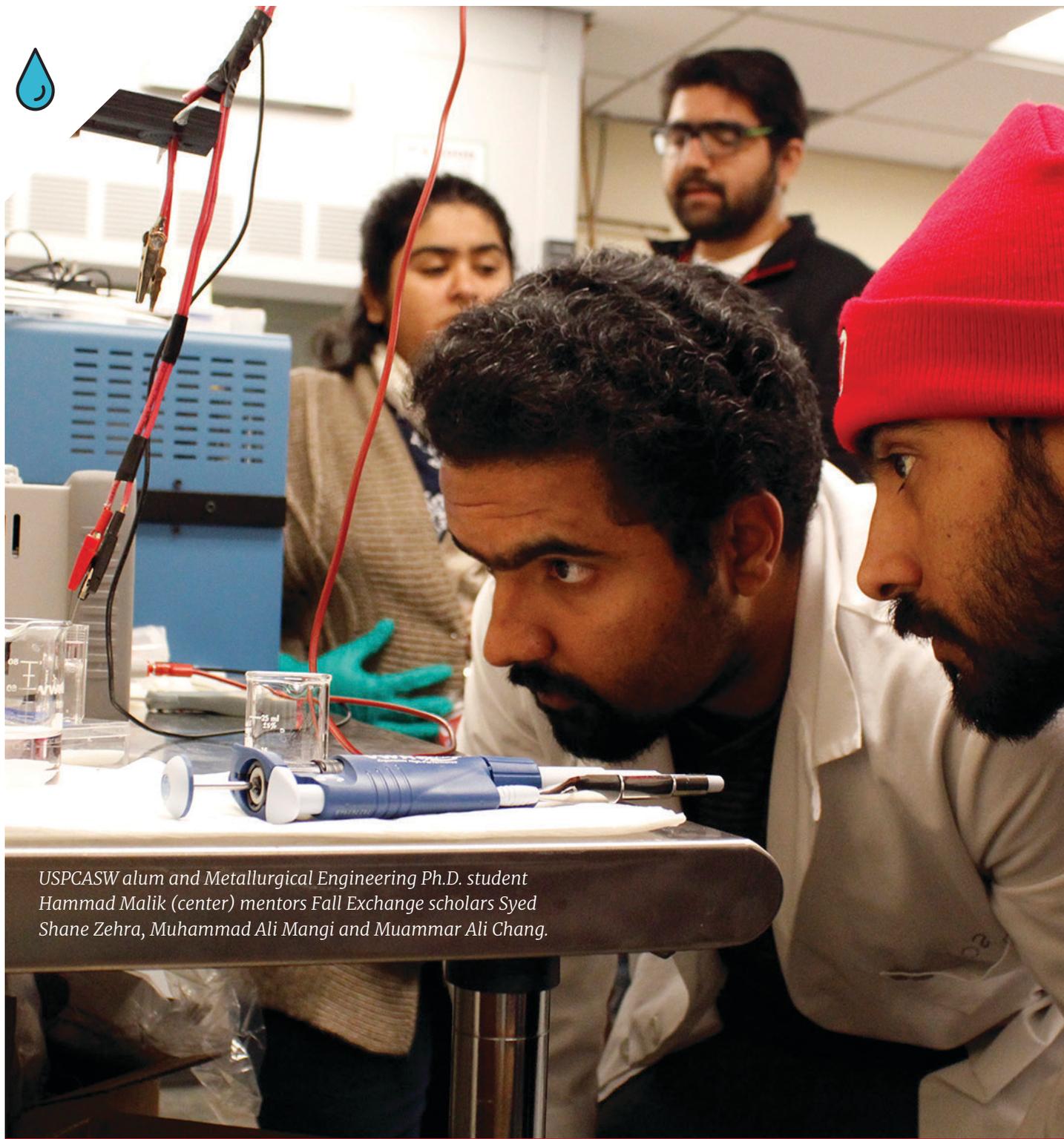


Making Waves

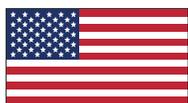
NEWS FROM THE

U.S.-Pakistan Center for Advanced Studies in [Water](#)

DECEMBER 2018



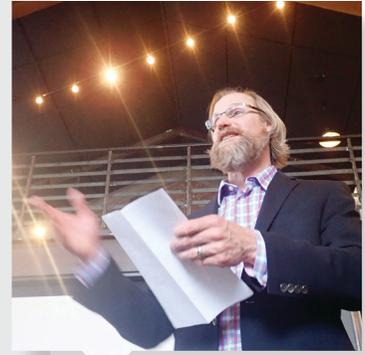
USPCASW alum and Metallurgical Engineering Ph.D. student Hammad Malik (center) mentors Fall Exchange scholars Syed Shane Zehra, Muhammad Ali Mangi and Muammar Ali Chang.



USAID
FROM THE AMERICAN PEOPLE



To say USPCASW has come a long way since its inception in 2014 would be a vast understatement. From just five faculty at our partner university—Mehran University of Engineering and Technology—to nearly 25, and from a handful of students to now hundreds, the triple-digit growth has been thrilling to witness. Nurtured by strategic investment, the completion of a new building in 2017, and the dedication of our faculty and staff, we remain unwavering in our commitment to educate Pakistan’s next generation of water leaders.



With a shared vision of achieving the United Nations Sustainable Development Goal for Water (SDG6), we’ve prioritized student success by creating four MS and three Ph.D. programs as well as a research program that addresses each of the six SDG6 targets. Catalyzed by research seed grants and joint research projects, and powered by students, USPCASW scholarly output has surpassed expectations. Inspired to create change, faculty and students have designed applied research projects that provide tangible benefits to their local communities in Pakistan.

To support the continued education of faculty, we developed a mission training program. To date, we have provided more than 15 training missions to Pakistan that have included more than 400 person-days of U.S. personnel time. Earlier this year, we enhanced the “learn by doing” approach we take to training with the addition of a joint research project that is executed during the mission. Participants have investigated solutions to soil salinity and protecting drinking water in distribution networks from antibiotic resistance bacteria—both problems in Pakistan and the U.S.

Our Exchange Program continues to flourish. Launched in 2016, the program has brought students and faculty from Pakistan to the University of Utah and Colorado State University to advance their research capacity. The experience has launched numerous joint collaborations between researchers in both countries. We continue to enhance and evolve the Exchange and launched our Water Entrepreneurship Exchange this past summer, which resulted in numerous viable business ideas and one that was awarded investor funding.

Looking now toward 2019, we are thrilled to celebrate the graduation of our first batch of Water, Sanitation and Hygiene students at MUET. We are excited by our budding partnership with the Higher Education Commission of Pakistan—a chance to share our successful capacity building programs for the benefit of all institutions of higher learning in Pakistan. And we are primed to expand the research impact of USPCASW into Balochistan and Khyber Pakhtunkhwa with strategic partnerships. There is much more to come and we look forward to the opportunities and challenges ahead as we work together toward a more water-secure future.

STEVE BURIAN, PROJECT DIRECTOR

18

Students set to graduate in the program’s innovative Water, Sanitation and Hygiene program in 2019

15

“Learn by doing” training missions to Pakistan completed to date

25

Faculty at Mehran University of Engineering & Technology (Up from 5!)



POINT-OF-USE NANOTUBE TECHNOLOGY “SHREDS” WATERBORNE PATHOGENS



“It’s 3D printed titanium,” said Dr. Krista Carlson, cradling the dark grey lattice-filled tube in her palms. Smaller than a toilet paper tube and nearly as light, the device represents years of research and offers an elegant solution to the ugly problem of pathogen-contaminated drinking water.

In Pakistan, lack of infrastructure means that sewage often mixes with potable water and the results are disastrous, as demonstrated in the country’s recent outbreak of antibiotic-resistant typhoid. The Pakistan Council of Scientific and Industrial Research Laboratories Complex estimates 80 percent of all

illnesses and 40 percent of deaths in Pakistan were caused by waterborne diseases. Poor water quality is particularly devastating for children. According to the World Health Organization (WHO), waterborne diarrheal diseases are responsible for two million deaths each year, with the majority occurring in children under five.

Communities that have the organizational and financial means to do so often turn to disinfectant chemical treatments like chlorine and ozone to remediate pathogenic water contamination. However, for many developing regions, these methods are



POINT-OF-USE NANOTUBE TECHNOLOGY “SHREDS” WATERBORNE PATHOGENS

continued from page 3



Dr. Krista Carlson explains the structure of her lab’s newest point-of-use cartridge.

challenging to implement. If not well managed, they can also have unintended health impacts of their own. What’s more, concern is growing that certain pathogens are becoming more robust and chlorine-derived oxidant-disinfectants are not as effective as they once might have been. All of these hurdles support the development of point-of-use solutions like the one Carlson, a metallurgical engineering professor at the University of Utah, is holding.

For households in Pakistan that receive potable water via pump truck, the nanotube-filled cartridge

This is the third prototype Carlson’s team has developed using this technology...while smaller in size, is “scaled-up” in design to serve up to 100 people in an apartment building.

is designed to fit into the pipe connected to the residence’s holding tanks. It serves as an oxidizing sieve--the titanium dioxide outer layer of the cartridge “shreds” pathogens as the tank is filled.

“Typically, titanium dioxide needs to be used in

combination with UV light to produce oxidants which physically destroy pathogens. In our case, we have adjusted the atomic structure of the titanium dioxide so that oxidants can be produced using only a small voltage,” said Carlson. What’s more, because the surface of the titanium dioxide is highly oxidizing, it is self-cleaning, meaning it inhibits biofilm growth, which leads to clogging and damage in traditional filters.

This is the third prototype Carlson’s team has developed using this technology. The first two were designed to support a single household, but this device, while smaller in size, is “scaled-up” in design to serve up to 100 people in an apartment building.

Funded through the U.S.-Pakistan Center for Advanced Studies in Water seed grant program, the cartridge will travel to Pakistan later this year for its first field test. The trip represents full-circle for Hammad Malik, who will help oversee the tests. Now a Ph.D. student in Carlson’s lab, Malik completed his



Ph.D. student Hammad Malik demonstrates the function of the cartridge during the USPCASW Fall Symposium.

graduate work at Mehran University of Engineering & Technology and was a student in the USPCASW Exchange program. He is eager to return to Pakistan to share an innovation that carries such potential to benefit his home communities.



VIDEOS, STORIES, AND PROGRAM INFORMATION AT

water.utah.edu/uspcasw

RESEARCH Highlights



The University of Utah, Mehran University of Engineering and Technology and Karakoram International University recently launched a collaborative field study in the Karakoram. Over one year, the team will collect and analyze glacier, snow, and river samples to better understand the sources of water in the critical Upper Indus.



Dr. Arabella Bhutto completed her sabbatical visit to the University of Utah. She was mentored by Dr. Cindy Furse and Mr. Spencer Walker while embedded as a Fellow in the U Center for Technology and Venture Commercialization. Her original project created a new approach to developing business oriented research projects.



U Law professor John Ruple recently traveled to Pakistan at the invitation of the Law and Justice Commission of Pakistan and the Pakistan Supreme Court to share lessons learned from management of the Colorado River. He discussed ways to create institutions and relationships to manage a finite resource with growing demand and supply uncertainty.



Dr. Munir Babar and graduate student Ahmad Rehman, researchers at MUET, along with Drs. Tim Gates and Joe Scalia, both civil engineering professors at Colorado State University, recently completed the first phase of their project for testing the application of granular polymers to seal canal beds to reduce seepage.

In the SPOTLIGHT



SHAHID PANHWAR heads up monitoring and evaluation efforts for USPCASW at Mehran University of Engineering and Technology. Panhwar spent four weeks this Fall on Exchange at The University of Utah gathering research and resources to help institutionalize policies and systems at MUET. His efforts support robust governance and will help ensure USPCASW's sustainability after the initial partnership phase of the project wraps next year. Of his visit, Panhwar said "the hands-on exposure to the way these offices run" has been essential to his goals of crafting career and professional development services for students, developing alumni programs, and enhancing faculty performance evaluation systems.

EXCHANGE Notes



USPCASW students represented Pakistan at the University of Utah's International Night on November 16, 2018.



Bushra Khan, Syed Shane Zehra and Kashaf Soomro hosted the Fall 2018 USPCASW Symposium. The festive evening featured student and faculty research posters and an awards ceremony. Exchange students also bestowed honorary titles upon their mentors and program staff.



"The ideas of 'desert' and 'water' are not totally unrelated...the exquisite environment in Arches National Park is loaded with cryptobiotic soil that is light sand loaded up with water-catching microorganisms to make life in the high desert conceivable."

-Excerpt from Bushra Khan's reflection on the trip

The Fall Exchange scholars took to the desert in October—exploring Moab, hiking in Arches National Park and enjoying two nights of camping at Bonderman Field Station at Rio Mesa. The students were introduced to the writing of local authors, including Edward Abbey whose thoughts on water served as a focal point for their written reflections on the trip. They also met with local experts to better understand water issues in the Colorado River basin.

EXCHANGE by the NUMBERS

100

Approximate hours of research completed

60

Approximate hours of writing instruction

5

Technical Field Trips completed

10

Hours of professional development

COURSES IN

Electric Properties of Materials
Hydrology
International Public Health Issues
Treatment Design
Epidemiology



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DECEMBER 2018

Making Waves

U.S.-Pakistan
Center for Advanced Studies in Water

The U.S.-Pakistan Center for Advanced Studies in Water is training a new generation of engineers and water professionals in order to solve the water security challenges of the twenty-first century.

In Pakistan, reliable drinking water is accessible to less than 15% of the population, inadequate sanitation contributes to preventable waterborne diseases leading to a child's death every two minutes, and inefficient management of water leads to supply losses greater than 50%. To forge solutions, USAID formed a strategic partnership between the University of Utah and Mehran University of Engineering and Technology (MUET) in 2015. The resulting Center fosters a nexus of higher education, government, business and communities working together to effectively guide sustainable development policy through water research.

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