Advanced Technologies and STEMM Education

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Biotechnology Research Incubator for Teachers
BRITE History



Teachers Externship	**BCM-BRITE Initiation, Dept EIT**	**Huffington Foundation Dept EIT pilot grant**	**BCM Breast Center & UTMB***	**NIH R25 SEPA**
2 days In 2 weeks Virtual	2 weeks Summer training Lesson plans	3 weeks Summer Training Lesson plans	3 weeks Summer training Lesson plans	3 weeks Literature adaptation Lesson plans
10 teachers	4 teachers	3 teachers	3 teachers	12-16 teachers

Applying for and receiving the NIH grant

Program Design

Objectives

- STEMM Teachers Training
- Middle or High School Teachers

Core Facilities

Resources in Advanced Technology Cores

METHOD

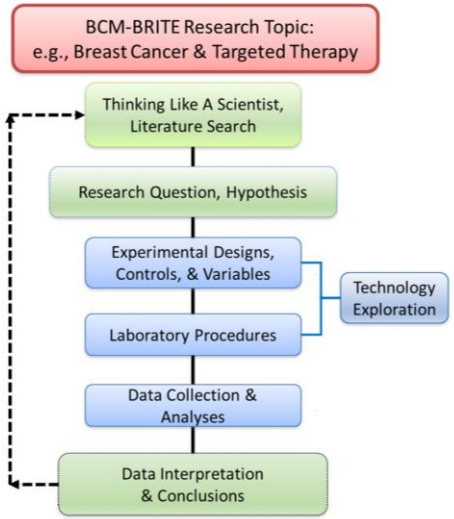
- Hands-on summer biotechnology research experience
- 7 teachers
- 2-3 weeks summer training
- Mentored by scientists and STEM specialists
- Development of lesson plans

METHODS

Before Summer:

- Recruit teachers and match with lab mentors
- Teacher Summer Pre-survey

Summer research experience:
2-3 weeks working with scientists and STEM specialists



End of Summer:

- Teacher Summer Post-evaluation

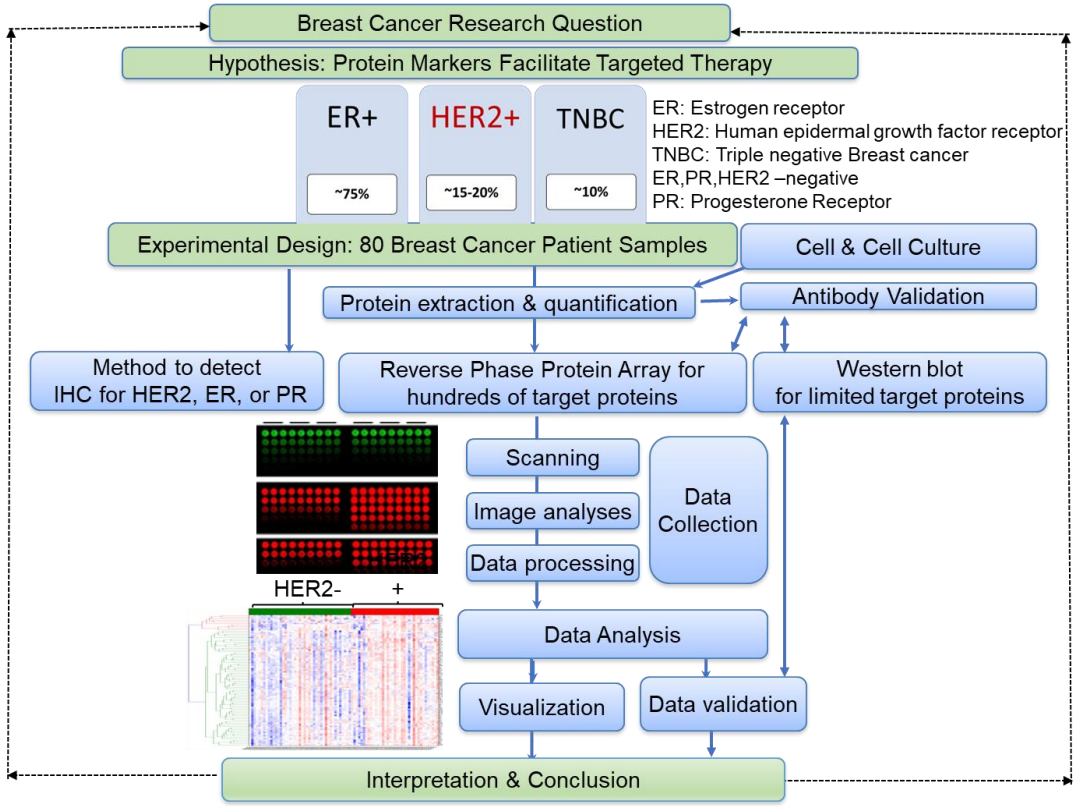
Program Development

Module 1: Workshops and Discussions
- Cancer biology and genomics & proteomics
- Breast cancer & targeted therapy
- Genomics and Next Generation Sequencing
- Antibody-based Proteomics and Cancer
- Mass Spectrometry Proteomics
- Flow Cytometry Technology and Applications
- Big Data and Multiomic Analysis
- Breast Cancer and Bone Metastasis
- Vaccine Development and Research

Module 2: Core Facility Hands-On Training
- Project design and experimental controls
- Cell Culture and protein extraction
- Next Generation Sequencing
- Flow Cytometry Technology
- Breast Cancer Progression
- Reverse Phase Protein Array (RPPA)
- Data Analyses & Visualization
- Public Data Mining

Module 3: Literature and Lesson Plans
- Reading Scientific Literature
- Thinking Like a Scientist
- STEMM Lesson Plans
- Guided Primary Scientific Literature comprehension
- Final Presentation

Advanced Technology Core Hands-On Training



Breast Cancer Patient Sample analyses: representative hands-on training on advanced technologies: experimental planning, sample preparation, data generation, and data analysis using informatic tools

Results & Conclusions

RESULTS

Participating teachers were more confident about their knowledge and abilities related to integrating authentic workforce STEM into their instruction after BRITE.

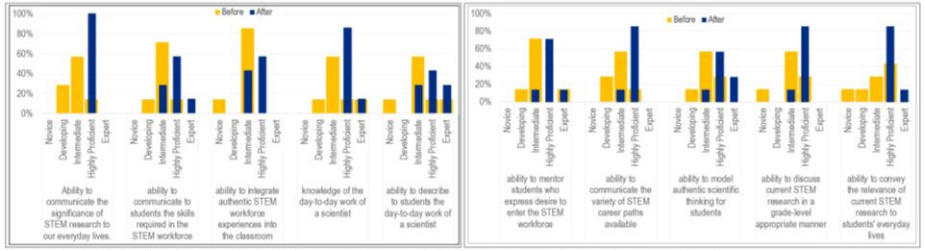


Figure 1. Percentage of teachers selecting each level of knowledge or skill pre- and post-participation in the program (N=7)

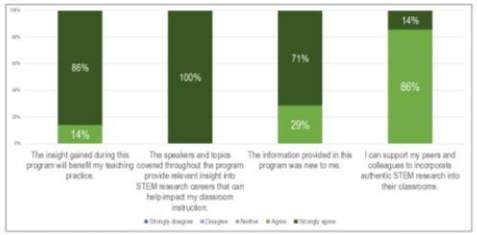
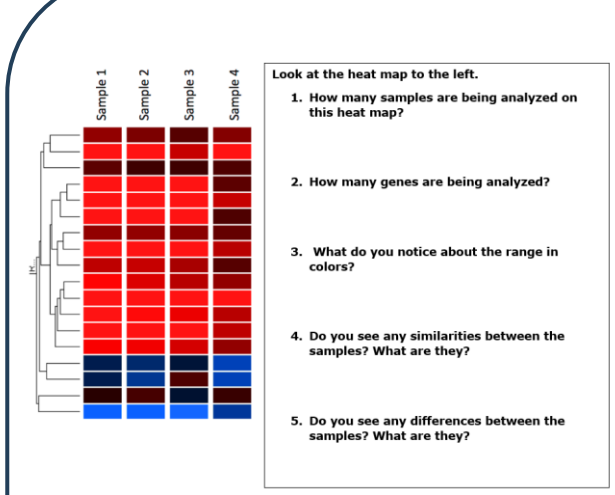


Figure 2. Percent of teachers selecting each level of agreement in response the following program evaluation statements (N=7)

ALL PARTICIPANTS AGREED THAT:

- The insight gained during the program will benefit their teaching practice
- The information provided during the program was new to them
- The program provided insight into STEM research careers that could impact their classroom instruction
- They could support peers and colleagues in incorporating authentic STEM research into their classrooms.



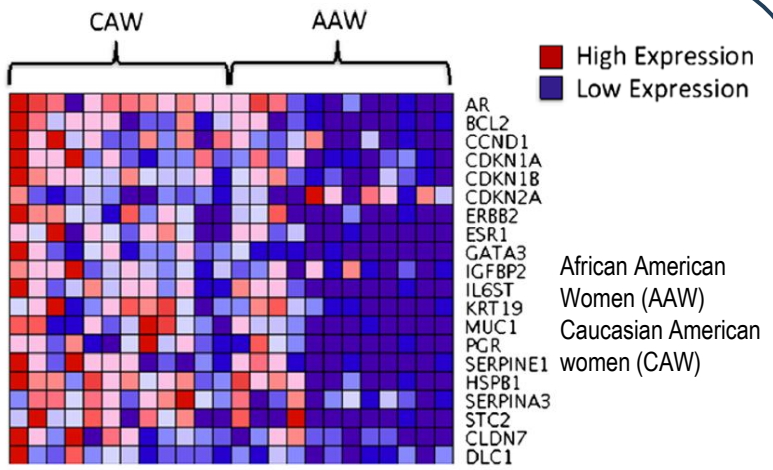


Figure 3. Example of a lesson crafted by a teacher incorporating insights gained from the summer program, tailored for high school students. Left: Heatmap and questions for the students
Right: Heat map illustrating difference in the expression of 20 beast cancer-associate genes between AAW and CAW) breast cancer patients; African American Women (AAW) Caucasian American women (CAW)

RESULTS

Participating teachers

- Increased confidence in their knowledge and abilities
- Enhanced understanding of scientific research

CONCLUSIONS

Participating teachers

- Identified concrete approaches to incorporate real-world science into lesson plans
- 3 out of 7 teachers designed comprehensive lesson units

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Biotechnology Research Education

1. **Secondary School Teacher NIHR25**
2. **College Student Summer Research NIHP20**
3. **High School Student Symposium**
4. **High School Student Literature Adaptation**
5. **Junior Doctors Program – K-12 (New)**
6. **IMPACT Medical Scholar – Medical Students**

Biotechnology Research Incubator for Teachers and Students (BRITE)





BRITE 2024 High School Symposium

Learn More



BCM-TSU CURED Cancer Research Education Program (C-REP)

Learn More



BRITE 2024 Teacher's Training Workshop



Advanced Technology Cores

Aknowledgement

Antibody-based Proteomics Core Staff:
- Zhongcheng Shi, PhD
- Michael Nguyen, MS
- Yuan Yao, PhD

BRITE Teacher's Training:
- Katherine Harris, MS
- Alana Newell, PhD
- Fred Pereira, PhD
- Cynthia Claire Hallmark, PhD
- Nancy Moreno, PhD
- Mentors
- Core directors and staff

High School Student Program
- Zaniqua Bullock
- Sara Adio
- Sophie Zhang
- Crystal Shin, PhD
- Guowei Gu, PhD
- Mentors and collaborators

CURED-CREP:
- Rayne Rouce, MD
- Veronica Ajewole, PharmD
- Huan Xie, PhD
- Debra Murray, PhD
- Flora Estes, PhD
- Mentors and core directors

– Nancy Moreno, PhD, Chair, Department of Education, Innovation & Technology
– Xiang Zhang, PhD, Director, Leste & Sue Breast Center
– Dean P. Edwards, PhD Executive Director, ATC Cores

Grant support for education programs

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- NIH P20 P20CA284971 BCM-TSU CURED Cancer Research Education Program (CREP)
- Huffington Foundation & Dept of Education, Innovation and Technology
- BCM Lester & Sue Smith Center
- Sealy Center for Environmental Health and Medicine, University of Texas Medical Branch

Grant support for core facility

- NIH S10 award (S10OD028648)
- CPRIT (Cancer Research and Prevention Institute of Texas)
  – Core Facility Award (RP210227 & RP170005)
- NCI P30 Cancer Center Support Grant (CA123125)

NCI Comprehensive Cancer Center
A Cancer Center Designated by the National Cancer Institute

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
SUPPORTED BY THE NATIONAL INSTITUTES OF HEALTH

NIH National Institutes of Health