally been a significant source of funding. Fifty-nine percent of gas and vehicle fees are used for

highway maintenance, reports Caltrans and the state department of finance. However, with the increase of fuel-efficient vehicles that use less gas, as well as electric and hybrid vehicles on the road, funding from taxes has decreased significantly.

Dr. Shailesh Chandra, an assistant professor of civil engineering and construction engineering management, is looking into ways the state can find new methods of raising money. One idea is a Road Usage Charge (RUC), a mileage-based alternative revenue mechanism that would charge drivers for every mile they trek.

"It's going to be more equitable for everybody because the more you drive, the more you use the road and the more the roads need maintenance," Chandra said.

Under this system, drivers would be required to plug in a monitoring device

COLLEGE OF ENGINEERING

WORDS: Janis Carr

ILLUSTRATION: Future transportation infrastructure could be funded through an innovative mileage-based mechanism.

"I can definitely see the potential in charging road users by miles traveled rather than higher taxes on gas because, as it is now, vehicles are becoming more fuel-efficient allowing for more travel at a cheaper price."

into their car's on-board diagnostics port located above the gas pedal in most cars. It would record tire rotations and every mile driven.

"I can definitely see the potential in charging road users by miles traveled rather than higher taxes on gas because, as it is now, vehicles are becoming more fuel-efficient allowing for more travel at a cheaper price," said Timothy Thai, a third-year civil engineering major. "California's choice to continue raising the gasoline taxes is becoming unsustainable. This is where a new pilot RUC program can change things."

Oregon became the first state last year to implement a road-usage charge system, where a vehicle's data port keeps track of miles driven and fuel consumption. The current usage charge is 1.7 cents per mile and, according to state legislation, will keep pace with climbing fuel tax.

California joined Utah in conducting pilot programs. Chandra said he can

foresee a full implementation in the state within the decade.

"When the 10 years run out, we again will need money to fund transportation systems in the state and country," Chandra said. "And there will be more electrical cars on the highway and those cars don't pay anything, not a penny to the transportation infrastructure. We need balance."

There could be options for drivers who routinely drive long distances, such as long-haul truck drivers. They could be charged a one-time monthly fee that would allow them to drive unlimited number of miles or given a coupon for unlimited miles, much like the system used by many European countries, Chandra said.

"That would help those who have to drive long distances or are on the road a lot," Chandra said. "Our team studied case studies from Europe and from nations around the globe and came to the conclusion that this would be a way to sustain funding for transportation infrastructure."

Fuel prices have increased in recent years, but as Chandra pointed out, fuel tax revenues have not kept pace because most fuel taxes do not account for inflation.

"The Road Usage Charge is a better alternative to gas tax that is rising every year," Chandra said.

Chandra received \$47,000 from the California Department of Transportation (Caltrans) to study the importance of a road usage charge and facilitate a program that is secure and fair for road users and cost effective. ■

A CAUTIONARY TALE COVID-19

Dr. Yanling Qi's early research during the pandemic strengthened the understanding of virus transmission

COLLEGE OF HEALTH AND HUMAN SERVICES





PAGE 12: Dr. Yanling Qi and the researchers studied how airborne transmission spread the coronavirus during a bus trip to a worship event in China.

LEFT: The findings were eventually backed by The World Health Organization, which said COVID-19 could be transmitted through respiratory droplets.

Illustrations by Jorge Hurtado

Dr. Yanling Qi and a colleague were visiting a university in Tianjin, China, when they first heard about the coronavirus in January. At the time, Qi wasn't alarmed or nervous. There were only 20 positive cases reported among the 16 million residents of Tianjin, largely because the local government urged people to wear masks and follow social distancing rules.

"Since I saw how the government and people took strict actions to the infectious disease, I actually felt really confident that this would be over by March," Qi said.

The assistant professor of health care administration, however, felt uneasy after a cruise ship docked in Japan for four weeks reported 700 cases of coronavirus among its 3,700 passengers and crew.

"I was shocked that infectious disease was not treated in the way it should be treated," said Qi, whose research at Cal State Long Beach focuses on individual behavioral responses to public policies that impact health outcomes and health care utilization.

"I started to worry that the outbreak would be eventually worldwide."

That concern led Qi and 21 other researchers from the United States and China to further study how COVID-19 spread. Several studies already had demonstrated, and been endorsed by the World Health Organization, that transmission happened through close contact and respiratory droplets produced when someone sneezed or coughed.

With the number of cases rising worldwide, Qi and her team began to look at whether COVID-19 could be spread through other routes. So, they studied a bus trip taken by 293 lay Buddhists, five monks and two bus drivers who were traveling to a worship event in the Zhejiang province of China, where COVID-19 started to spread shortly after the disease outbreak in Wuhan, the epicenter in China.

Their findings, published September 1, 2020 in the peer-reviewed Journal of the American Medical Association (JAMA) Internal Medicine, showed epidemiological evidence of potential airborne transmission of COVID-19. The World Health Or-

ganization eventually agreed that COVID-19 could be transmitted through aerosol, supporting the team's research.

"I think most people suspected that it could be transmitted through other ways than the droplet, however, as many experts stated at that time, there was no scientific evidence showing that the virus can be transmitted through aerosol," said Qi, citing the Centers for Disease Control and Prevention's recommendation in March to wash hands, but not necessarily wear masks if they were not sick.

"We were trying to provide epidemiological evidence of potential airborne transmission of COVID-19, Qi said of the findings. "I think most people knew that it could be transmitted through ways other than droplet, otherwise, did the rising number of confirmed cases imply that people do not wash hands?"

Qi's team figured if they understood how the novel virus was transmitted, perhaps, the number of cases and deaths could be reduced. So, they focused on the bus trip that Qi said gave them a "good quasi-experiment."

The team, which had collaborated on previous studies, was made up of experts in infectious diseases, epidemiology, health policy and health care systems, and contact tracing.

"One bus had a source patient, while the other bus had no source patients with COVID-19," she added. "Passengers in the two buses provided an unparalleled opportunity to compare rates of infection and to infer possible routes of virus transmission because under different transmission modes, the infection rates will differ."

The study looked at how the passengers on two buses fared by the end of the worship event.

“**One bus had a source patient, while the other bus had no source patients with COVID-19. Passengers in the two buses provided an unparalleled opportunity to compare rates of infection and to infer possible routes of virus transmission because under different transmission modes, the infection rates will differ.**”

On Bus 2, a 64-year-old woman had been exposed to residents from Wuhan and was initially asymptomatic during the bus trip. Shortly after the event, she was the first participant developing a cough, chills and muscle aches and was diagnosed of COVID-19 in a local hospital. Since she was the only one who had been exposed to residents from Wuhan, and the first patient having symptoms and being diagnosed of COVID-19 in this group of event participants, she was identified as the index patient and source patient.

The Zhejiang CDC did very thorough contact tracing, and all event participants were tested for COVID-19. Qi and colleagues were able to analyze data collected from the contact tracing. It turned out that 34.3% of the travelers on Bus 2 were infected by COVID-19, while no one on the other bus became sick.

More importantly, through investigating seat orders of all infected cases on Bus 2, the investigation team identified that passengers sitting closer to the infected woman on Bus 2 did not have statistically higher risks of COVID-19 as those sitting further away. Two passengers sitting in the far end of the bus were even infected. Such distribution suggested that airborne transmission should have played an important role in the high transmission rate in this affected bus.

"The finding has very important public health significance," said Qi, "it provided evidence for airborne transmission, and prevention strategies, such as wearing facemasks, should be adopted to prevent the airborne transmission." "The finding also explains why the number of infected cases rose so fast in early March in the U.S., although people were following CDC guidelines to wash hands and keep social distancing."

"When I noticed the pandemic, and how fast the disease spread out, I was worried that the overwhelming number of infected cases would crash the hospital system," Qi said. "The current health care system is not designed to face a pandemic, so (I thought) there will not be enough hospital beds, ICUs or ventilators if the disease breaks out."

Qi said that since COVID-19 is an infectious disease, having a vaccine is ideal. In the meantime, she says infected people should be quarantined.

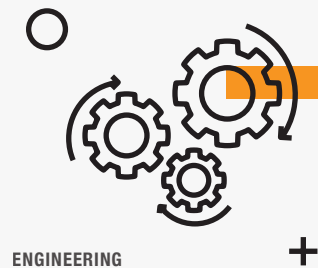
"For respiratory diseases, the most effective way (to stop the spread) is to wear face masks," she said. ■

CLOSING THE OPPORTUNITY GAP IN STEM LEARNING

Evaluating best practices and interventions for successes system-wide

COLLEGE OF EDUCATION

WORDS: Jordan Gibler



ENGINEERING

When **Drs. Don Haviland** and **Avery Olson** signed on as research leaders for the Chancellor's Office system-wide Hispanic-Serving Institution Science, Technology, Engineering and Math program, they couldn't have imagined their work would launch Cal State Long Beach into the national education spotlight.

In 2015, they conducted an evaluation of best practices at seven California State University campuses awarded by Department of Education HSI-STEM grants. Their work resulted in the current systemwide HSI-STEM research project, a collaborative partnership among 10 Cal State campuses that looks at how to narrow opportunity gaps for students.

Their work not only set a high standard for STEM interventions and resources but revealed the effectiveness of similar interventions and gave Cal State Long Beach's collaborative program a prominent profile nationwide.

"They didn't expect us to build a rocket; they expected us to start to figure out

how to build a rocket. Well, we made it to the moon," Olson said.

The project was overseen by Olson, an assistant professor in Educational Leadership and director of the Center for Evaluation and Educational Effectiveness (CEEE). She worked with other universities to reimagine how evaluations of these interventions are done and how successes can be shared and replicated. Her work provided a close-up view of the efficacy of programs, such as mentoring and undergraduate research and transfer pathways.

"This early work became a proof of concept that we could do it, and with the funding, we were able to scale up," Olson said. "We examined what different interventions, such as STEM mentoring, looked like throughout the CSUs and developed strong partnerships with our sister schools. We wanted to learn what's common in how we run programs throughout the system."

The success of the research led to the current system-wide research project, led by Dr. Erika Kato, CEEE project director.

MATHEMATICS



In Fall 2016, the CSU system was awarded 12 HSI-STEM grants, 10 of those projects committed to participating in the 2016-2021 CSU HSI-STEM Systemwide Research project, with the goal of continuing the research started five years ago.

The role of CEEE in this project is to provide technical support to the 10 collaborating campuses, share best practices, and conduct original research to determine the impact of interventions on a system-level. CSU system partners include CSU's Bakersfield, Channel Islands, Chico, Fullerton, Humboldt, Long Beach, Monterey Bay, Northridge, San Bernardino and Stanislaus.

"It's a collaborative effort that gives us a national profile, and a place to speak with authority to help other campuses that are doing this work," said Haviland, the department chair.

With a CSU-wide sample size, researchers can compare common programs, such as mentoring, to see which components work best at which universities so they can wisely invest their resources.

"Now people inquire for best practices. 'What do I do to make sure my stu-

dents will persist and stay in the field?' People are thirsty for this information, so we're getting lots of national attention and notoriety, and we're representing the CSU system," Olson said.

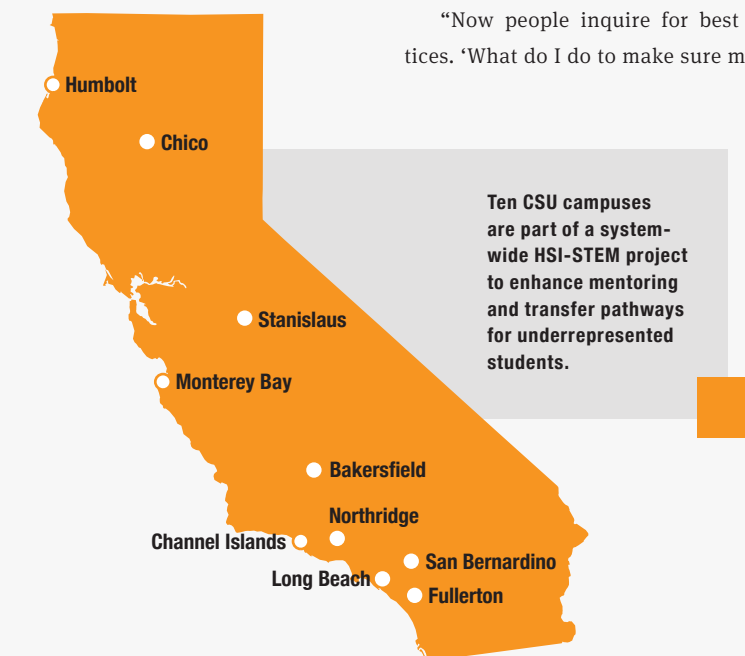
The statewide project confirmed preliminary analyses on peer mentoring and transfer articulation. The results demonstrated a positive impact on STEM retention and first-year GPA, as well as on enrollment and graduation rates for STEM transfer students.

The third part of the current HSI-STEM project is dissemination. Dr. Veronica Fematt, policy and practice dissemination coordinator, established an HSI-STEM "Lessons Learned" website (csulb.edu/hsi-stem-lessons-learned), which hosts their programs' webinars, briefs, best practices and policies. These resources will connect specific partners with high-impact practices that are most relevant for their institutions as they become available.

HSI-STEM's continued success in the CSU not only elevates pedagogical research methods throughout the system, but also helps push the needle forward on the CSU's Graduation Initiative 2025 – an ambitious commitment to significantly raise graduation rates among historically underserved students in the next five years.

The lessons learned by Haviland and Olson, and their colleagues in the CEEE, could help drive those graduation rates higher at Cal State Long Beach and refine methods for success that will benefit institutions in the CSU system and beyond.

"First was figuring out what works," Olson said. "If the CSU figures out what works best to serve Hispanic and/or low-income students, then we can teach the rest of the nation." ■



Ten CSU campuses are part of a system-wide HSI-STEM project to enhance mentoring and transfer pathways for underrepresented students.



EXPOSING TOXINS

Dr. Erika Holland's research seeks to identify the invisible contaminants affecting our health

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

WORDS: Angela Ratzlaff

M

ost of us cannot walk on the beach without seeing a plastic bottle bobbing in the ocean, a shopping bag fluttering in the breeze, possibly a sandwich bag submerged in sand, or straws and candy wrappers left behind by beachgoers.

These plastics are visible to the human eye, but **Dr. Erika Holland** is just as concerned about the effect of invisible chemicals - those unseen-yet-common pollutants - on human development.

In order to find out what effects these chemicals can have on humans and wildlife, Holland and a team of students have turned to a common research model used in biological sciences: zebrafish. Her research is funded by a \$425,000 grant from the National Institutes of Health Support of Competitive Research (SCORE) Program.

"They are just a really great model to study your cellular pathway of interest," she said. The genetic makeup of zebrafish is about 70% like humans.

"They've been accepted as a model for human work, and because of this, they have a lot of resources available that other fish don't have," she added.

Zebrafish also share similarities to some major organs and tissue types as humans, including muscles, blood, kidneys and eyes.

Holland said she is using the fish as a research tool for basic toxicology, which is the study of effects that chemicals can have on living organisms. She exposes the fertilized fish eggs to certain, known toxic chemicals, including neurotoxicants - chemicals that cause adverse effects to the nervous system - such as polychlorinated biphenyls (PCBs), to see how the chemicals affect the fish's neural development.

Certain behaviors in zebrafish are like those in other mammals, such as learning patterns, memory and even anxiety, Holland said.

Some PCBs she is exposing the fish to are known to hinder neural development. This is important when it comes to child development in humans, Holland said. Exposures to these kinds of chemicals have been tied to learning impairments and behavioral deficits or disorders.

Holland's lab features about 300 adult fish, including reproductive pairs that can lay 200 eggs every two weeks, which helps with research productivity as students sometimes work with 1,000 eggs at a time, testing a variety of exposure situations.

"Using this model organism, our research has been able to provide insight to human disease and development. Interestingly, my concern for environmental justice is what prompted my decision to participate in environmental toxicology research," said Danielle Sandoval, a marine biology undergraduate student.

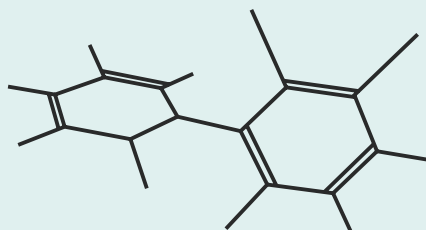
"I am optimistic that my current and forthcoming research will not only provide intellectual merit, but also contribute to the improvement of environmental health."

What Holland is ultimately doing with her research is building a tool, a screen test that uses cells to look for pollutants that can have adverse effects on neural development.

To build this tool, Holland is studying the effects of PCBs, the chemicals that are known to hinder neural development, on calcium pathways in cells.

PAGE 18-19: Students in the Tox Lab study the translucent zebrafish, which possess similar genetic makeup to humans, making them ideal research models.

BELOW: Neurotoxicants, such as the ones found in common pollutants, can destroy nerve tissue.



ABOVE:
Dr. Erika
Holland in
her Tox Lab.

According to Holland, PCBs can alter calcium pathways and change calcium levels inside the cell, which can disrupt neuron communication, a vital function of the brain and nervous system.

"We know that PCBs do these certain kinds of things," she said. "There could be thousands of other chemicals that do this as well, but we don't know because there hasn't been an available screening tool."

Ultimately, this screening tool could be used to test different chemicals by many researchers and perhaps mainstream regulatory agencies. The potential uses could provide a way to screen for and identify toxic chemicals before the manufacturing process begins resulting in safer consumer products and less pollution to the environment.

For example, some chemicals that likely affect neurological development can be found in upholstery as flame retardants, Holland said.

"If we knew this information before they included the chemicals in upholstery, that could help protect humans," she added. "It would help the environment, too. People are throwing out couches that have tons of this stuff, and that gets into the water."

Holland said that industries are already starting to change when it comes to using chemicals in commerce.

"There's been a lot of pressure, the public is a lot more aware of these things now, which is really, really great," she said. "The public being more aware is really pushing the industries to start having more of this green approach, because they recognize that that's what the public wants." ■

Getting tested for diabetes is the first step in eliminating cultural barriers for Latinos. Medical adherence and telehealth appointments are additional ways to manage the disease.

Illustrations by Jorge Hurtado

BATTLING DIABETES IN THE LATINO COMMUNITY

Seeking solutions to cultural barriers in treating the disease

COLLEGE OF HEALTH AND HUMAN SERVICES

WORDS: Janis Carr

Cal State Long Beach graduate student Wilma Figueroa watched for years as her grandfather struggled to control his diabetes. Often, he would fail to take his medication or not follow dietary guidelines. This motivated her to learn more about the disease herself through research.

“At 15 years old, I wasn’t aware that managing type 2 diabetes required the need to address more than the nutritional aspect of a person’s lifestyle,” Figueroa said.

In the United States, Latino adults are at greater risk for type 2 diabetes than other groups and have more than a 50% chance of developing this debilitating medical disease, according to the Center for Disease Control.

Dr. Melawhy Garcia, assistant professor in the Department of Health Science and director of Cal State Long Beach’s Center for Latino Community Health, Evaluation and Leadership Training, is seeking to better understand the barriers to treatment for this at-risk group and make positive changes.

“There are so many factors that increase blood sugar levels,” said Garcia, who received a small grant from the College of Health and Human Services.

Garcia said Latinos face several barriers beyond diet in treating their diabetes, starting with access to culturally tailored services. Another is the fact that they need to take medications as prescribed. She added that Latinos often do not have knowledge of the disease, financial means or transportation to keep doctor’s appointments and get prescriptions, and that can lead to complications from the disease.

“Medication adherence is one of many self-management behaviors that is very important and other prevention programs don’t focus on it,” Garcia said. “Although people might be exercising and eating a little healthier, they still aren’t able to bring themselves down to where they should be with their HbA1c.”

HbA1c is a glycosylated hemoglobin test that measures blood sugar levels. It can tell whether a patient needs to adjust their medication, and it is the primary indicator used to diagnose diabetes.

“Taking medications as prescribed is crucial for them to maintain control of their blood sugar,” Garcia said. “So, if you don’t go for your regular checkups and you don’t get your medication prescription, then there are big gaps.”

According to Garcia’s recent research publication (Factors Predicting Adherence to an Integrative Model of Care Intervention in Hispanic/Latino Patients with Type II Diabetes), approximately 72% of Mexican heritage adults demonstrated low adherence at enrollment in a diabetes trial. Further, she found significant differences in medication adherence based on perceived social support from family and providers.

Garcia said those gaps occur generally with middle-aged adults who are still working and can’t make time to get to the doctor’s office and get their medication.

To study these barriers, Garcia partnered with The Children’s Clinic Family Health of Long Beach California, the largest federally qualified center in the city that serves underrepresented families, so she can conduct focus groups and survey interviews of Latinos with uncontrolled diabetes.

The data will help her develop research goals with the potential to tailor solutions to the Latino community. Garcia believes that telemedicine is one such solution to removing barriers to better health for Latinos. She is aiming to develop a telemedicine study so Latinos can engage in tailored counseling and get the necessary medical support they need.

Even though barriers to telehealth include a lack of access to computers and phones, Garcia said research has shown that 75% to 80% of low-income adults have access to some sort of technological device. Garcia believes that telehealth could play a significant role in improving the health within the Latino community.

Figueroa wanted to gain a better understanding of the cultural, social and emotional barriers that Latinos with uncontrolled type 2 diabetes face after seeing her grandfather work to understand his health.

“After diving into the literature, I learned that Latinos face multi-level barriers when it comes to their self-management,” Figueroa said.

UNDRESSING HOLLYWOOD

A behind-the-scenes peek at nudity, sexism and sexual intimacy on the set

COLLEGE OF THE ARTS

WORDS: Emily Holland

Since Thomas Edison’s 1896 film “The Kiss,” on-screen displays of erotic pleasure have been a powerful way in which many people received a sex education. Now, in what is being called the “New Golden Age of Television,” themes of sexuality are more explicit and prevalent. Women’s bodies are often seen nude or scantily clad, fragmented in voyeuristic close-ups and as plot devices for a male character. Because film and television are among the most popular ways we learn about the world and our place in it, this is fraught terrain.

Assistant Professor **Helen Hood Scheer**, an award-winning documentary filmmaker, is producing and recording sound for a feature-length documentary tentatively titled “Body Parts.” This work-in-progress investigates the process of making scenes that feature nudity and intimacy for mainstream film and television, revealing lesser-known aspects of “movie magic” and candidly exploring the impact on cast, crew and the world at large.

With support from the Sundance Institute, California Humanities and Cal State Long Beach, the film traces a cinematic leg-

acy of exploitation and ingenuity through to the entertainment industry’s current grappling with remedy and redemption.

Ironically, work on “Body Parts” started a few months before the Harvey Weinstein scandal broke.

“For decades, we’ve been troubled by the way women are represented on screen and the lack of female representation behind the camera,” Scheer said. “Director Kristy Guevara-Flanagan and I want to be part of the movement helping to reinterpret what has been wrong, and what can be right, about the media we consume. The goal is to have viewers consider how our culture needs more ethical and authentic ways to deal with sex and power.”

“Body Parts” takes an ambitious artistic approach that interweaves interviews from a wide range of perspectives, verité behind-the-scenes footage, reenactments that convey actresses’ perspectives, and animations that transform film and television clips.

Actresses, such as Jane Fonda and Rosanna Arquette, tell about being pressured into taking their clothes off. Emi-



“

For decades, we've been troubled by the way women are represented on screen and the lack of female representation behind the camera. The goal is to have viewers consider how our culture needs more ethical and authentic ways to deal with sex and power.

”

LEFT: Assistant Professor Helen Hood Scheer is producing and recording sound on "Body Parts," a documentary feature film work-in-progress.

ment writers and directors, including Jill Soloway, Angela Robinson and David Simon, discuss messages we learn from what we see and why it is important to show consent and non-heteronormative sexuality. Behind-the-scenes technicians talk about their craft while making pubic wigs and prostheses of “private parts.”

“Body Parts” also explores the world of intimacy coordinators, who help pre-

pare actors to feel safe while performing scenes with nudity and simulated sex. The intimacy coordinator is a new addition to the production crew and has become increasingly popular as the entertainment industry attempts to correct past wrongs in the post #MeToo world.

“The intimacy coordinator brings the historical and abstract ideas to life and demonstrates the positive changes in the

industry as they're happening in real time,” Scheer said.

Scheer, who heads the creative non-fiction track for the department of Film and Electronic Arts, won Cal State Long Beach's Advancement of Women Award from the President's Commission on the Status of Women in 2020. Scheer has worked in various aspects of documentary filmmaking for nearly two decades before she started teaching. Her career in film began with an internship at the Survivors of the Shoah Foundation, where she helped record interviews of Holocaust survivors.

After working her way up to producing documentaries commissioned by major networks such as PBS and HBO, Scheer made the leap to directing her first film. “JUMP!” - an award-winning documentary feature acquired by Showtime, which follows kids who are in pursuit of winning the World Rope Skipping Championship.

“That film is more about collaboration than competition,” she said. “The jumpers I followed taught me an enormous amount about the value of play and creative risk-taking.”

To help promote learning, Scheer likes to take students on field trips to prestigious documentary film festivals out of state. Chalisa Phiboolsook, a documenta-

ry undergraduate student who attended the True/False Film Festival with Scheer in 2020, reflected on the experience.

“It made me excited to be in this field because of the impact I can produce with the tools I am gaining in school,” Phiboolsook said. “It helped me visualize where I want to be in the future. I loved taking part in this opportunity with my peers and professor to further develop our relationships.”

Scheer received a \$50,000 grant from the Hollywood Foreign Press Association to purchase cameras for students in the creative nonfiction track, which gave everyone much-needed access to equipment.

“It's diversified who is filming projects and it has leveled the playing field,” Scheer said of the equipment.

Scheer and her students have enjoyed winning first place in the documentary category for the California State University (CSU) Media Arts Festival for the past four years.

Samantha Hernandez, who graduated in 2018 with a B.A. in film, said Scheer was the reason she studied documentary filmmaking. What followed that decision was an unprecedented sweep of awards for the nonfiction track in the 2018 CSU Media Arts Festival. Hernandez won the all-around Jury and Audience Choice awards in addition to Best Documentary. Hernandez said Scheer's training, knowledge and support helped her create the lauded film.

“I started out as an unsure, fearful, second-guesser and Helen helped shape me into the confident and empowered woman in film that I am today,” Hernandez said. ■



PHOTO: The Millard Sheets mosaic mural, gifted from Farmers & Merchants Bank, will be preserved and eventually installed at the Carolyn Campagna Kleefeld Contemporary Art Museum.

SPOTLIGHTING RESEARCH

COLLEGE OF THE ARTS

Paul Baker Prindle:
Museum Director

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

Dr. Xianhui Bu:
Professor of Inorganic, Solid State & Materials Chemistry

COLLEGE OF EDUCATION

Dr. Ruth Piker:
Professor of Teacher Education

INNOVATION SPACE

Dr. Christiane Beyer:
Director

COLLEGE OF ENGINEERING

Dr. Jelena Trajkovic:
Assistant Professor of Computer Engineering and Computer Science

COLLEGE OF BUSINESS

Dr. Hojong Shin:
Assistant Professor of Finance

COLLEGE OF LIBERAL ARTS

Dr. Sarvenaz Hatami:
Assistant Professor of Linguistics

COLLEGE OF HEALTH AND HUMAN SERVICES

Dr. Scott Ducharme:
Professor of Kinesiology



LEFT: The Millard Sheets mosaic, made of Italian glass tiles and created in the 1950s, was inspired by fabric the artist found in Mexico.

Kleefeld Contemporary Expands Opportunities for Minority Artists

COLLEGE OF THE ARTS

Paul Baker Prindle:
Museum Director

Museum director **Paul Baker Prindle** is focused on using the Carolyn Campagna Kleefeld Contemporary Art Museum as a research laboratory, to explore how the Kleefeld can work as a community, not just a building.

Baker Prindle aims to promote and support minority artists who traditionally have been marginalized in museum settings to better reach the community.

“Part of our mission is to work in a reparative way as a museum and to make our resources available to artists and communities for whom museums are not their primary cultural point of contact,” he said.

Another way Baker Prindle looks to expand the reach of the museum is to generate

original scholarships and extend conversations about abstraction from the university’s historic collection.

“We are also very interested in exploring material innovation and the connection between artists and material fabricators and engineers,” Baker Prindle said.

The museum’s primary research focus can be found in its exhibitions, which are like a scholarly paper or book. Sitting at the crossroads of current knowledge and the production of new knowledge, an exhibition is the outcome of months of research and engagement with art practitioners by Baker Prindle and his staff.

Several exhibitions, featuring artists such as Michael Goldberg (abstract), Robert Irwin (installation art), Jessica Rath (visual art, educator) and David Lamelas (conceptual art), have been recognized for adding to the larger discourse.

“Abstraction and possibility go hand in hand,” Baker Prindle said. ■

Crystal-Clear Look at Reducing Harmful Gases

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

Dr. Xianhui Bu:
Professor of Inorganic, Solid State & Materials Chemistry

BELOW: Dr. Xianhui Bu uses porous crystals to better understand a molecule’s atomic structure.

Whenever a new compound or molecule is created, there is a need for new research to understand its atomic structure and molecular properties. Knowing a molecule’s atomic structure helps determine its potential applications.

X-ray crystallography, a technique that determines the three-dimensional arrangement of a molecule using a crystal, provides an image of a molecule’s atomic arrangement, in the same way an X-ray can show the image of a fractured bone.

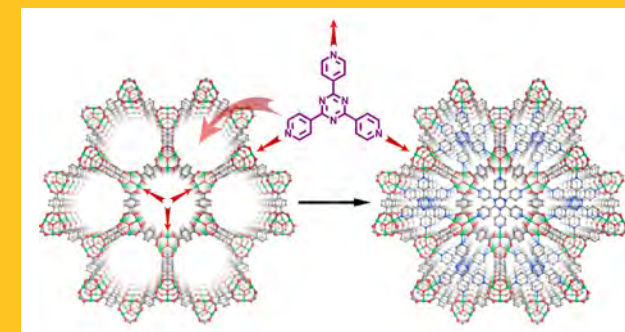
Dr. Xianhui Bu, a professor of inorganic, solid state and material chemistry, is focused on growing crystals that are porous. Like a sponge, these crystals contain cavities that act “like a nanoscopic beaker where we can do chemistry,” said Bu, who teaches in the chemistry and biochemistry department.

Bu’s research has been supported by multiple grants from the National Science Foundation totaling \$1.36 million since 2009 when he received the prestigious NSF CAREER award. These grants have supported Bu’s research into the synthetic design, structural exploration, and gas adsorption studies of crystalline porous materials.

Bu creates and tests new porous materials that have practical applications. One of his priorities is creating a material that can more effectively capture some of the excess carbon dioxide in the atmosphere. “Depending on how you optimize your porous materials, CO₂ can be selectively captured into those porous materials,” he said.

Bu said gas capture and storage can be improved by creating materials that improve energy efficiency. One of his recent publications sought to create high-performance materials for adsorption-based separation of ethane from ethylene, which is a large-scale industrial process currently performed by energy-inefficient distillation processes.

“If you can make it more efficiently, it’s better for the environment.” ■



Examining Classroom Environment Impacts on Preschool Science Learning

COLLEGE OF EDUCATION

Dr. Ruth Piker:
Professor of Teacher Education

Children are naturally curious, and science builds off their natural curiosity and desire to explore, said **Dr. Ruth Piker**, a professor in the Teacher Education department with an emphasis in early childhood education. Her research examines how a classroom environment might support children's science learning and development, as well as how teachers' educational training and preparation supports learning.

Specifically, Piker's study focuses on science education in preschool classrooms within the private sector. Preschool experiences include the constructivist approach to teaching and learning that emphasize hands-on exploration and investigation, problem solving and critical thinking, she said.

Her research has included classroom observations and interviews with preschool teachers about their knowledge, background and comfortability with science. Piker has also looked at what science materials were available to children and any science-related language used between the teacher and children. Her research has revealed distinctive differences in approach to science instruction between newer teachers and experienced teachers.

"For those who have been 'in the field' longer, you see science integrated throughout their classrooms in different ways, like having live plants and animals," she said. "They will have a range of material there for children to explore." This integration makes science more relatable to students in a multitude of ways in the classroom.

And more experienced teachers tend to refer to a wide range of information for inspiration, such as their education, training and books, when designing and implementing science curriculum. This approach provides children with focused and in-depth information on selected science concepts, she said.

Newer teachers tend to focus more on experiments, but they struggle when designing science activities that are hands-on and appropriate for their students' ages.

A unique aspect of Piker's study is that the participants are from the private sector, where programs rely solely on tuition, making funds limited for instructional support, conferences and training workshops. These funding limitations negatively impact these pre-school teachers' wages and the instructional resources available to them. As a result, Piker said, teachers resort to Pinterest and Google for ideas. ■



BELOW: Integrating hands-on learning for preschoolers can make science more relatable in many ways.

Art provided by Dr. Ruth Piker.



What's New in Your World? Step into a Virtual Reality

INNOVATION SPACE

Step inside the enigmatic 7-meter black cylinder and suddenly you are watching a grey whale float over your head while a school of fish swim around your ankles. On another visit you might find yourself deep in someone's bloodstream or visiting a foreign country. These ultra-sensory experiences are provided in specially equipped labs in the Gerald M. Kline Innovation Space at the Cal State Long Beach University Library.

The newest technological addition to the Innovation Space lab is a tracking wall that will, for example, allow you to take a virtual walk through a house created by an industrial design student and use tracking devices to move the furniture around. Or a dance student, with the aid of sensors and

goggles, might research an interpretive dance by watching and performing alongside virtual dancers who are projected onto a 9-meter screen.

The Igloo Vision Cylinder and Virtual Reality & Augmented Reality Tracking Wall are the latest additions to the Innovation Space, an interdisciplinary on-campus design facility that houses 3D printers, laser cutters, digital scanners and now virtual reality labs.

PAGE 33: In the Igloo Vision Cylinder, students can visit places around the world or in their own neighborhoods.

Director **Dr. Christiane Beyer** said Igloo can imitate surface space by taking a computer-design image and project it on cameras that are placed overhead on trusses. In the VR & AR tracking lab, an optical tracking system, along with virtual reality glasses, give viewers a sense of being in the scene.

“It’s very interesting because there are five projectors on top and they project down around you,” Beyer said of Igloo. “It’s used a lot for training purposes because in most cases, military and police were trained to look forward and not over their shoulders to see what was coming from the back. This changes that.”

Beyer said the applications are endless.

“We are moving quickly through the digital world and we don’t know how to teach it all yet,” she said.

The new labs were set to open in spring 2020, but because of the COVID-19 pandemic, teaching shifted to online delivery and the library was closed. Reopening the library to the public will depend on when university officials deem it is safe to do so.

In the meantime, the Innovation Space staff has continued to be a vital resource to the community by using their 3D printing resources to manufacture protective face shields for local healthcare workers.

“We had the expertise and the engineering equipment to design stuff and I said, ‘I can’t just walk out of the room and not think about how to help with the coronavirus,’” Beyer said.

She estimates that in the first three to four months of the university shutdown the Innovation Space produced more than 2,000 masks that were donated to area hospitals. ■

The Internet of Things to Help Improve Our Drinking Water

Everyone wants to be assured that their water contains healthy biological characteristics and not harmful containments.

Dr. Jelena Trajkovic, assistant professor of computer engineering and computer science, is looking into a way to tell the world that our water, whether in a drinking glass or pool, is safe to enjoy. She is doing this by using in-pipe monitors within a global water distribution network.

Trajkovic teamed with others in her college to investigate the development of a low-cost system that monitors water quality

around the world using the Internet of Things (IOT) sensor technology. The IOT allows internet-connected devices to talk with one another. Over 12 billion devices are connected to the internet.

Trajkovic’s idea is to use sensors that would collect water. The sensors would then analyze the data and make a conclusion about the quality of the water that would be stored in the Cloud, thus making the information accessible to everyone who needs it.

“We are trying to propose a computer engineering system that is going to be able to acquire the data and propose a system that is going to be able to analyze it,” she said. “We are trying to make something that is reasonably priced so that it can be implemented everywhere.”

The research collaboration includes the leadership of Dr. Antonella Sciortino, professor of civil engineering & construction engineering management, and the assistance of undergraduate student Trevor Cunningham. ■

COLLEGE OF ENGINEERING

Dr. Jelena Trajkovic:
Assistant Professor of
Computer Engineering and
Computer Science

Family Feuds Hurt Business

When a head of a successful business retires or dies, the company, in many circumstances is left to their children. If the siblings present a unified front, the company will succeed. If rivalries arise, it could lead it to its demise.

Dr. Hojong Shin, an assistant professor of finance, has discovered in his research

that when an inheritance is divided, it influences the future of the company. Shin suggested in a scholarly paper entitled, “How Inheritance Law Affects Family Firm Performance,” published in Pacific-Basin Finance Journal (Feb. 2020), that equal distribution of the company among descendants has a positive effect on firm value.

“Prior to an owner’s death, their descendants usually assume crucial roles in the firm’s management,” Shin said. “For this reason, severe rivalry among descendants would negatively affect firm value by causing unnecessary internal troubles or inefficiencies inside the firm.”

Shin said that unequal distribution of inheritance can result in infighting and possible mismanagement of the company. That’s because heirs who receive smaller shares or roles in the company try to influence decisions by creating conflict.

However, if there is equal distribution of inheritance, the heirs’ incentives to compete with siblings will be weakened, which is more likely to lead to an improvement in firm values.

Shin said that one feature that distinguishes family firms from non-family firms is continuity and that can happen more successfully without the in-fighting.

Shin’s research into empirical corporate finance will next delve into the impact family composition (i.e., number of sons, daughters, marriage etc.) in family firms; how inheritance law reform influences family firms’ performance or risk taking and are family firms more or less likely to commit fraud during succession period. ■

COLLEGE OF BUSINESS

Dr. Hojong Shin:
Assistant Professor
of Finance

Exploring New Methods for Improving the Language Learning Journey

Dr. Sarvenaz Hatami wants to help make language acquisition easier for learners. Her mother tongue is Farsi, and she knows some French. She lived in Australia as a child, went to Canada for her Ph.D. and moved to the United States five years ago.

Living in a variety of English-speaking communities and experiencing first-hand English as a Second Language (ESL) learning inspired Hatami, an assistant professor of linguistics, to research strategies and conditions that would make second-language vocabulary learning more effective. She said learning words in sequences is especially beneficial.

“People tend to learn a new language one word at a time,” Hatami said. “But when native speakers say, for example, ‘Once upon a time...’ they don’t put the phrase together word by word – they recall the phrase holistically. More than 50% of English consists of

COLLEGE OF LIBERAL ARTS

Dr. Sarvenaz Hatami:
Assistant Professor
of Linguistics

such formulaic sequences, so one of my research goals is to learn how ESL learners can easily grasp these sequences.

“It can be daunting to imagine all the thousands of unknown words at the start of the language learning journey.”

She has found that reading and listening to materials that are enjoyable and level-appropriate for learners have a significant impact on vocabulary acquisition.

Her current research examines out-of-school English language exposure in Iran, where opportunities to learn English through apps, video games, and social media weren’t as widely available just a decade ago and are thus under-studied.

Hatami received Cal State Long Beach’s Professors Around the World Award in 2019 and plans to establish connections with universities in South Korea to create opportunities for CSULB students to teach English there. ■

Stability and Health Walking Hand in Hand

You’re walking on a linoleum floor when suddenly you step onto a wet spot and begin to fall. How do you brace yourself for the impact? How do you avoid falling?

If you are among the elderly, the results could be devastating. Falls among the elderly are common and can pose serious health problems. **Dr. Scott Ducharme** is taking steps to reduce the number of incidents among older residents with his research in gait stability.

Gait stability involves foot placement and how well we respond to disturbances.

That task is easy for most, especially if it’s a flat surface, such as walking on a gymnasium floor, Ducharme said.

Ducharme, a professor of kinesiology, is looking at how people adjust their walking patterns in response to internal or external challenges. Think of crossing a street. When a person crosses a street, they slow then lift their foot to ascend or descend a curb. It’s a situation that can pose bigger risks for older people.

“As people age, they lose strength, are more fatigued, and their vision might not be as strong,” Ducharme said. “Also, our sensory receptors don’t give us the right information and our perception isn’t as good. All these things that occur with age are going to make it more challenging to respond to a slip or trip or any other disturbance.”

Funded by a \$33,000 grant from the College of Health and Human Services, Ducharme’s plans for a 10-week study at the American Gold Star Manor retirement community in Long Beach was postponed until next spring because of COVID-19. His aim is to research how a multi-modal exercise intervention helps with walking, physical function and quality of life. He and his kinesiology students will monitor and assess the quality of the residents’ gait while on treadmill.

“I shifted my research to older adults because I wanted to have a research line that could help society at large,” he said. ■

COLLEGE OF HEALTH
AND HUMAN SERVICES

Dr. Scott Ducharme:
Professor of Kinesiology



FY 2020 FUNDING SUMMARY

California State University, Long Beach serves the university community by creating a campus environment that is conducive to promoting research and other scholarly activities that contribute to the mission of the university.

With a primary emphasis on faculty-student research engagement, the Office of Research & Sponsored Programs provides leadership, information, direction, resources, training and technical assistance to faculty and students engaged in externally funded research, instruction, community service and other scholarly activities.

266

Proposals Submitted

157

Proposals Awarded

\$124.3M

Funds Requested

\$43M

Funds Awarded

\$37.4M

Total Expenditures

ABOVE: Although classes are mostly online, the campus continues to be a valuable resource for students.

Quest

CALIFORNIA STATE UNIVERSITY
LONG BEACH

Office of Research & Sponsored Programs
1250 Bellflower Boulevard, (MS-4509)
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PHOTO: Students use the Innovation Space virtual reality lab to experiment with and design geometric patterns.

