Biomedical Research

The University of Texas at El Paso’s Border Biomedical Research Center (BBRC), through NIH support and collaborative partnerships with researchers in the region, has become the preeminent institute focusing on health and biomedical issues affecting the El Paso/Ciudad Juárez region of the Texas-Mexico border.

On maps, borders are big and bold—firm demarcations between cities, states or countries.

In the Paso del Norte region, however, things are not quite so clear. Our border is as fluid as the river that defines it. El Paso and Juárez, sister cities in the truest sense of the word, represent the largest bi-national metropolis in the world.

There is a challenging aspect to being on the frontier; for what makes us unique also increases our vulnerability. Our culture, a hybrid of developed and developing worlds, presents formidable health concerns for both sides of the border. Poor sanitation systems, impure drinking water and inadequate health care plague some border communities, and disease does not respect checkpoints—or borders.

Challenging circumstances require ambitious approaches, so in 1992 the University of Texas at El Paso (UTEP) created the BBRC. Through the broad range of innovative biomedical research now taking place at UTEP, the University is on its way to meeting the health needs of the region. The five-story, 140,000-square-foot Bioscience Research Building houses key facilities and equipment to support cutting-edge research studies.

What makes the BBRC even more impressive is the fact that its students have access to technologies that would typically be restricted at many comparably-sized universities. UTEP’s Department of Biological Sciences serves more than 1,550 majors, enrolling about 6,300 students in more than 75 courses each semester.

While the $45 million dollar building reflects the growing significance of biomedical research at the University, the department has grown in other ways. In 1992, the Department of Biological Sciences had 19 tenured or tenure-track faculty, with less than half participating in biomedical research. Those figures have now doubled. In addition, during that same period, annual grant expenditures climbed from $1 million to $13.7 million a year. These successes are due in part to the core research laboratories within the building.

The BBRC’s efforts have been aided greatly by the National Institutes of Health Research Centers in Minority Institutions (RCMI) program, which has helped the center recruit several outstanding virologists, parasitologists, immunologists and neuroscientists who are performing valuable research on diseases seen locally. These include maladies that have a higher incidence near the border than they do in the rest of the United States—diseases such as diabetes, drug-resistant tuberculosis, staphylococcus infections, cirrhosis of the liver and HIV/AIDS, along with certain cancers.

Along with the gifted scientists working at the Center, the BBRC continues to expand its research program by recruiting faculty members interested in infectious agents such as the hepatitis A, B and C viruses and mycobacterium tuberculosis. Other areas of interest include diabetes, environmental toxicants and neurological disorders. The Center has established a Biosafety Level 3 (BSL-3) laboratory to facilitate research into relevant human pathogens such as West Nile virus, tuberculosis, severe acute respiratory syndrome (SARS) virus and other agents.

“I have worked in facilities all over the world,” said Siddhartha Das, Ph.D., a Professor in the Department of Biological Sciences at UTEP. “These laboratories are state of the art.”
Core Facilities

Along with the other scientists conducting vital research in the facility, Robert Kirken, Ph.D., PI for the BBRC Program, and Dean College of Science sees a future in which there is a direct link between the laboratories and the region they serve.

“El Pasoans love their community, and the BBRC has a tremendous opportunity to improve their health and well-being through research,” Kirken said.

SIX CORE LABORATORIES PROVIDE RESEARCHERS WITH THE LATEST TECHNOLOGICAL ADVANCEMENTS TO CONDUCT THEIR STUDIES:

BIOINFORMATICS COMPUTING
This facility supports computational and mathematical modeling, as well as bioinformatics software and database development. Many of its features include building web-based software tools for sequence analysis and structure prediction for nucleic acids and proteins, mass spectrometry data analysis, image data processing, and integrating computational approaches to solve biomedical research questions. Current projects include identifying exonic DNA variants from entire exome sequence data, prediction and visualization of RNA structures, and posttranslational modification site prediction. High performance computing capabilities are provided by the local grid-computing network, the IBM High Performance Computing Virtual Research Lab cluster, and the facilities at the Texas Advanced Computing Center.

BIOMOLECULE ANALYSIS
The Biomolecule Analysis Core Facility is instrumental to the separation and characterization of biomolecules. The facility possess state-of-the-art equipment that includes two mass spectrometers (Q Exactive Orbitrap and LTQ XL/ETD) coupled to nano-UHPLC, micro-UHPLC, or nano-HPLC for proteomic analysis, a gas chromatography-mass spectrometer and a Biacore T100 that uses surface-plasmon resonance technology for detection and characterization of molecular binding interactions in real time. Equipment such as ultracentrifuges, preparative centrifuges, plate readers, scintillation counters, vacuum centrifuges and lyophilizers are available within the Core. These resources promote new insight into the mechanisms of infectious agents, cancer and other diseases of greater importance to the Paso del Norte region, and support the needs of researchers within and beyond the BBRC.

THE CYTOMETRY, SCREENING AND IMAGING (CSI) CORE FACILITY
This Core is a comprehensive facility that provides investigators with state-of-the art technology to conduct cell-based experiments with 24/7 access. The Core provides technical expertise and training related to cell culture techniques, cryogenic preservation, flow cytometry, confocal microscopy, drug discovery, experimental design and data analysis. The available screening technologies allow investigators to test a large number of compounds against cancer and infectious agents. The Core contains six culture suites, three flow cytometers (one sorter and two analyzers), two bioimagers, two robotic pipetting systems, two ultra-low cryogenic freezers (−140°C), and two Zeiss confocal microscopes to support multiple research initiatives. Apart from the established procedures currently performed in the core, additional cell culture or screening services can be implemented upon consultation with the Core Director and the core staff.
COMMUNITY ENGAGEMENT CORE
The Community Engagement Core (CEC) of the BBRC will create partnerships among researchers and community organizations to disseminate findings emanating from the research projects of the Center. The goal of the CEC is to build a sustainable infrastructure that fosters investigative collaboration and dissemination of project findings throughout the scientific community and residents of the Paso del Norte border region. Overall, the CEC will support and synergize research efforts of the BBRC Clusters through sustained partnerships and develop innovative community engagement and dissemination strategies to better serve the community.

GENOMIC ANALYSIS CORE FACILITY (GACF)
The Genomic Analysis Core Facility supports all researchers at UTEP and beyond in their nucleic acid-based research studies on a 24/7 basis. Available services include DNA sequencing, microsatellite and fragment length polymorphism analyses, quantitative PCR and RT-PCR, and access to sophisticated nucleic acid analysis software. Additional state-of-the-art equipment includes thermostycers; UV/Vis spectrophotometers; a Phosphorimager; automated film developers; digital gel documentation system; AKTA FPLC for purification of proteins; a SpeedVac concentrator; and micro-preparative and ultra-centrifuges for sample preparation.

The Genomic Analysis Core Recharge Center currently provides fee-for-service DNA sequencing and microsatellite analysis on an ABI capillary electrophoresis system. The Core provides training on, and access to, all equipment as well as sophisticated software tools such as Sequencher (DNA sequence analysis) and GeneSpring (microarray data analysis). Core personnel provide assistance with DNA and RNA sequence analysis in collaboration with the Bioinformatics Core Facility. Services include DNA and protein sequence assembly and alignment; multiple sequence alignments; assembly of phylogenetic trees; and prediction of RNA secondary and tertiary structures.

Planned acquisition of next generation sequencing (NGS) equipment will allow users access to this new technology, which can be applied to not only the sequencing of entire human genomes, but to other potential applications such as analysis of transcriptomes (the collection of RNAs expressed in a cell) or epigenomes (including methylation analysis), small cellular RNAs or viral RNA genomes, DNA-protein interactions, gene regulation, structural variations, and identification of single nucleotide polymorphisms, for example those involved in certain cancers.

STATISTICAL CONSULTING
The mission of the Statistical Consulting Laboratory (SCL) is to provide statistical and computing support to BBRC researchers. We additionally serve as consultants to BBRC scientists and regional investigators in the health sciences, education, medical sciences and other fields. The SCL provides concentrated statistical support for institutional and individual grant applications, including protocol review, design of experiments and surveys, power calculations, statistical analysis of data, and interpretation of results.

COMMUNITY IMPACT
The Core laboratories are not only about technology. The mission of UTEP includes a dedication to the advancement of and service to the people of this region. BBRC’s mission is aligned with these goals.

“We want to have an impact on our community,” Kirken said. “Some universities are insulated from the regions they serve. We want to crack that barrier. This is our challenge. We must become advocates for a healthier community through our science, and serve as liaisons between the University and the community.” The way to do that, Kirken said, is through outreach. “Many people live their entire lives in this region. That makes it a unique environment. We need to determine their health histories, and why some people are more susceptible to certain diseases than others. We need to investigate these important questions. We must communicate that early detection is important for overcoming disease, and that prevention can be achieved through maintaining healthy lifestyles,” Kirken said. The goal, he said, is to help the community through these research findings. “To help them, we must have their trust—and open communication,” he said.
3 Research Clusters

INFECTIONOUS DISEASE AND IMMUNOLOGY CLUSTER
With its outstanding research facilities, including BSL-3 capabilities, scientists are able to investigate and test strategies to eradicate pathogens common to the Paso Del Norte region. They study the molecular mechanisms through which these infectious agents cause disease. Areas of significant focus include mechanisms of innate and adaptive immunity, tuberculosis, giardiasis, amebiasis, leishmaniasis, Chagas’ disease and viral infections including HIV, influenza, and West Nile. Investigators are also involved in developing novel therapeutics for, and diagnostic vaccines against, these actively infectious agents.

NEUROMODULATION DISORDERS CLUSTER
Research programs in this area seek to address brain disorders and mental health issues that are of primary importance to the Paso del Norte region. Areas of focus include understanding the mechanisms of obesity, substance/alcohol abuse and addiction, attention deficit hyperactivity disorder, learning disabilities, and dementia. Our scientists have a wide range of research interests and expertise to promote interdisciplinary research, which is quintessential for the comprehensive understanding and improved development of new therapeutic strategies and interventions for these diseases.

TOXICOLOGY & CANCER BIOLOGY CLUSTER
Researchers are exploring how exposure to environmental agents negatively affects our health, including the question of why individuals differ in their susceptibility to disease and cancer. Scientists employ a wide variety of research technologies, including field studies, genomics, microarray and cell-based image analysis to address these issues from the mechanistic to ecosystem level. The border region provides an ideal area examining health disparities among different population groups and how environmental quality may impact risks for cancers and other diseases.
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TESTIMONIALS

“The Border Biomedical Research Center acts as a major hub for researchers and clinicians in the Border Region to interact and collaborate with one another, creating an inspiring environment conducive to interdisciplinary research at UTEP. Bioinformatics research rely heavily on such settings to interface mathematical modeling and data management with experimentation. It provides unique training opportunities for our students to develop both computational and experimental skills to be competitive in the modern scientific workplace.”

– Ming-Ying Leung, Ph.D., Director, Bioinformatics

“The BBRC offers UTEP students and faculty unprecedented and cost-effective access to the highest quality instrumentation. The labs are spacious and foster collaborative efforts between investigators and students. Because of this access and high quality, we are able to train outstanding students and provide them with the skills they need to compete with students from institutions across the nation. I feel very lucky to be a part of such a motivated and enthusiastic environment.”

– Anita Quintana, Ph.D., Assistant Professor, Biological Sciences

“BBRC brings together collaborative teams and infrastructure to research on various biomedical and health issues emerging in the El Paso area of the Texas-Mexico border with biopathology research being the focal point. Statistics is an indispensable component of collaborative research. The Statistical Consulting Laboratory (SCL) consolidates the statistical expertise and statistical computing facilities around the UTEP campus to provide statistical support to the BBRC research activities. As a statistician, I am pleased to have the opportunity to take part in this.”

– Xiaogang Su, Ph.D., Director, Statistical Consulting

“The BBRC’s Proteomics Core facility has helped my research tremendously, and with their findings I have recently published a paper in the number one distinguished journal in my field Environmental Science & Technology. Also, Dr. Igor Almeida, the Director of the Biomolecule Analysis Core Facility has been a great collaborator to work with.”

– Jorge Garda-Torresdey, Ph.D., Professor, Chemistry

“As a member of the BBRC from the Department of Chemistry, I feel that the BBRC core facilities are essential to my lab because they provide the expensive instrumentation that otherwise are not easily affordable for individual labs, such as ultracentrifugation, DNA sequencing, various spectrophotometers, etc. In addition to providing access to expensive instruments, all of the core facilities have staff members with expertise, who not only maintain the instruments well but also have helped to enhance our current research endeavors. This applies to many researchers all over the campus in different departments and colleges who are currently using any of the core facilities housed in the Bioscience Research Building.”

– Chuan (River) Xiao, Ph.D., Associate Professor, Chemistry
BBRC FACTOIDS

BBRC is housed primarily in the $45 million dollar, 5-story, 140,000 square foot Bioscience Research Building that was completed in 2009.

UNDERGRADUATE STUDENTS WORKING IN BBRC LABS IN A GIVEN YEAR ARE:

250

CORE FACILITIES:
Bioinformatics, Biomolecule Analysis, Community Engagement, Cytometry, Screening and Imaging, Genomic Analysis, Statistical Consulting Laboratory

RESEARCH PRODUCTIVITY OF BBRC RESEARCHERS FOR 2015:

Published Manuscripts: 220
Funded Grants: 93
Annual Grants Portfolio: $36.1 M
Total Grants Portfolio: $108.6 M

NEW PATENTS FROM RESEARCH AT THE BBRC INCLUDE:


INFO

The University of Texas at El Paso opened a new five-story, 140,000 square-foot Bioscience Research Building in 2009.

As impressive as the facility is structurally, it is equally impressive for the research being conducted by UTEP professors and students—research that includes studies into diseases such as cancer, tuberculosis and HIV/AIDS.

The $45 million dollar building houses the Border Biomedical Research Center (BBRC), which is supported by the National Institutes of Health Research Centers in Minority Institutions.

“We want to help the community,” said Siddhartha Das, Ph.D, Professor in the Department of Biological Sciences. “That’s the bottom line.” Das has worked in facilities all over the world, and the infrastructure and technology in this building is as impressive as any he has seen.

The state-of-the-art equipment supports investigators as they conduct in-depth studies involving genomics and cell-based image analysis, allowing important advances and inquiries into important health problems prevalent along the U.S.-Mexico border; including:

1. Neuromodulation Cluster: Researchers are studying neurological disorders including obesity, diabetes and drug and alcohol addiction.

2. Infectious Disease & Immunology Cluster: Scientists are testing strategies to eradicate pathogens common along the border, including viral infections such as influenza, HIV/AIDS, West Nile and TB.

3. Toxicology & Cancer Biology Cluster: Investigators are examining the effects of environmental toxin exposure on organism health and function.

4. Health disparities among different population groups. With its rich diversity, the Paso del Norte region represents a prime testing ground for such investigations.

The University of Texas at El Paso
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