Delaware INBRE

Delaware's Biomedical Research Catalyst

2021 STUDENT SUCCESS REPORT

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DelawareINBRE

Delaware's Biomedical Research Catalyst

The Delaware IDeA Network of Biomedical Research Excellence (DE-INBRE) is a statewide collaborative network that seeks to expand research activities across basic, translational and clinical areas while increasing Delaware's competitiveness for federal biomedical research funding. In doing so, DE-INBRE supports impactful, state-of-the-art research that creates jobs, prepares tomorrow's workforce, and improves the health of Delawareans. This happens in three ways: by providing biomedical research opportunities for undergraduates; supporting early-career investigators on their quest to become independent researchers; and improving Delaware's research infrastructure with a collaborative network of over twenty Core Facilities offering state-of-the-art research equipment and expertise.

This report focuses on programs that support students across our institutions and network.

Delaware INBRE is supported by a grant from the National Institute of General Medical Sciences Institutional Development Award (NIH-NIGMS: P20 GM103446, PI: Stanhope) and the State of Delaware.

Delaware INBRE's goals are:

- Foster a statewide network for biomedical research
- Develop independent and inter-dependent researchers and institutions
- Cultivate Delaware INBRE initiatives
- Enhance Delaware's knowledge of biomedical science and technology

Delaware INBRE SUMMER SCHOLARS PROGRAM

The Delaware INBRE Summer Scholars Program is an undergraduate summer research program supported by the National Institutes of Health (NIH) – National Institute of General Medical Sciences (NIGMS) and the State of Delaware.

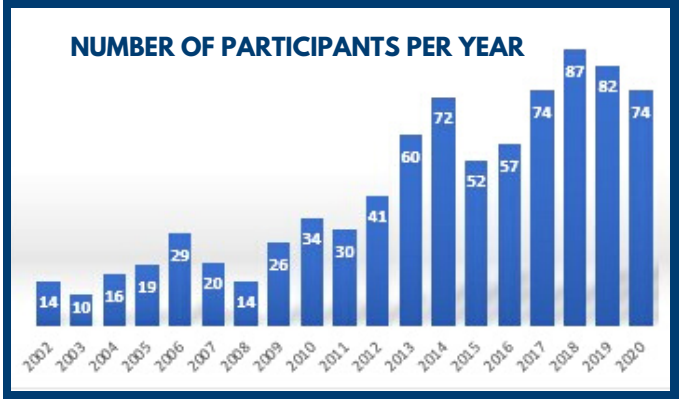
Program Overview: Selected undergraduate students are placed into full-time, 10-week long research internships working with faculty or clinicians who conduct research in one of the partnering institutions, clinical facilities, or with active researchers affiliated with INBRE programs based in other states.

Summer Scholars are required to complete responsible conduct of research training and are invited to participate in professional development workshops focused on scientific and professional skills such as scientific communication and applying to graduate and professional school.

Students from groups traditionally underrepresented in biomedical fields, including first generation college students, students from low-income families, students with disabilities, and/or students from racial and ethnic minority groups are especially encouraged to apply for the program.

At the conclusion of the program, Summer Scholars participate in an oral or poster session at their host site and/or at the University of Delaware Undergraduate Research and Service Learning Celebratory Symposium organized by the University of Delaware Undergraduate Research Program.

Expansion of the Delaware INBRE Summer Scholars Program

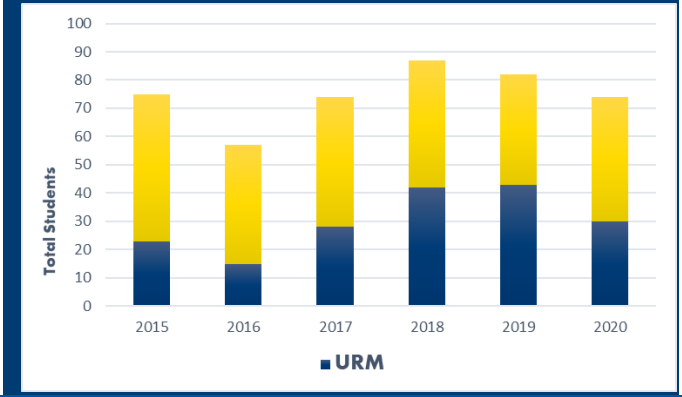


811

TOTAL STUDENT PARTICIPANTS SINCE 2002

Growth of Delaware INBRE Summer Scholar Students

from Groups Traditionally Underrepresented in Biomedical Fields (URM)



SUMMER SCHOLARS SUCCESS

EDUCATIONAL OUTCOMES

ACADEMIC PROGRESS

96% OF PAST PARTICIPANTS ARE ON-TRACK, COMPLETING, OR ENROLLED IN AN UNDERGRADUATE DEGREE PROGRAM

80% OF THE STUDENTS IN UNDERGRADUATE PROGRAMS ARE IN BIOMEDICAL MAJORS

*NATIONAL STUDENT CLEARINGHOUSE DATA FROM 2002 THROUGH 2020

GRADUATION

OVER **300** SUMMER SCHOLAR STUDENTS HAVE GONE ON TO COMPLETE OR PURSUE GRADUATE DEGREES

45% IN BIOMEDICAL FIELDS

73% IN MEDICAL OR BIOMEDICAL FIELDS

88% IN MEDICAL, BIOMEDICAL AND/OR SCIENCE FIELDS

CAREERS

85% OF PAST PARTICIPANTS EMPLOYED IN SCIENCE OR HEALTH-RELATED FIELDS

VICTOIR CAHOON
2019 & 2020 SUMMER SCHOLAR
Wesley College - Biochemistry Major

Victoir was placed in the biomedical laboratory setting at Wesley College's Chemistry Lab and the Green Clinics Laboratory in Dover, DE. Alongside his mentor, Dr. Malcom D'Souza, he increased his biomedical research skills in studying chemical genetics as well as conducting, reading, and analyzing COVID-19 test results.

His research experiences led him to develop a deep appreciation for the field of science, witnessing the time and effort it takes to make data relevant. Victoir explains that his experiences led him to develop more expertise, fueling his intentions to continue his educational and occupational pursuits in the medical field. He has stated, "Before, I never even knew research was an option for me. I've loved it ever since!"

AMBER CONYERS
2019 SUMMER SCHOLAR
2020 Delaware State University Graduate - Biological Sciences

Working with mentor Dr. Kimberly Gannon at ChristianaCare during the summer of 2019 gave Amber the opportunity to conduct research involving patients with symptoms or diagnoses of ischemic stroke and atrial fibrillation.

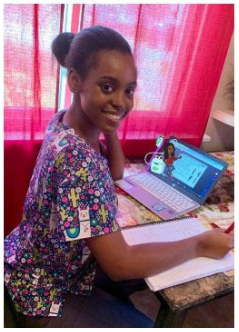
The time she spent with Dr. Gannon and other physicians during her summer experience was perhaps the most impactful, for it led Amber to an amazing breakthrough in terms of her career plans. "I shadowed my mentor and loved it. I learned that I actually wanted to become a doctor."

SUPPORTING THE PIPELINE

Students who participate in DE-INBRE supported programs pursue employment and higher education in Biomedical and STEM (Science, Technology, Engineering, and Math) related fields in Delaware, thus expanding and strengthening the biomedical research capacity across the state.

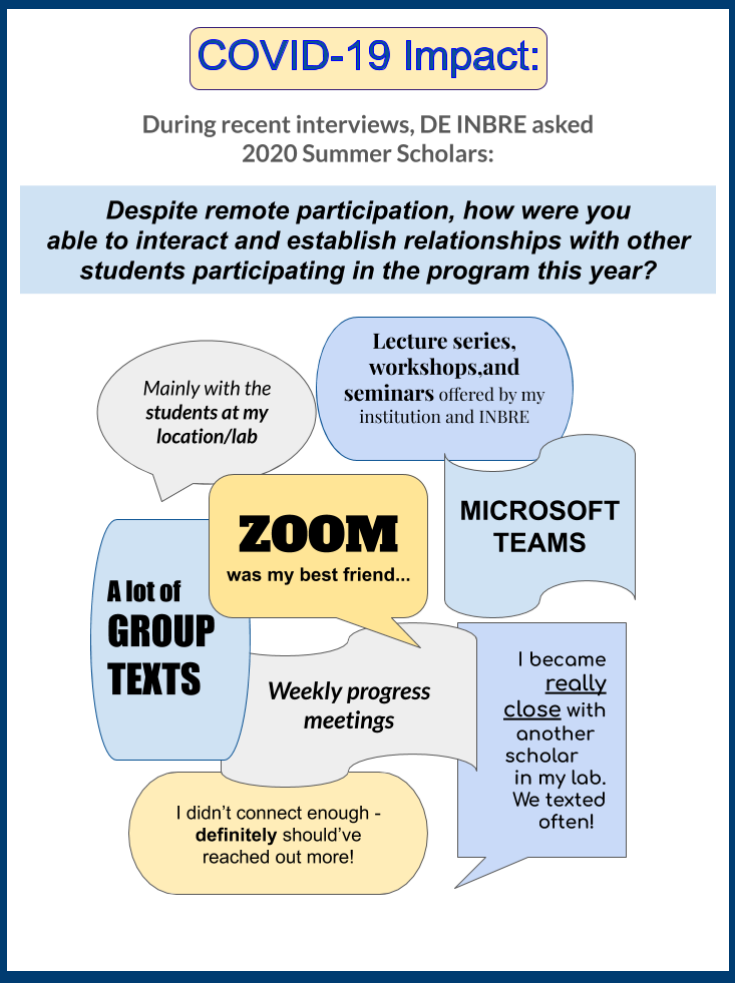
30%

OF PAST PARTICIPANTS EMPLOYED IN SCIENCE OR HEALTH-RELATED FIELDS IN DELAWARE



COVID-19 IMPACT ON SCHOLARS PROGRAM

Despite the impact of COVID-19 upon the collegiate community as a whole, the 2020 DE-INBRE Summer Scholar program still provided meaningful research opportunities for undergraduate students. Almost all of the students were required to participate virtually and many assumed data science and data analysis roles.



One student shared that analyzing data allowed her to study the "more qualitative side of science" since the analysis involved the transcription of previously recorded interviews. Other students mentioned benefitting from learning how to better read, understand, and interpret scientific literature. It helped me "become a better applicant for grad school," proclaimed one sophomore.

Other scholars voiced that emphasis on data science allowed them to understand the populations and settings they would like to work with in the future. Additionally, it influenced future career plans. One student voiced, "Now I know I want to be a physician who also has a knowledge of public health."

UNIVERSITY OF DELAWARE

University of Delaware students are supported by the DE-INBRE Summer Scholars Program and have the opportunity to gain experience working in the biomedical research sector in Delaware. These opportunities show UD students how successful biomedical research careers can be found here in Delaware, further supporting the pipeline.

AKRAM AHAMED

2019 SUMMER SCHOLAR

2021 - University of Delaware - Senior
BBE Biomedical Engineering

Akram Ahamed is a senior engineering major at the University of Delaware who worked with Dr. Jennifer Goldstein at ChristianaCare during the summer of 2019. His research involved the collection of data pertaining to the advertisement and illegal sales of life-saving prescription drugs on online shopping markets such as Craig's List.

In addition to data collection, Akram improved his technical communication skills, learned how to write abstracts for scholarly publications, and created a scientific poster that depicted and described his work in detail. "It was a very good experience. I learned a lot," Akram explained.

His plans to attend medical school did not change, but Akram is now interested in "both practice and research, like Dr. Goldstein." Akram's ability to connect with other doctors at ChristianaCare, who he now feels comfortable reaching out to, is an additional opportunity he was grateful for as a result of his summer experience.

Akram is a co-author on the publication from his summer work, "Analysis of Unregulated Sale of Lifesaving Prescription Drugs Online in the United States" published in JAMA Internal Medicine.

UD'S CONTRIBUTION TO THE PIPELINE

Undergraduate and graduate programs at UD, including the Associate of Arts (AA) Program, support DE-INBRE's goal to recruit and retain students in STEM and biomedical-related fields and create opportunities for them to remain in Delaware after graduation.

RILEY CURTIN

2018 SUMMER SCHOLAR

2019 - University of Delaware
BBE Biomedical Engineering

Riley worked with her mentor Dr. Sharon Gould at Nemours/Alfred I duPont Hospital for Children to explore how computed tomography (CT) can be used to better understand the causes of death. Riley is a co-author on two publications from her summer work: "Pediatric postmortem computer tomography: initial experience at a children's hospital in the United States" published in the journal Pediatric Radiology. "Tibial Intraosseous Insertion in Pediatric Emergency Care: A Review Based upon Postmortem Computed Tomography" published in the journal Prehospital Emergency Care.

Riley is currently enrolled in medical school at West Virginia University School of Medicine., class of 2024.

WESLEY COLLEGE

Located in Dover, Delaware, Wesley College is a premiere liberal arts college, founded in 1873. The approximate 1,500 student population includes many from diverse backgrounds across the Middle Atlantic region in pursuit of degrees at the undergraduate and graduate levels. In July 2021, Wesley College became part of the Delaware State University heritage.

Wesley College has been an active participant in the DE-INBRE network since its inception in 2002. Wesley's Mentored Directed Undergraduate Research Program is a unique and impactful STEM-related initiative that has been successfully implemented with DE-INBRE support. Under this program, incoming freshman participate in STEM research projects and are immersed in the field through course-embedded research opportunities, paid research internships, and senior research capstone projects. The program has also supported the purchase of biomedical instrumentation and supplies, renovation of lab spaces, and access to online library resources.

Many Wesley students come from groups that are traditionally underrepresented in STEM, including racial/ethnic minority, first-generation college, low-income, and academically challenged students. Many of these students go on to find future success in STEM-related academic and professional endeavors.

In July 2021, Wesley College became part of the Delaware State University heritage.

97% OF WESLEY STEM STUDENTS COMPLETE THEIR UNDERGRADUATE DEGREES

85% OF WESLEY STEM STUDENTS GO ON TO COMPLETE GRADUATE OR PROFESSIONAL PROGRAMS

97% OF WESLEY STEM GRADS ARE WORKING IN STEM FIELDS, IN GRADUATE SCHOOL, OR TEACHING HIGH SCHOOL STEM COURSES

Dr. Malcom J. D'Souza:
Wesley College DE-INBRE Site Principal Investigator

"Prior to 2002, only one Wesley graduate had completed Medical School. Now, the majority of Wesley STEM graduates (upwards of 90%) continue to work in STEM fields, either through postgraduate study, research careers or in teaching."

WESLEY STUDENT SUCCESS

60 UNDERGRADUATE STUDENT CO-AUTHORS

76 PEER-REVIEWED PUBLICATIONS

59 NATIONAL & REGIONAL SCIENCE AWARDS

BIOMEDICAL INITIATIVES

supported by DE-INBRE funding at Wesley College

- **STEM Directed Research program, scholarships, subject tutoring, and online career & retention tools**
- **Travel funds for STEM students and faculty to participate in scientific conferences**
- **College Core-Curriculum (First Year Seminar and Frontiers in Science courses)**
- **Informatics minor**
- **Honors Program**
- **Senior-Thesis, Scholars Day, and Experiential Learning projects**
- **Outreach activities to recruit students from diverse backgrounds and sponsor activities to address and eliminate health disparities**

"INBRE helped open the doors to everything that I'm doing and everything that I've been exposed to."
- Riza Li

BIOMEDICAL RESEARCH INFRASTRUCTURE

Added facilities and instrumentation supported by DE-INBRE funding at Wesley College:

- **Overhaul of organic chemistry lab**
- **New chemistry and biology storerooms**
- **Biology Prep-room**
- **Three undergraduate research facilities**
- **Purchase of high-end instrumentation**
- **WiFi and SmartBoard in classrooms & labs**
- **Accommodation of graduate students**

BRETT SANSBURY, PH.D.

2011 SUMMER SCHOLAR

2014 - Wesley College, BS, Biological Chemistry
2016 - Delaware State University, PhD, Applied Chemistry, Nanomaterials, & Tissue Engineering
2020 - University of Delaware, PhD, Medical Laboratory Sciences, Molecular Genetics

In 2014, Brett Sansbury graduated from Wesley College with her Bachelor's degree in Biological Chemistry. Prior to her graduation, she participated in the 2011 DE-INBRE Summer Scholar program at Wesley College under mentor Dr. Malcom D'Souza studying the "Solvent Reaction of 4-Chlorophenyl Chlorothionoformate". She then went on to pursue her PhD in Medical and Molecular Sciences at the University of Delaware, working in the Gene Editing Institute in the Helen F. Graham Cancer Center at ChristianaCare.

Upon graduation, Brett transitioned to a full-time position at the Gene Editing Institute where she continues her research with CRISPR gene editing technology, working with colleagues to currently understand the role of gene editing in diagnosing COVID-19. Presently, she is also an instructor for the 2021 Delaware Mini-Medical School program, open to adults and high school students across the state.

RIZA LI

2015, 2016 SUMMER SCHOLAR

2016 - Wesley College, BS, Mathematics
2022 - PhD Candidate, University of Delaware Bioinformatics Data Science

In 2015 and 2016, Riza participated as an undergraduate student in the INBRE Summer Scholars Program at Wesley College analyzing epidemiological data involving obesity rates across Delaware. After graduating from Wesley in 2016, she began her Master's degree in Bioinformatics at the University of Delaware. Shortly after, she was accepted into the NSF-funded IGERT (Integrative Graduate Education and Research Traineeship) program.

By the Spring of 2017, Riza successfully converted to the PhD program and began her doctoral studies. Ms. Li is currently working on her dissertation entitled "Predicting Long-term Diabetic Complications by Utilizing Electronic Health Records" with the ChristianaCare Value Institute. Riza has also recently co-authored "Twenty-Year Observational Study Shows Rising Alcohol-Attributable Death Profiles in the U.S. and Delaware" with her former INBRE summer scholar mentor, Dr. Malcolm D'Souza.

DELAWARE TECHNICAL COMMUNITY COLLEGE

Delaware Technical Community College (DTCC) serves approximately 15,000 students with three campuses across the state. It is an open-access technical and community institution that prepares students to enter directly into the workforce upon graduation or to transfer to a four-year institution.

As an initial recipient of DE-INBRE support in 2002, Delaware Technical Community College (DTCC) has developed and expanded their Biological Sciences program to include course embedded and mentored undergraduate research experiences (UREs) to enhance student training in biomedical and biotechnology fields.

DE-INBRE support has provided DTCC faculty with professional development and the purchase of supplies and equipment to enhance the curriculum with high-impact practices. These initiatives increase statewide science and technology competencies through training, seminars, courses, tutoring, and workshops.

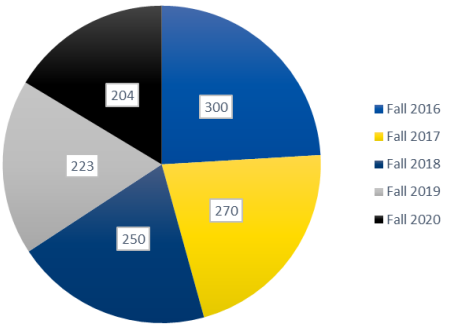
DTCC student participation in DE-INBRE Summer Scholar internships has also forged connections between DTCC and partner institutions to further support the DE-INBRE goal of expanding the pipeline of students into biomedical research and the bioscience workforce across Delaware.

DTCC Student Enrollment in Biological Sciences or Biotechnology (BIS-BIT) Programs

SINCE 2016

1,247

DTCC BIS-BIT STUDENTS ENROLLED



DE-INBRE IMPACT ON DTCC BIOMEDICAL CULTURE:

Undergraduate research is now integral to the Biological Science, Biotechnology, and Allied Health programs at DTCC including:

- *Pre-nursing*
- *Biotechnology*
- *Chemistry*
- *Genetics*
- *Molecular Biology*
- *Microbiology*
- *Chemistry*

Dr. John McDowell
DTCC
DE-INBRE
Site Principal Investigator

"A real focus of the Delaware INBRE program over the past several years has been to highlight the unique nature of each institution and allow Delaware INBRE to be utilized and leverage activities to support what is going on at that institution... and that's certainly true at Del Tech."

DELTECH STUDENT SUCCESS

Many DTCC Biomedical Studies/Biotechnology (BIS-BIT) students obtain Associates degrees prior to entering the biomedical workforce, while others go on to pursue Bachelor's degrees at other institutions. Of these students, some go on to complete graduate degrees in biomedical fields, sometimes conducting research along with new DTCC BIS-BIT students, thus creating a cyclical impact of biomedical study across the state.

SOUTHERN DELAWARE IMPACT

One of the unique aspects of DTCC student impact is felt in Sussex County, Delaware at the Georgetown Owens Campus. Since 2016, over 400 students predominantly located in southern Delaware have been involved in undergraduate research experiences through the Biological Sciences and Biotechnology programs. Extending these programs to impact students in Kent County at the Dover Terry Campus is currently in the works.

POSITIVE OUTCOMES ASSOCIATED WITH URES*

MULTI-DIMENSIONAL LEARNING

INCREASED CONFIDENCE AND PROFESSIONALISM

TRANSFER/CAREER ADVICE

JOB READY - NEW TECHNOLOGIES

**From 2014 Interviews with DTCC BIS-BIT Alumni (Stanton Campus)*

"Research definitely changed my whole life."

- Thanh Nguyen

THANH NGUYEN

2014 SUMMER SCHOLAR

2014 - Del Tech Community College:
AS Biological Sciences
2016 - Delaware State University:
BS, Biology/Biological Sciences
2021 - University of Delaware:
MS Candidate, Biological Sciences

Thanh Nguyen spent four years engaged with undergraduate biomedical research at DTCC Stanton campus while working full-time at her family's business and taking classes to earn two Associate of Science degrees. The scientific knowledge, laboratory skills, and support she received at DTCC and as a DE-INBRE Summer Scholar were vital to advancing her educational pursuits in research.

Upon pursuit of her BS from Delaware State University, Thanh was the first DSU undergraduate to receive the NSF Undergraduate Student research fellowship. She states that without her Delaware INBRE Summer Scholar experience, where she was able to present her research and network with key individuals in the Delaware biomedical field, she "would never have received the fellowship."

After graduating in 2016 with her BS from DSU, Thanh began her graduate work at the University of Delaware where she is currently pursuing her Master's degree in Biological Science and instructing undergraduate students. Her future plans include applying to medical school and pursuing an MD-PhD.

KRISTEN PISCARIK

2016 & 2017 SUMMER SCHOLAR

2017 Del Tech Community College
AS Biotechnology, Biological Sciences,
Biotechnology Technician & Chemistry/Math Conc.
2021 University of Delaware - Senior
Applied Molecular Biology and Biotechnology

Kristen first became involved in undergraduate research at DTCC and was able to continue over two summers via the DE-INBRE Summer Scholars program. Along with her mentors at the ChristianaCare Gene Editing Institute (GEI), her initial summer research led her to obtain her four-year position with the GEI funded by the Technical Training in Gene Editing NSF-ATE grant.

In her position as Research Assistant and Science Educator she conducts gene editing experiments and translates them into laboratory exercises and curriculum for a variety of audiences. She describes her role as, "an amazing experience that has allowed me to become a better researcher, student, and person overall. " Kristen is due to graduate from the University of Delaware with a BS in May 2022.

DELAWARE STATE UNIVERSITY

Founded in 1891 as the State College for Colored Students, Delaware State University is one of the country's first land-grant educational institutions, now welcoming a population of over 5,000 students from diverse backgrounds. DSU offers both undergraduate and graduate degree options on the main campus, located in Kent County within the city of Dover, the capital of Delaware.

The partnership between DE-INBRE and Delaware State University has forged many educational and professional development opportunities in biomedical fields for a diverse population of undergraduate and graduate students. As a Historically Black Colleges and University (HBCU), DSU is uniquely poised to create opportunities for students from groups that are traditionally underrepresented in STEM fields.

The novel DE-INBRE-supported DSU Graduate Student Training Program aims to support the recruitment and retention of high quality graduate students in biomedical disciplines. Graduate student fellows in the program mentor undergraduate students in research laboratories during the academic year as well as participate in K-12 student outreach and professional development training.

DE-INBRE support compliments other training grants at DSU including the Undergraduate Research Training Initiative for Student Enhancement (U-RISE) program, which provides skill-development workshops and summer training opportunities, and the Science Education Partnership Award (SEPA) program, which facilitates the interaction of DSU students with middle-school students during their summer camp experiences.

DSU is also a host site for DE-INBRE Summer Scholars, who participate in undergraduate summer research experiences at the institution.

DSU GRADUATE STUDENT TRAINING PROGRAM

17
UNIQUE STUDENTS SUPPORTED SINCE 2017

11
UNDERREPRESENTED MINORITY STUDENTS

14
FEMALE STUDENTS

Dr. Hacene Boukari
DSU
DE-INBRE
Site Principal Investigator

"The way we evaluate the successes of our students is really through stories… because hidden in the numbers are the full stories of students who come from very different backgrounds…we give them this chance and they build from that and move toward a research pathway."

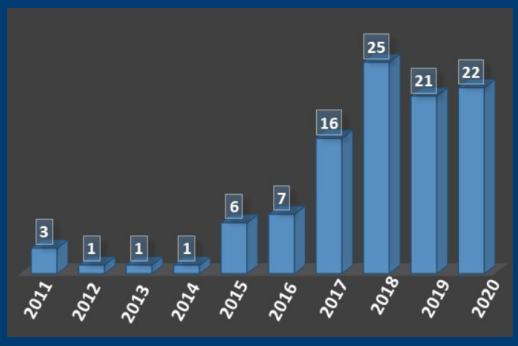
DSU STUDENT OUTCOMES

The comprehensive nature of DE-INBRE programming at DSU impacts students at the undergraduate and graduate levels. Students have the ability to learn and engage in biomedical research utilizing cutting-edge equipment working alongside highly-skilled faculty and mentors.

OCSAR IMAGING FACILITY

The Optical Science Center for Applied Research (OSCAR) imaging facility provides DSU students, professors, and scientists with immediate hands-on research experience using cutting-edge light-based technologies to address current societal challenges. DSU-INBRE students gain access to this invaluable resource through summer research programs, paid internships, and various research projects.

GROWTH OF SUMMER UNDERGRADUATE RESEARCH PARTICIPATION AT DSU



"INBRE support has undoubtedly been instrumental in achieving my goals."
- Holly Miller

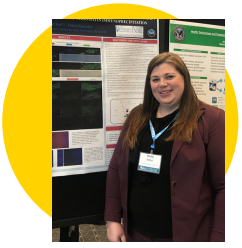
TIARA WHITE

2018 & 2019 Summer Scholar

2020 Delaware State University
BS, Biology Health Professions
PhD Candidate - Stony Brook University, Genetics

During her time as a DSU-INBRE Summer Scholar student, Tiara had the opportunity to intern at the Vermont College of Medicine, gaining laboratory research experience in studying Hantavirus. By providing funding for traveling expenses, DE-INBRE also supported Tiara in presenting her research at conferences across the country in California, Washington DC, and Maryland.

The research aptitude she gained from her experiences made her a strong candidate when applying for graduate school. Currently, Tiara is pursuing her PhD in Genetics at Stony Brook University, citing that the research aptitude she gained from her undergraduate experiences is contributing to her graduate study success as well..



HOLLY MILLER

2017 Summer Scholar

2017 - Delaware State University
BS, Biology/Biological Sciences
2020 - Delaware State University
MS, Cellular and Molecular Neuroscience

By the end of her 2017 Summer Scholar experience at DSU, Holly learned valuable research techniques that allowed her to perform complex experiments, present her findings at multiple symposiums, and continue as an INBRE-funded Undergraduate Research Assistant in the DSU Miletti lab. Holly's summer experience also inspired her to apply to the DSU Graduate Program, where she was given a DE-INBRE Graduate Research Fellowship.

As a graduate student, Holly advanced her research capabilities, attended more conferences, and received a scholarship to attend the Frontiers in Stem Cells in Cancer (FriSC2) Training Program in Puerto Rico. As a wife and a mother of two daughters, she was grateful to receive the support of DE-INBRE and her mentors, Dr. Boukari and Ms. Niamat, while maintaining a family. She states, "INBRE not only provided me with financial peace of mind, but also with invaluable opportunities and experiences."

After graduation, Holly began her current position as a Molecular Biologist for the Delaware Department of Health and Social Services at the Delaware Public Health Lab (DPHL) where she is currently working on a special project performing whole genome sequencing on COVID-positive samples to determine how COVID variants are moving through communities. In addition to her current position at DPHL, she also teaches as an Adjunct Professor at DSU.