Interdisciplinary Research (IDR) Enhancement Program
University of Texas at El Paso

Level 2 Round 1 Awards

Fall Prevention Research Coalition

Team Members:
The University of Texas at El Paso

- Candyce Berger, Ph.D., Social Work (PI)
- Donna Cude-Islas, Ph.D., Social Work
- Rebecca Reed-Jones, Ph.D., Kinesiology/Physical Therapy
- Eugenia Gonzalez, Ph.D., Occupational Therapy
- Guillermina Solis, Ph.D., Nursing
- Charon Pierson, Ph.D., Nursing
- Amanda Loya, Ph.D., Pharmacy
- Selina Aguilar, Ph.D., Pharmacy
- Joao Ferreira-Pinto, Ph.D., College of Health Sciences
- James Holcomb, Ph.D., Economics and Finance
- Katherine Lawson, Ph.D. student, Interdisciplinary Health Sciences
- Chandra Bulusu Kameswara Venkatrama, Ph.D. student, Interdisciplinary Health Science

Visiting Nurse Association: Fabian Barragan
Area Agency on Aging: Yvette Lugo
Texas Tech School of Nursing: Homero Guaderrama
New Mexico State University: Robert Wood, Ph.D.

A New Approach to Evaluating Copper Binding and Toxicity Using Copper Isotopes

Team Members:
The University of Texas at El Paso

- Elizabeth Walsh, Ph.D., Biological Sciences (PI)
- David Borrok, Ph.D., Geological Sciences

University of Texas Brownsville: Andrea Schwarzbach, Ph.D.

Socio-Ecology of Hispanics: A Translational Research Agenda for the Human Development of Hispanics in the U.S.

Team Members:
The University of Texas at El Paso

- Hector Olvera, Ph.D., Center for Environmental Resource Management (PI)
- Ernesto Castañeda-Tinoco, Ph.D., Sociology
- William Medina-Jerez, Ph.D., Teacher Education
- Holly Mata, Ph.D., Hispanic Health Disparities Research Center

Research on Identity and Participation in Science, Technology, Engineering, and Science (STEM)

Team Members:
The University of Texas at El Paso

- Elsa Villa, Ph.D., College of Engineering (PI)
- Martine Ceberio, Ph.D., Computer Science
- Alberto Esquinca, Ph.D., Teacher Education
- Eric Hagedorn, Ph.D., Physics
- Pei-Ling Hsu, Ph.D., Teacher Education
- Erika Mein, Ph.D., Teacher Education
- Patricia Nava, Ph.D., College of Engineering/Electrical and Computer Engineering
- Gina Nunez-Mchiri, Ph.D., Sociology and Anthropology

Structural Elucidation of Carbohydrate-Antibody Complexes to Enhance Vaccine Development

Team Members:
The University of Texas at El Paso

- Chuan (River) Xiao, Ph.D., Chemistry (PI)
- Katja Michael, Ph.D., Chemistry
- Igor Almeida, Ph.D., Biological Sciences

University of Texas M.D. Anderson Cancer Center: Dapeng Zhou, Ph.D.

Level 2 Round 2 Awards

Grafting DNA Code on Paper for Low-Cost and Sensitive Multiplex Pathogen Detection on 3D Microfluidic Devices

Team Members:
The University of Texas at El Paso

- XiuJun (James) Li, Ph.D., Chemistry (PI)
- Siddhartha Das, Ph.D., Biological Sciences
- Thomas Boland, Ph.D., Metallurgical and Materials Engineering

University of Maryland, College Park: Zhihong Nie, Ph.D.

Level 2 Round 3 Awards

Research on Contextualizing K-12 Mathematics Education within the Real World Context of Musical Composition and Musical Instrument Design

Team Members:
The University of Texas at El Paso

- Daniel Tillman, Ph.D., Teacher Education (PI)
- Song An, Ph.D., Teacher Education
- Andrea Shaheen, Ph.D., Music
- Larry Lesser, Ph.D., Mathematical Sciences

Study of Removal of Contaminants of Emerging Concerns in Municipal Wastewater

Team Members:
The University of Texas at El Paso

- Wen-Yee Lee, Ph.D., Chemistry (PI)
- Shane Walker, Ph.D., Civil Engineering
- Marc Cox, Ph.D., Biological Sciences

New Mexico Tech: Frank Y.C. Huang, Ph.D., Environmental Engineering

Development and analysis of a new Preclinical model of Her-2 positive human breast cancer

Team Members:
The University of Texas at El Paso

- Giulio Francia, Ph.D., Biological Sciences (PI)
- Wei Qian, Ph.D., Electrical and Computer Engineering
- Marian Manciu, Ph.D., Physics

Multispectral Analysis of Facial Skin: Detecting Emotional State

Team Members:
The University of Texas at El Paso

- Olac Fuentes, Ph.D., Computer Science (PI)
- Miguel Velez-Reyes, Ph.D., Electrical and Computer Engineering
- Stephen Crites, Ph.D., Psychology Department
- María Jiménez-Velasco, Ph.D. Student, Computer Science

Level 2 Round 4 Awards

Using hybrid microscopic methods to study highly movable biological objects

Team Members:
The University of Texas at El Paso

- Chunqiang Li, Ph.D., Physics (PI)
- Chuan Xiao, Ph.D., Chemistry
- Igor Almeida, Ph.D., Biological Sciences
- Wei Qian,Ph.D., Electrical and Computer Engineering
- Xiujun Li, Ph.D., Chemistry

Max Planck Institute for Medical Research, Germany: Matthias Fischer, Ph.D.

Novel Tools for Parasite Targeting and Delivery of a Chemotherapeutic Drug

Team Members:

The University of Texas at El Paso

- Rosa A. Maldonado, Ph.D., Biological Sciences (PI)
- Katja Michael, Ph.D., Chemistry
- Thomas Boland, Ph.D., Metallurgy and Materials Engineering

Developing an environmental-economic accounting framework for water use in the United States

Team Members:
The University of Texas at El Paso

- Stanley Mubako, Ph.D, Center for Environmental Resource Management (PI)
- Thomas Fullerton, Ph.D., Economics and Finance
- Adam G. Walke, M.S., Economics and Finance
- Tim Collins, Ph.D., Sociology and Anthropology
- Grace Mubako, Ph.D., Accounting
- Shane Walker, Ph.D., Civil Engineering

Assessment of aridland aquatic biodiversity using second generation sequencing

Team Members:
The University of Texas at El Paso

- Elizabeth Walsh, Ph.D., Biological Sciences (PI)
- Thomas Gill, Ph.D., Geological Sciences
- Ming-Ying Leung, Ph.D., Mathematical Sciences and Director of Bioinformatics Program
- Michael Moody, Ph.D., Biological Sciences

Level 2 Round 5 Awards

Cross-border rail infrastructure assessment in El Paso del Norte Region: A pilot project of the PdN interdisciplinary research platform

Team Members:
The University of Texas at El Paso

- Patrick Schaefer, J.D., LL.M., Hunt Institute for Global Competitiveness (PI)
- Ana P. Rodriguez, M.A., Hunt Institute for Global Competitiveness
- Thomas Fullerton, Ph.D., Business Administration
- Josiah Heyman, Ph.D., Center of Inter-American and Border Studies
- Joao Faria, Ph.D., Public Administration
- William Hargrove, Ph.D., Center for Environmental Resources Management
- Kelvin Cheu, Ph.D., Civil Engineering
- Soheil Nazarian, Ph.D., Civil Engineering

University of New Mexico Schools of Law, Management, Albuquerque: Lucio Lanucara, J.D., L.L.M.
Instituto Municipal de Investigación y Planeación, Ciudad Juarez, Mexico: Salvador Barragan, M.A.

This project aims to fill the gap in research and data about rail transportation infrastructure in the El Paso del Norte Region (PdN) — West Texas, Southern New Mexico and Northern Chihuahua — and provide crucial information to key regional stakeholders. Considering the exponential increase of trade volumes that go through the region, there will be

higher demand for more and better rail infrastructure in the next decades. For this reason, it is important to strengthen planning activities and to begin exploring this topic from an interdisciplinary point of view. Composed of members from three UTEP Colleges (Business Administration, Liberal Arts and Engineering) and two external members from New Mexico and Chihuahua (University of New Mexico and the *Instituto Municipal de Investigación y Planeación* (IMIP), the PdN interdisciplinary research Platform constitutes an unprecedented example of academic cooperation in the cross-border region. Conducting this pilot project will generate the preliminary research results needed to submit a competitive set of proposals to capture extramural funding opportunities.

Modulation of light exposure as an innovative approach to reduce stress and improve health

Team Members:
The University of Texas at El Paso

- Kristin Gosselink, Ph.D., Biological Sciences (PI)
- Carl Dirk, Ph.D., Chemistry
- Hector A. Olvera, Ph.D., Center for Environmental Resource Management

PhotoKinetics, Inc.: Douglass Steel, Ph.D. and Fred Jaeger
Institute of HeartMath: Jackie Waterman

Ambient light, whether natural or artificial, is a pervasive factor in the environments in which we live and work. Humans and other animals have circadian biorhythms that are both entrained by photoperiod and affected by light exposure. Light has been shown to modulate physiological processes, at least in part, through the stimulation of a class of intrinsically photosensitive retinal ganglion cells in the eye, and the subsequent recruitment of brain regions involved in stress and metabolism. Key outcomes of this activation include increased nervous system and hormone responses that are implicated in health conditions ranging from hypertension to depression and anxiety, obesity, and cognitive decline. This innovative project will demonstrate a correlation between human physiological responses and changes in spectral light exposure, and establish a proof-of-concept for the development of light-based therapies as non-invasive and non-pharmacological treatments for human health issues. Our work has a high level of significance and far-ranging implications, as previous studies have demonstrated that exposure to specific wavelengths of light at inappropriate times of the day is linked with insomnia, stress, depression, immune dysfunction, and cancer. Immediate applications include situations in which the photoperiod is changed, including jetlag, shift work, and extensive work hours or intermittent exposure to light during the dark cycle (e.g., the healthcare environment). This project will provide critical preliminary data that support our hypothesis that we can affect biological and psychological outcomes by manipulating environmental light conditions.

Laser-induced photochemistry for micro-channels in tissue engineering

Team Members
The University of Texas at El Paso

- Katja Michael, Ph.D., Chemistry (PI)
- Chunqiang Li, Ph.D., Physics
- Thomas Boland, Ph.D., Metallurgical and Materials Engineering

In the future, organ or tissue transplants may not come from a donor person, but rather the organ or tissue may be grown in the laboratory in a matrix, e.g., in a collagen gel. Currently, one of the biggest problems is that the three-dimensionally growing cells in the middle of the tissue often die because of lack of nutrients and oxygen. This challenge could potentially be overcome with a pre-formed micro-vascular system that would allow for the transport of nutrients and oxygen into all areas of the growing tissue. We propose to generate a gel from synthetic collagen-like peptides that contain photoreactive cleavage sites. When the light of a femtosecond laser of an appropriate wavelength hits the

photoreactive groups in the collagen-like gel, the material is expected to break down into small debris at this spot. Since this photolytic cleavage can only occur at the laser's focal point where the photon intensity is at its maximum, we hypothesize that by precisely moving the laser through the gel a micro-tunnel of any desired diameter and shape can be "carved out" within the three-dimensional matrix. After removal of the debris we propose to grow endothelial cells along the wall of this micro-tunnel forming a tubular cellular structure that resembles a blood vessel. If successful, this project could have a tremendous impact on tissue engineering by supplying nutrients through micro-channels thereby keeping the cells of the newly growing tissue alive and healthy.

Level 2 Round 6 Awards

An innovative training approach to decrease joint contact loads during plyometric exercises.

Team Members:
The University of Texas at El Paso

- Roger V. Gonzalez, Ph.D, College of Engineering (PI)
- Sandor Dorgo, Ph.D., College of Health Sciences
- Jerome, Hausselle, Ph.D., College of Engineering
- Rena, Hale, College of Engineering

El Paso Orthopedic Surgery Group and Texas Tech University: Brandon Broome, Ph.D.

High intensity lower-body plyometric exercise is predicted as the most popular fitness training modality for 2014. With intense loading conditions and quick repetitive movements that typically occur during plyometric exercises, the risk of joint injury increases and may lead to early joint degeneration. We propose to investigate the changes in individual knee kinematics and kinetics during plyometric jump tasks due to squat technique auditory feedback (AF) training, and to quantify intersegmental forces and ligament strain during the jump tasks before and after training. Twenty healthy 20-35 year old male subjects will be tested on squat, jump squat, and drop jump performances pre, post, and one week after AF training. *In vitro* simulations of three cadaver specimens will be performed on the UTEP joint simulator. Intersegmental force and ligament strain during the squat jump and drop jump will be determined. We hypothesize that, after AF training during the squat maneuver, subjects will be able to perform jump squats with decreased net joint moments and greater muscle co-contraction, decreasing knee contact forces and ligament strains. Results from this study will enable us to generate personalized performance assessment training programs that lower the risk of joint injury when performing highly dynamic tasks.

Use of Natural Zeolite as soil amendment to control salinity and moisture control in sandy soil

Team Members:
The University of Texas at El Paso

- Ivonne Santiago, Ph.D, College of Engineering (PI)
- Lin Ma, Ph.D, College of Science

New Mexico State University: Antonio Lara, Ph.D, College of Science.

Irrigation waters generally contain appreciable quantities of salts and crops extract water from the soil while leaving most of the salt behind. Unless leached away (continuously or intermittently), such salts sooner or later begin to hinder crop growth. In the El Paso area, like much of the arid southwestern United States, decreased supply of surface water has resulted in increased use of groundwater to supplement the drought-impaired surface water supply, which in turn has resulted in a groundwater overdraft, significant drops in groundwater levels, and a rise of brackish water levels. This means that more wells have been drilled and the wells have to be drilled deeper to find good quality water, which

means higher energy costs. We are proposing to evaluate the use of natural zeolite as soil amendment to control salinity of the irrigation water and retain moisture in the soil. This proposal will provide a feasible and sustainable alternative for agricultural applications. We will be testing zeolites found within a 125 mile radius from El Paso as well as evaluate the use of other low-sodium deposits that are the most promising for successful technology implementation. The project will have two main goals that drive the experimental design of the components: (1) Characterize and evaluate the capacity of the zeolite to absorb salinity by performing kinetic and equilibrium batch studies and, (2) Evaluate how a layer of zeolite on top of an agricultural soil can help reduce salinity and retain moisture by performing laboratory bench scale studies.

Development of a point–of-care device for rapid tuberculosis diagnosis in low-resource settings: a pilot study

Team Members:
The University of Texas at El Paso

- Jianjun Sun, Ph.D, College of Science (PI)
- Xiujun Li, Ph.D, College of Science (PI)
- Thomas Boland, Ph.D, College of Engineering

University of Maryland at College Park: Zhihong Nie, Ph.D, Department of Chemistry.

Mycobacterium tuberculosis (Mtb), a contagious and airborne bacterial pathogen, infects 1/3 of the world population and causes over 1 million deaths each year. Failure to control the spread of tuberculosis (TB) is largely due to our inability to detect and treat all cases of pulmonary TB in a timely fashion. Current TB diagnostic methods are slow, insensitive, or dependent on expensive equipment and infrastructure, which limits their applications in TB diagnosis in low-resource settings. A rapid, sensitive and instrument-free, point-of-care (POC) device is urgently needed for TB diagnosis. Recently, two Mtb antigens, ESAT6 and CFP10, have been extensively investigated as promising targets for TB diagnosis, but none of the ESAT6/CFP10-based diagnostic methods meet the POC standards. Therefore, the goal of this project is to develop a low-cost, instrument-free POC device for TB diagnosis by detecting both genes of esat6 and cfp10 with high sensitivity and specificity. In the proposed POC device, loop-mediated DNA isothermal amplification (LAMP) will be integrated on the chip to achieve high detection sensitivity, down to a few copies of target genes. LAMP primers will be designed to amplify both esat6 and cfp10 to reach the optimal detection specificity. Combination of on-chip centrifuge-free DNA extraction, visual instrument-free detection and battery-powered portable heater will significantly improve the capacity of the POC device in poor-resource settings and make it robust for the diagnosis of TB in various scenarios.

Interdisciplinary and International Smart City Research Innovation Program

Team Members:
The University of Texas at El Paso

- Kelvin Cheu, Ph.D, Department of Civil Engineering (PI)
- Carlos Ferregut, Ph.D, Department of Civil Engineering
- Sergio Cabrera, Ph.D, Department of Electrical Engineering
- Heidi Taboada-Jimenez, Ph.D, Department of Industrial, Manufacturing, and Systems Engineering
- Ann Gates, Ph.D, Department of Computer Science
- Cesar Carrasco, Ph.D, Department of Civil Engineering
- Soheil Nazarian, Ph.D, Department of Civil Engineering
- Natalia Villanueva-Rosales, Ph.D, Department of Computer Science
- Oscar Mondragon Campos, Ph.D, Department of Industrial, Manufacturing, and Systems Engineering

Universidad de Guadalajara (UDG): Victor Larios, Ph.D, Dept. of Information Systems
Czech Technical University (CTU): Miroslav Svitek, Ph.D, Faculty of Transportation Sciences

Making cities “smarter” or transforming them into smart cities is the process of improving economic competitiveness and quality of life by implementing cyberinfrastructure technologies throughout a city. UTEP researchers have been active in various aspects of research that has the potential to “smartifying” cities. Their efforts need to be integrated and strengthened in order to compete for extramural research funding at the national and international levels. Nine researchers from four departments in the College of Engineering have formed a team with partners in Universidad de Guadalajara, Mexico, and Czech Technical University, Czech Republic. Funds are requested in this IDR project to review the start-of-the-art research in smart city initiatives across the world, identifying research gaps and issues, and develop an integrated, multidisciplinary research agenda for an international smart city research program.