

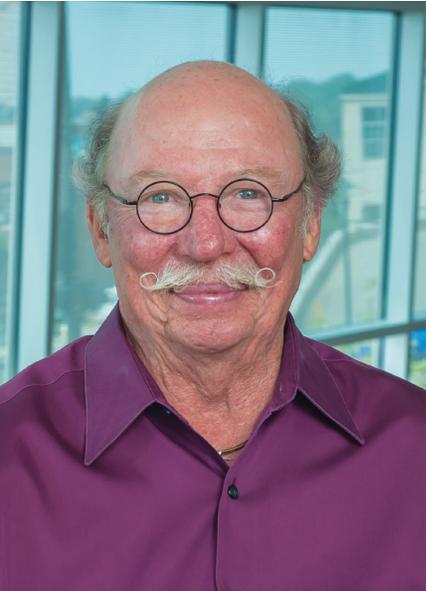


INBRE

IDEA Networks of Biomedical
Research Excellence

MESSAGE FROM THE DIRECTOR

Since its establishment at the University of Nebraska Medical Center in 2001, the Idea Networks of Biomedical Research Excellence (INBRE) program has captured the excitement, imagination and vigor of students across Nebraska.



Jim Turpen, Ph.D. | Director

It's the only two-year program in the state that supports students financially in their pursuit of scientific research.

And it furthers the science of undergraduate faculty by bringing them together with researchers at the state's premier professional schools.

Supported by \$16.2 million from the National Institutes of Health (NIH), INBRE is the state's largest grant.

More than 325 undergraduates have taken part in INBRE at an investment of \$18,500 per student and \$1.5 million invested on undergraduate campuses. A cooperative program that involves faculty and students at 11 participating institutions throughout the state, INBRE has created opportunities that never would have been possible.

It enabled Maggie Bartlett the opportunity to work in the lead Department of Defense laboratory for biodefense research at the U.S. Army Medical Research Institute of Infectious Disease in Fort Detrick, Md.

And the INBRE program is part of the curriculum vitae that propelled former INBRE Scholar, Christine Cutucache, Ph.D., who now holds the first Haddix Community Chair in Science at the University of Nebraska at Omaha.

Funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health

Through INBRE program incentives, undergraduate instructors are able to establish laboratories, and create opportunities for more students to participate in research.

It also provides them with the dollars necessary to buy equipment to establish or support existing core facilities, a crucial component of the program.

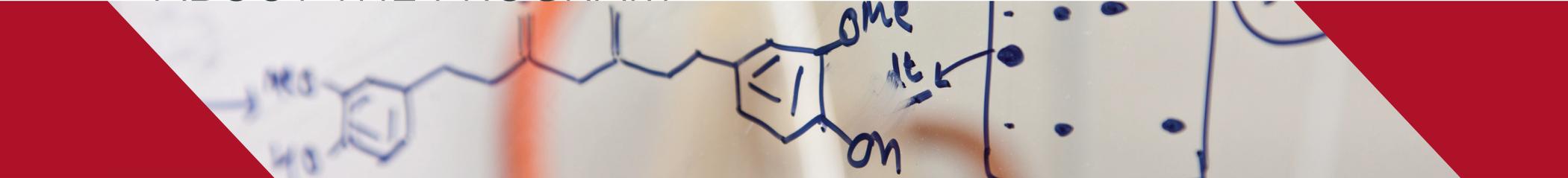
There are now four INBRE supported core facilities covering everything from genomics and proteomics to bioinformatics and imaging at the disposal of faculty and students. The services provided by these core facilities attract new talent to Nebraska and enable researchers to be more competitive in applying for federal funding.

And there are many other ways the INBRE program has contributed directly or indirectly to the success of students and faculty.

We're proud to be part of a unique program that establishes a pipeline of undergraduate students interested in scientific research and matches those students with researchers. We're also proud of how INBRE is a direct investment in the future of biomedical research in the state and the nation.



ABOUT THE PROGRAM



Advances in biomedical research have led to personalized medicine, improvements in agricultural production and new therapies to manage chronic illness.

Biomedical researchers are on the front lines, testing new ideas, unraveling mysteries that will one day lead to better medicine. These researchers are not in unlimited supply, but encouraged at an early age to join the ranks through programs like Nebraska INBRE. The Nebraska INBRE program provides undergraduate students with an opportunity to explore careers in biomedical research. The hands-on experience keeps talented students in the state, increases the research accomplishments of undergraduate faculty and helps advance scientific knowledge that improves lives.

Supported by \$16.2 million from the National Institutes of Health, INBRE helps pay for faculty salaries and student stipends, as well as equipment, laboratory supplies and travel to conferences nationally and internationally.

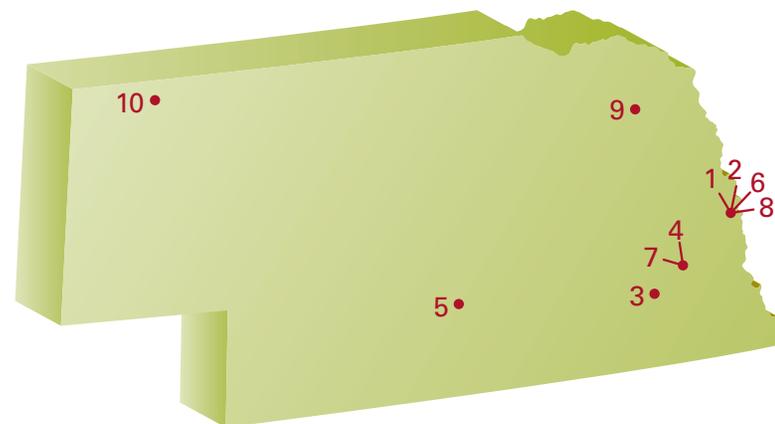
An integral component of INBRE is the scholars program, which provides summer fellowships for advanced research training at one of the Ph.D. granting institutions, as well as research assistantships during the academic year. Scholars have numerous opportunities to present work at regional, national and international scientific meetings, in hopes of being recruited into graduate research programs. Once a scholar has been admitted to a Ph.D. program in Nebraska, the INBRE project provides support for the first year of graduate studies.

To enhance the competitiveness of biomedical research in the state, INBRE develops research infrastructure and provides research opportunities for students and faculty at Nebraska's higher education institutions.

The Nebraska INBRE network consists of eight undergraduate institutions and three Ph.D. granting institutions that serve the network as training and mentoring institutions. These include:

- 1 Creighton University
- 2 College of Saint Mary
- 3 Doane University
- 4 Nebraska Wesleyan University
- 5 University of Nebraska at Kearney

- 6 University of Nebraska at Omaha
- 7 University of Nebraska-Lincoln
- 8 University of Nebraska Medical Center
- 9 Wayne State College
- 10 Chadron State College



SCHOLARS

The INBRE scholars program serves a dual purpose: to provide meaningful research experiences for scholars and enable talented undergraduate students to take part in research projects on their home campus. Since 2001, hundreds of undergraduate students have completed the program, entered graduate or professional school or joined the scientific workforce.

INBRE scholars are identified and recruited by undergraduate science faculty on their home campus during their sophomore year. To participate, scholars should have a 3.0 GPA, two letters of recommendation and a strong interest in scientific research. Scholars are given opportunities for mentored, full time research during their first summer in the program. This takes the form of a Research Foundations Workshop at one of the Ph.D. granting training campuses. Scholars then commit to part time

research on their home campus during the following two academic years and full time research on their home campus during their second summer in the program.

Financial support is provided to these undergraduates throughout their tenure as INBRE scholars. Scholars are required to present their research at the annual INBRE meeting and at the annual meeting of the Nebraska Academy of Sciences. They also are encouraged to present their work at national meetings. Scholars who matriculate into a Ph.D. program at one of Nebraska's participating Ph.D. granting institutions receive stipend support and tuition remission during their first year in graduate school.

STUDENT TESTIMONIALS

"It is imperative to have programs like INBRE. They are a huge help to students like myself who get first-hand experience of what it would be like to be a research scientist." – Sushrut Kamerkar, 2010 INBRE Scholar

"INBRE reinforced that this is the right path for me, and gave me opportunity after opportunity to further my career and explore what it means to do research." – Maggie Bartlett, 2013 INBRE Scholar

"Without the INBRE program, I wouldn't have learned any of the bioinformatics that I studied during my summer research experience, made the connections I have now, or been given the opportunity to present my research to a larger audience." – Nick Johnson, 2015 INBRE Scholar

"INBRE is an incredible opportunity to do research and network with future colleagues and esteemed faculty. I find it easy to see that the program effectively equips and trains its scholars for promising careers in biomedical research." – Harim Won, 2016 INBRE Scholar



INBRE scholars spend two years in the program during which time they learn valuable laboratory and critical thinking skills through mentored research opportunities. These undergraduate students receive financial support throughout their tenure as INBRE scholars.

SCIENTIFIC FOCUS



The scientific focus of the INBRE program is based on the strengths and expertise of campus faculty in the areas of structural biology, cell signaling and infectious disease. Collaborative arrangements between undergraduate faculty and research mentors are integral to the development of the focus areas and help lead to a greater understanding of the structure and function of viruses and how cells communicate. Together, faculty and mentors engage, inspire and educate students to pursue scientific careers in Nebraska.

STRUCTURAL BIOLOGY

Structural biology and molecular biophysics applies the principles and techniques of biology, chemistry, computer science, physics and mathematics to elucidate the governing forces and structures of biological macromolecules, supra-molecular structures, organelles and cells.

Understanding the structure, function and energetics of medically-relevant macromolecules can help researchers better understand the causes of cancer and aid in the development of drugs based on the structure of targeted proteins.

CELL SIGNALING / NEUROSCIENCE

Cell signaling has emerged as a major field of scientific focus because of its central role in all aspects of normal cell function, as well as in diseases and the effects of toxins and other pathogens in humans, animals, plants and lower organisms.

The difficult, but exciting, challenge is to determine how these various cellular signals work together to regulate the many aspects of cell function.

INFECTIOUS DISEASE

Viruses are the simplest of biological systems. They consist only of protein and nucleic acid and are incapable of reproducing themselves without a host. Yet, viruses have made a huge impact on 20th century life, from their role as infectious agents in devastating diseases like smallpox and AIDS to their use as one of the key tools in the quest to decipher the workings of the gene.

Virology research in Nebraska crosses disciplines and explores the basic nature of viruses and their potential applications for diagnosis and control of diseases in plants, animals and humans.



The INBRE program is based on the strengths and expertise of campus faculty in the areas of structural biology, cell signaling and infectious disease. These faculty and their research mentors combine to educate, engage and inspire students to pursue scientific careers.

CORE FACILITIES

Confocal microscopy, mass spectrometry and DNA microarray analysis are just a few of the different types of services provided through five core laboratories supported by the INBRE program.

The University of Nebraska Medical Center and Creighton University Medical Center serve as hosts for these technologically advanced laboratories.

INBRE provides salary support for technical personnel, major equipment purchases and operating supplies. It also helps make the services of the core laboratories available to all investigators throughout the state.

BIOINFORMATICS

University of Nebraska Medical Center | Babu Guda, Ph.D., director

This core includes state-of-the-art bioinformatics capabilities and is designed to support and streamline multidisciplinary collaborative research in biomedical and health informatics. The purpose of the BI-Core facility is to build a core infrastructure and provide expertise necessary to assist and support INBRE researchers in the network to develop software and technology solutions for the biosciences and health care. As part of the Bioinformatics Core, INBRE provides additional support to the McGoogan Library of Medicine at the University of Nebraska Medical Center for the purchase of electronic subscriptions to major biomedical journals.

DNA SEQUENCING AND MICROARRAY

University of Nebraska Medical Center | James Eudy, Ph.D., director

The core is a full-service microarray and sequencing facility and performs all aspects of microarray experimentation. These procedures include DNA microarray slide fabrication, labeling of RNA, hybridization of samples as well as data analysis. The facility provides the necessary resources for academic investigators throughout the state to utilize DNA microarray technology in their respective research projects. The facility functions as a subsidized fee-for-service facility. In addition, the sequencing facility houses a next generation DNA sequencer. The costs to users simply recover the cost of slide fabrication and sample processing.

INTEGRATED BIOMEDICAL IMAGING

Creighton University | Richard Hallworth, Ph.D., director

A multi-user core closely related to the scientific focus in structural biology, this core can image with most fluorophores, in either single-photon or multi-photon modes, with resolution approaching the theoretical limit (222 nm). The META multi-channel system enables separation of fluorophores with closely-spaced emission peaks by linear un-mixing. The types of experiments available far surpass those of conventional high resolution confocal imaging. Particular emphasis is placed on fluorescence-based and other dynamic imaging modalities including: live cell imaging in culture with temperature control, metabolic imaging and deep brain or deep tissue imaging in vitro or in vivo.

STRUCTURAL BIOLOGY

University of Nebraska Medical Center | Gloria Borgstahl, Ph.D., director

The lab is divided into five components:

- Protein expression and purification;
- Crystal screening and growth, using the Formulatrix industry-standard automated crystallization platform;
- Single Crystal X-ray crystallography, using a Rigaku protein crystallography instrument;
- Small angle X-ray scattering, with a Rigaku BioSAXS-1000 for data collection;
- Nanocapillary electrophoretic (nanoELP) immunoassays with separations by size or charge under the direction of Laury Steinke, Ph.D.

NUCLEAR MAGNETIC RESONANCE

University of Nebraska Medical Center | Paul Sorgen, Ph.D., director

Nuclear magnetic resonance, this lab has three NMR spectrometers (400, 500 and 600 Mhz) allowing the lab to perform a wide variety of NMR data collection including protein structural data up to 30 kDa.

Five core facilities combine to support the Nebraska INBRE program. These facilities are housed at the University of Nebraska at Omaha, University of Nebraska Medical Center and Creighton University Medical Center. INBRE provides salary support for technical personnel, major equipment purchases and operating supplies.





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