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The South Carolina Collaborative Undergraduate HBCU Student Summer Training Program

PRINCIPAL INVESTIGATOR:
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INTRODUCTION

The Scientific Context of the Training Program

The South Carolina Collaborative Undergraduate HBCU Student Summer Training Program (referred to as the Training Program) will provide a biomedical research training experience to 12 students over a three-year period (2012-2015) from three Historically Black Colleges and Universities (HBCUs) – Claflin University (CU), South Carolina State University (SCSU), and Voorhees College (VC). Undergraduate students from the three HBCUs (defined as Student Fellows) will participate in research intensive summer internships in the laboratories/research units of senior prostate cancer research scientists at the Medical University of South Carolina Hollings Cancer Center (MUSC-HCC). This Training Program builds upon the success of the previously funded Department of Defense (DOD) prostate cancer research training program (2009-2012) and the long standing NIH-funded Summer Undergraduate Research Training Program at MUSC (1992-present). The inter-institutional leadership of these summer training efforts have carefully examined the formative and summative evaluations provided by previous Student Fellows, Mentors, and Advisors in order to maximize the ability of this enhanced program proposal to reach its ultimate goal – to increase the racial and ethnic diversity of emerging scientists who may choose prostate cancer research careers in basic, clinical, and population sciences. The Training Program was improved by the inclusion of a built-in, dual-level research and career mentoring strategy involving current graduate students and post-doctoral trainees included on the mentoring team; the addition of a clinical shadowing experience in the MUSC-HCC multidisciplinary genitourinary clinics and tumor board; more year-round opportunities for which the Student Fellows will participate; and an opportunity for Training Program alumni to continue relationships with new trainees going forward. Measurable outcomes of the Training Program include the number of Student Fellows who take the Graduate Record Examination (GRE), apply to graduate school, and give scientific presentations and publish their research results in peer-reviewed scientific journals based on their summer research experience. Efforts were made to capture long-term outcomes as well as to determine how many Student Fellows choose to pursue a medical or biomedical focused graduate and post graduate career.

The three Specific Aims are to:

Aim 1. To provide training in the basics of research design and methods to 4 Student Fellows each year from the three HBCUs;

Aim 2. To immerse 4 Student Fellows per year in prostate cancer research;

Aim 3. To implement a unique dual-level research mentoring strategy for the students.

Program Director and Training Team

Dr. Marvella E. Ford is the Program Director. Drs. Omar Bagasra (CU), Judith Salley (SCSU), and Leroy Davis (VC) are Associate Directors. This four-person leadership team collaborates closely in the management and administration of the award, as well as the continued development and enhancement of the Training Program. The Program Director and Associate Directors share scientific interests in health disparities, serve in other leadership roles within their institutions, and meet frequently, both formally and informally. These individuals form the Executive Committee for the Training Program. Each institution has appointed Faculty Advisors consisting of Dr. Ewen McLean (CU), Dr. James B. Stukes (SCSU), and Mrs. Gayle Tyler Stukes (VC).

BODY

Statement of Work

Task 1. Identify and Recruit the Student Fellows

- (a) Identify the pool of potential Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)
- (b) Interview the potential Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)
- (c) Select the top Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)
- (d) Match the Student Fellows with their Research Mentors at MUSC (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)
- (e) Hold the Kickoff Intensive and Luncheon (Year 1, months 4-6; Year 2, months 4-6; Year 3, months 4-6)

Deliverables: Four Student Fellows per year were identified, recruited to participate in the program, and matched with senior prostate cancer research mentors at MUSC.

Task 2. Provide Training in Biomedical and Prostate Cancer Research

- (a) Conduct Aim 1: Training in the Basics of Research Design and Methods through participation in the MUSC Summer Undergraduate Research Program (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)
- (b) Conduct Aim 2: Prostate Cancer Research Training (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)
- (c) Sponsor the Student Fellows' Participation in a Graduate Record Examination (GRE) course (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)

Deliverables: We provided state-of-the art comprehensive prostate cancer research education and training opportunities for 12 students from three of South Carolina's HBCUs. We have developed a cadre of scientists who are well-prepared to play a significant role in discovering and testing new prostate cancer biomarkers. These investigators will conduct research spanning the continuum from basic science to clinical science to population-based research. Some Student Fellows are completing their junior or senior years of college and are continuing to take the GRE and apply to graduate or professional schools. We expect at least 75% of the Student Fellows to take the GRE and at least 75% of the Student Fellows to apply to graduate school.

Task 3. Prepare Tangible Scientific Products

- (a) Prepare and present scientific abstracts based on the Student Fellows' prostate cancer research (Year 1, months 10-12, Year 2, months 1-12, Year 3, months 1-12)
- (b) Prepare manuscripts that will be submitted to peer-reviewed journals (Year 1, months 10-12, Year 2, months 1-12, Year 3, months 1-12)
- (c) Develop manuscripts to describe the scope and outcomes of the project (Year 3, months 9-12)

Deliverables: At least 12 scientific presentations were conducted by Student Fellows. At least 6 peer reviewed publications will result.

Task 4. Evaluate the Training Program

- (a) Assess the number of applicants to the Training Program (Year 1, months 1-4, year 2, months 1-4, Year 3, months 1-4)
- (b) Assess the number of Student Fellows who apply to graduate school (Year 2, months 1-12, Year 3, months 1-12)
- (c) Assess the number of Student Fellows who are admitted to graduate school (Year 2, months 1-12, Year 3, months 1-12)
- (d) Assess the number of graduate schools to which Student Fellows are admitted (Year 2, months 1-12, Year 3, months 1-12)
- (e) Employ several tracking mechanisms to monitor the scientific progress of the students, including:
 1. Searching the MUSC graduate program databases to identify whether any of the students applied, were offered, or accepted positions at MUSC.

2. Contacting the participating universities' alumni offices.
 3. Employing other internet-based search tools/communications (Google, Twitter, Facebook, and Historically Black College/University Connections, etc.) to identify students' current locations, contact information, and academic achievements (Year 2, months 10-12, Year 3, months 1-12)
- (f) Identify the number of scientific abstracts presented and peer-reviewed publications that result (Year 1, months 10-12, Year 2, months 1-12, Year 3, months 1-12)

Deliverables: We have published a peer-reviewed manuscript that describes the design of the Training Program and tangible products that have resulted from its implementation (**Appendix F**).

KEY RESEARCH ACCOMPLISHMENTS

Task 1. Identify and Recruit the Student Fellows

- (a) Identify the pool of potential Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)**
- (b) Interview potential Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)**
- (c) Select the top Student Fellows (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)**

To accomplish Tasks 1(a) – 1(c), Dr. Ford, the Program Director, worked with Associate Directors Dr. Rebecca Bullard-Dillard and her replacement upon leaving Claflin University, Dr. Omar Bagasra (CU), Dr. Judith Salley (SCSU), and Dr. Leroy Davis (VC) as well as Faculty Advisors Dr. Ewen McLean (CU), Dr. James Stukes (SCSU), and Mrs. Gayle Stukes (VC) to identify potential Student Fellows. The Associate Directors and Faculty Advisors issued a call for applicants to their student bodies and personally approached students whom they felt would be outstanding applicants for the summer research program.

To broaden the pool of potential applicants, each Associate Director invited faculty and students from his/her institution to participate in the annual Ernest E. Just Symposium held every February at MUSC. Between 2012 and 2014, a total of 730 students representing 25 different high schools, colleges, and universities participated in the Symposium. Of these students, 204 individuals were from HBCUs in SC and 226 were from HBCUs in other regions of the country. The Associate Directors from each institution were instrumental in recruiting HBCU students from across the U.S. The students who participated in the Symposium also received a tour of scientific research laboratories at MUSC and met with MUSC faculty members who could become their future research mentors. For each Symposium held between 2012 and 2014, the agenda and the number of students from each institution are included in **Appendices A-B**. The investigators also led a Student Research Forum as part of the National Conference on Health Disparities from 2012-2014. The Student Research Forums included oral presentations, a poster session, roundtable discussions, and an interactive presentation by an NIH National Library of Medicine representative. In 2012, 61 students participated, in 2013, 87 students participated, and in 2014, 62 students participated.

(d) Match the Student Fellows with Their Research Mentors at MUSC (Year 1, months 1-3; Year 2, months 1-3; Year 3, months 1-3)

Each year, the Student Fellows were matched with their Research Mentors at MUSC based on the expressed interests of the Student Fellows as stated in their written MUSC Summer Undergraduate Research Program (SURP) applications. The following tables show the names of the students who participated in the 2012-2015 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program, their Research Mentors at MUSC, and their cancer research topics.

| Summer 2012 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Students, Mentors, and Research Topics | | | |
|---|-----------------------------|-----------------------------|--|
| Student Name | Academic Institution | MUSC Research Mentor | Research Topic |
| Ms. Myshayla Bell | Clafin University | Shikhar Mehrotra, PhD | Overexpression of an Antigen in Melanoma Tumors and the Surrounding T Regulatory Cells using Immunohistochemistry |
| Ms. Jasmine Fox | SC State University | Erika T. Brown, PhD | The Role of RAD51 in Triple Negative Tumor Progression/Relationship Between Cancer and Metabolic Syndrome |
| Ms. Claudia Thompson | SC State University | Danyelle Townsend, PhD | The Effects of PDI Inhibitors on S-Glutathionylation in Prostate Cancer Cells |
| Ms. Britney White | Clafin University | Patrick Woster, PhD | Cancer Epigenetics: Using MTS Assays to determine cytotoxicity in drugs containing LSD1 and DNA methylation inhibitors |

| Summer 2013 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Students, Mentors, and Research Topics | | | |
|---|-----------------------------|-----------------------------|---|
| Student Name | Academic Institution | MUSC Research Mentor | Research Topic |
| Ms. Kiera Addison | SC State University | Danyelle Townsend, PhD | Redox Signaling is Deregulated in Cancer |
| Ms. Evelyn Martinez | SC State University | Steven Rosenzweig, PhD | Growth Factor Contribution to Epithelial Mesenchymal Transition |
| Ms. Tomesha Nesbitt | Voorhees College | Shikhar Mehrotra, PhD | The Effect of Vitamin D3 on T cell Activation and Death |
| Ms. Sadia Robinson | SC State University | David P. Turner, PhD | Examining the AGE-RAGE Signaling Axis as a Mechanism of Prostate Cancer Disparity |

Summer 2014 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Students, Mentors, and Research Topics

| Student Name | Academic Institution | MUSC Research Mentor | Research Topic |
|-------------------------|-----------------------------|-----------------------------|--|
| Ms. Casseanna Holmes | Voorhees College | David P. Turner, PhD | Targeting RAGE Expression in Cancer |
| Ms. Franshawn Mack | SC State University | Marvella E. Ford, PhD | Evaluating the Prevalence of Overweight/Obesity and Physical Activity in a Diverse Sample of South Carolina Cancer Survivors |
| Ms. Khaalida Poindexter | SC State University | Victoria Findlay, PhD | miRNA-510 as a Non-Invasive Biomarker in Triple Negative Cancer |
| Mr. Jagreet Singh | Clafin University | Shikhar Mehrotra, PhD | Antioxidant Capacity Of MDSCs: Potential Target For Immunotherapy |

In addition to the students listed above, the Director and Associate Directors leveraged funding from two other grants and from the MUSC Hollings Cancer Center to support an additional eight students (**Appendix C**).

(e) Hold the Kickoff Intensive and Luncheon (Year 1, months 4-6; Year 2, months 4-6; Year 3, months 4-6)

The Kickoff Intensive and Luncheon took place each year during the first meeting of the didactic training program in prostate cancer research. Each year, a small group meeting was held with the Student Fellows to introduce them to the internal training team, and review the student handbook. The student handbook was developed to provide the students with a detailed resource that describes the infrastructure of the training program as well as the expectations of the students. Ms. Tonya Hazelton, who coordinated the DOD Training Program, gave an overview of the DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program. In addition, Dr. Marvella Ford gave a presentation informing the students of cancer disparities in the United States, with a focus on South Carolina, and cancer disparities research at MUSC.

Task 1 Deliverables: Twelve Student Fellows (plus an additional eight students who were supported using leveraged funds) were identified, recruited to participate in the program, and admitted to the DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program. The Student Fellows were matched with Research Mentors at MUSC, with whom they conducted research in the summers of 2012 – 2014.

Task 2. Provide Training in Biomedical and Prostate Cancer Research

(a) Conduct Aim 1: Training in the Basics of Research Design and Methods through participation in the MUSC Summer Undergraduate Research Program (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)

The Student Fellows participated in an intensive training program in the Basics of Research Design and Methods through participation in the MUSC Summer Undergraduate Research Program (SURP). The following tables show the SURP curricula from 2012 – 2014.

Summer Undergraduate Research Program (SURP) Lecture Series
Summer 2012

| <u>Date</u> | <u>Topic</u> | <u>Lecturer</u> |
|--------------------|---|--|
| | <u>Responsible Conduct of Research – MANDATORY</u> | |
| June 1 | What is Translational Research? | Kathleen T. Brady, M.D., Ph.D. |
| June 2 | The Development of a New Treatment and Diagnostic Test for Bladder Cancer: From Bench to Bedside | Omar Moussa, PhD |
| June 3 | Human Subject Research Success Center: How Scientists Get Help Conducting Research/ Examples of Translational Research | Susan C. Sonne, PharmD Royce Sampson, MSN, RN |
| | Research/Examples of Translational Research | |
| | <u>Responsible Conduct of Research – MANDATORY – 8:30 – 10:20 am</u> | |
| June 6 | MANDATORY: Public Perceptions of Scientific Research (“And the Band Played On”) Questionable Research Practices (discussion of video) | Ed Krug, PhD Titus Reaves, PhD |
| June 7 | Mandatory: Moral Reasoning in Ethical Dilemmas (lecture/case study/discussion) Mentoring (lecture and discussion) Responsible Lab Citizenship | Ed Krug, PhD |
| June 8 | MANDATORY: <i>Data Management/Data Manipulation</i> & Mentoring (lecture/discussion) Authorship and Plagiarism (lecture/case/study/discussion) | Ed Krug, PhD |
| June 9 | Animal Use in Research (lecture & discussion) Research Misconduct/Whistleblower Protections (lecture/case study/discussion) | Alison Smith, PhD Ed Krug, PhD |
| | Closing Comments/Exit Evaluation | |
| June 10 | Treatment of Cocaine Addiction: From Bench to Bedside | TBA |
| June 13 | Hepatic Steatosis in a Growing World: The Impact on Transplantation | Kenneth Chavin, MD |

Outside Assignment: Complete the University of Montana On-Line RCR training (link below) by June 13th – you must score a minimum of 70% on all quizzes. Bring paper copies of quiz completion with you to the RCR Lectures starting on June 6th. (http://ori.dhhs.gov/education/products/montana_round1/research_ethics.html)

| | | |
|---------|---|--------------------------|
| June 14 | Lipidomics | Maurizio Del Poeta, MD |
| June 15 | Stem Cells | Amanda LaRue, PhD |
| June 16 | Cell Biology – Tissue Ultrastructure | Debra Hazen-Martin, PhD |
| June 17 | Developmental Biology | Michael Kern, PhD |
| June 20 | Proteomics Technology | Lauren Ball, PhD |
| June 21 | (H) The Heart | Perry Halushka, PhD, MD |
| June 22 | Confocal/Multiphoton Microscopy of Living Cells and Tissues | John Lemasters, MD, PhD |
| June 23 | (C) Cancer Cell Cycle | Cynthia Wright, PhD |
| June 24 | Microarray Analysis | Jeremy Barth, PhD |
| June 27 | Recombinant DNA | David Kurtz, PhD |
| June 28 | Transcription | Steven Kubalak, PhD |
| June 29 | (H) Electrical Properties of the Heart | Rupak Mukherjee, PhD |
| June 30 | (C) Cytogenetics | Dayna Wolff, PhD |
| July 1 | (N) Retinoids & Vision | Masahiro Kono, PhD- |
| July 5 | G Proteins | John Hildebrandt, PhD |
| July 6 | (H) Arterial Pressure Control & High Blood Pressure | Perry Halushka, PhD, MD |
| July 7 | (N) Dementia | Mark Kindy, PhD |
| July 8 | (N) ADD/ADHD | Antonieta Lavin, PhD |
| July 11 | (C) Kinds of Cancer | Robert Gemmill, PhD |
| July 12 | Receptors | Steven Rosenzweig, PhD |
| July 13 | (N) Spinal Cord Injury | Narendra Banik, PhD |
| July 14 | (H) Aspirin & NSAIDS | Perry Halushka, PhD, MD- |
| July 15 | (C) Herbals & Cancer | Michael Wargovich, PhD- |
| July 18 | (C) Cancer Disparities | Marvella Ford, PhD |
| July 19 | (N) Addiction & Drugs | Kimber Price, PhD |
| July 20 | (C) Epidemiology of Cancer | Kristin Wallace, PhD- |
| July 21 | (H) Atherosclerosis | Samar Hammad, PhD |
| July 22 | (C) Cancer Chemotherapy | David Kurtz, PhD |
| July 25 | (N) Neuroimaging Lab Demonstration | TBA |
| July 26 | (H) Kidney | Ed Soltis, PhD |
| July 27 | (H) Imaging the Heart | Joseph Schoepf, MD |
| July 28 | (N) Addiction & Alcohol | Corigan Smothers, PhD |
| July 29 | (N) Schizophrenia | Antonieta Lavin, PhD |

Note: Lectures in Black are for all students.

Lectures in Blue are for Cardiovascular track students. (7 lectures)

Lectures in Red are for Cancer track students. (7 lectures)

Lectures in Green are for Neuroscience track students. (8 lectures) CTSA – (5 lectures)

Summer Undergraduate Research Program Lecture Series

Summer 2013

Location: BE 112, 8:30-9:30 AM (unless otherwise noted)

(Absolutely no food or drinks allowed in BE 112)

| <u>Date</u> | <u>Topic</u> | <u>Lecturer</u> |
|-------------|---|--|
| | <u>Responsible Conduct of Research – MANDATORY</u> | |
| May 28 | The Development of a New Treatment and Diagnostic Test for Bladder Cancer: From Bench to Bedside | Perry Halushka, MD, PhD |
| May 29 | Novel Therapies to Treat Acute Kidney Injury: From Bench to Bedside (*note: this lecture will be in BSB 302) | Rick Schnellmann, PhD |
| May 30 | What is Translational Research? | Carol Wagner, MD |
| May 31 | Human Subject Research Success Center: How Scientists Get Help Conducting Research/ Examples of Translational Research | Susan C. Sonne, PharmD Royce Sampson, MSN, RN |
| June 3 | 9-9:50am MANDATORY: Responsible Lab Citizenship & Mentoring (lecture/discussion) 9:50-10am - - - Break- - - 10-10:50am Data Management/Data Manipulation (lecture/case/study/discussion) | Ed Krug, PhD |
| June 4 | 8:30-9:30am MANDATORY: Public Perceptions of Scientific Research ("And the Band Played On") 9:30-9:40am - - -Break- - - 9:40-10:20am Questionable Research Practices (discussion of video) | Ed Krug, PhD |
| June 5 | 8:30-9:20am Mandatory: Moral Reasoning in Ethical Dilemmas (lecture/case study/discussion) 9:20-9:30am - - -Break- - - 9:30-10:20am Animal Use in Research (lecture & discussion) | Ed Krug, PhD Alison Smith, PhD |
| June 6 | 8:30-9:20am MANDATORY: Authorship and Plagiarism (lecture/case study/discussion) 9:20-9:30am - - -Break- - - 9:30-10:10am Research Misconduct/Whistleblower Protections (lecture/case study/discussion) 10:10-10:20am Closing Comments/Exit Evaluation | Ed Krug, PhD |

Outside Assignment: Complete the University of Montana On-Line RCR training (link below) - you must score a minimum of 70% on all quizzes. Submit paper copies of quiz completion to Stephanie Brown-Guion (BE101F) no later than 4 PM Friday, June 15 (http://ori.dhhs.gov/education/products/montana_round1/research_ethics.html)

NOTE: The schedule on the following pages is color-coded. Lectures in the Black font are required of everyone. You must select a lecture track for the remainder of the summer. Your choices are **Cardiovascular** (blue font), **Cancer** (red font), **Craniofacial biology** (pink font), and **Neuroscience** (green font). If you are part of the OHH group, your lectures are attached at the end of this schedule.

Lecture Time: 8:30-9:30; Place: Bioengineering Building Room 112

| <u>Date</u> | <u>Topic</u> | <u>Lecturer</u> |
|--------------------|---|--|
| June 7 | Hepatic Steatosis in a Growing World: The Impact On Transplantation | Kenneth Chavin, MD, PhD |
| June 10 | Lipidomics | Ashley Cowart, PhD |
| June 11 | (C) Kinds of Cancer | Robert Gemmill, PhD |
| June 12 | Cell Biology – Tissue Ultrastructure | Debra Hazen-Martin, PhD |
| June 13 | Developmental Biology | Michael Kern, PhD |
| June 14 | Proteomics Technology | Lauren Ball, PhD |
| June 17 | Recombinant DNA | David Kurtz, PhD |
| June 18 | Transcription | Steven Kubalak, PhD |
| June 19 | (H) The Heart | Perry Halushka, PhD, MD |
| June 19 | (D) Tooth Development – Room BSB 451 | Michael Kern, PhD |
| June 20 | (C) Cancer Cell Cycle | Cynthia Wright, PhD |
| June 21 | Confocal/Multiphoton Microscopy of Living Cells And Tissues | John Lemasters, MD, PhD |
| June 24 | Microarray Analysis | Jeremy Barth, PhD |
| June 25 | (H) Electrical Properties of the Heart | Rupak Mukherjee, PhD |
| June 26 | (C) Cytogenetics | Dayna Wolff, PhD |
| June 27 | (N) Retinoids & Vision | Masahiro Kono, PhD |
| June 27 | (D) Salivary Diagnostics – Room BSB 451 | V. Palanisamy, PhD |
| June 28 | G Proteins | John Hildebrandt, PhD |
| July 1 | Stem Cells | Amanda LaRue, PhD |
| July 2 | (N) Dementia | Dr. Mark Kindy, PhD |
| July 3 | (N) ADD/ADHD | Antonieta Lavin, PhD Jonathan Dilgen, PhD |
| July 5 | (H) Arterial Pressure Control & High Blood Pressure | Perry Halushka, PhD, MD |
| July 8 | Receptors | Steven Rosenzweig, PhD |
| July 9 | (N) Spinal Cord Injury | Narendra Banik, PhD |
| July 10 | (H) Aspirin & NSAIDS | Perry Halushka, PhD, MD |
| July 10 | (D) Temporomandibular Joint Biomechanics – BSB 451 | Hai Yao, PhD |
| July 11 | (C) Smoking & Cancer | Michael Cummings, PhD |
| July 11 | (D) Periodontal Disease – BSB 451 | Keith Kirkwood, DDS, PhD |
| July 12 | (D) Oral Pharyngeal Cancer – BSB 451 | Boyd Gillespie, MD |
| July 15 | (C) Epidemiology of Cancer | Kristen Wallace, PhD |
| July 16 | (H) Atherosclerosis | Perry V. Halushka, PhD, MD |
| July 17 | (C) Cancer Chemotherapy | David Kurtz, PhD |
| July 17 | (D) Oral Infections – BSB 451 | Caroline Westwater, PhD |
| July 18 | (N) Neuroimaging Lab Demonstration | Colleen Hanlon |

| | | |
|---------|--|--|
| July 18 | (D) Craniofacial Anomalies – BSB 451 | Carlos Salinas, DDS, DDM |
| July 19 | (H) Renal Regulation of Homeostasis | Ed Soltis, PhD |
| July 22 | (H) Imaging the Heart | Joseph Schoepf, MD |
| July 23 | (N) Addiction & Alcohol | Corrigan Smothers, PhD |
| July 23 | (C) Cancer Disparities | Marvella Ford, PhD |
| July 24 | (N) Schizophrenia | Antonieta Lavin, PhD Jonathan Dilgen, PhD |
| July 24 | (D) Oral Health Community Engagement – BSB 451 | Renata Leite, DDS |
| July 25 | (N) Addiction & Drugs | Patrick Mulholland, PhD |

Key: Black – mandatory for everyone
Red or (C) – Cancer track
Blue or (H) – Cardiovascular track
Green or (N)– Neuroscience track
Pink (D) – Craniofacial Biology

Summer Undergraduate Research Program CGS 761 Lecture Series, Summer 2014
8:30-9:30 AM (unless otherwise noted)

| <u>Date</u> | <u>Topic</u> | <u>Lecturer</u> |
|-------------|---|---|
| May 27 | MANDATORY: Introduction to the Summer Program ROOM BSB 402 | Cynthia Wright, PhD |
| May 28 | Transcription ROOM BSB 402 | Steven Kubalak, PhD |
| May 29 | Example of Translational Research: Thromboxane Receptors in Bladder Cancer ROOM BSB 402 May 30 Human Subject Protection SCTR SUCCESS Center: Scientist Support for Conducting Research ROOM BSB 402 | Perry Halushka, PhD, MD Susan C. Sonne, PharmD Stephanie Gentilin, MA, CCRA |

MANDATORY - All Responsible Conduct of Research Sessions - LOCATION BSB 100

| | | |
|---------------|--|---------------------------------------|
| June 2 | 9:50am MANDATORY: Responsible Lab Citizenship & Mentoring (lecture/discussion) 9:50-10am - - - Break - - - 10-10:50am Data Management/Data Manipulation (lecture/case/study/discussion) ROOM BSB 202 | Ed Krug, PhD |
| June 3 | 8:30-9:30am MANDATORY: Public Perceptions of Scientific Research ("And the Band Played On") 9:30-9:40am - - -Break - - - 9:40-10:20am Questionable Research Practices (discussion of video) ROOM BSB 202 | Ed Krug, PhD |
| June 4 | 8:30-9:20am Mandatory: Moral Reasoning in Ethical Dilemmas (lecture/case study/discussion) 9:20-9:30am - - -Break - - - 9:30-10:20am Animal Use in Research (lecture & discussion) ROOM BSB 202 | Ed Krug, PhD Alison Smith, DVM |
| June 5 | 8:30-9:20am MANDATORY: Authorship and Plagiarism (lecture/case study/discussion) 9:20-9:30am - - -Break - - - 9:30-10:10am Research Misconduct/Whistleblower Protections (lecture/case study/discussion) 10:10-10:20am Closing Comments/Exit Evaluation ROOM BSB 202 | Ed Krug, PhD |

Outside Assignment: Complete the University of Montana On-Line RCR training (link below) - you must score a minimum of 70% on all quizzes. Submit paper copies of quiz completion to Stephanie Brown-Guion (BE101F) **no later than 4 PM Friday, June 13**

(http://ori.dhhs.gov/education/products/montana_round1/research_ethics.html)

NOTE: The schedule on the following pages is color-coded. Lectures in the Black font are required of everyone. You must select a lecture track for the remainder of the summer. Your choices are **Cardiovascular (blue font)**, **Cancer (red font)**, **Oral Health Sciences (pink font)**, and **Neuroscience (green font)**. If you are part of the MBHS group, your lectures are attached at the end of this schedule.

Lecture Time: 8:30-9:30; Location: 100 BSB (unless otherwise noted)

| <u>Date</u> | <u>Topic</u> | <u>Lecturer</u> |
|----------------|---|-------------------------|
| June 6 | Hepatic Steatosis in a Growing World: The Impact On Transplantation ROOM BSB 202 | Kenneth Chavin, MD, PhD |
| June 9 | Lipidomics ROOM BSB 202 | Ashley Cowart, PhD |
| June 10 | (C) Cytogenetics Daynna Wolff, PhD | |
| June 11 | Cell Biology – Tissue Ultrastructure ROOM BSB 202 | Debra Hazen-Martin, PhD |
| June 12 | Developmental Biology ROOM BSB 202 | Michael Kern, PhD |

June 13 Recombinant DNA **ROOM BSB 202**
 June 16 Proteomics Technology **ROOM BSB 202**
 June 17 (C) Cancer Cell Cycle **ROOM BSB 202**
 June 18 Microarray Analysis **ROOM BSB 202**
 June 19 (D) Tooth Development – **ROOM BSB 252**
 June 20 Confocal/Multiphoton Microscopy of Living Cells
 And Tissues **ROOM BSB 202**
 June 23 (H) Atherosclerosis **ROOM BSB 202**
 June 24 (H) Electrical Properties of the Heart **ROOM BSB 202**
 June 25 (C) Kinds of Cancer **ROOM BSB 202**
 June 25 (D) Temporomandibular Joint Biomechanics – **BSB 252**
 June 26 (N) Retinoids & Vision **ROOM BSB 202**
 June 27 Receptors **ROOM BSB 202**
 June 30 G Proteins **ROOM BSB 202**
 July 1 (N) Dementia **ROOM BSB 202**
 July 2 (N) ADD/ADHD
 July 3 (H) The Heart **ROOM BSB 202**
 July 7 Stem Cells
 July 8 (N) Spinal Cord Injury
 July 8 (D) Salivary Diagnostics – **ROOM BSB 252**
 July 9 (H) Aspirin & NSAIDS
 July 9 (D) Overview of Dentistry & Dental
 Materials – **ROOM BSB 252**
 July 10 (C) Smoking & Cancer
 July 10 (D) Periodontal Disease – **BSB 252**
 July 11 (D) ****Oral Pharyngeal Cancer – **BSB 252**
 July 14 (C) Epidemiology of Cancer
 July 15 (H) Arterial Pressure Control & High Blood
 Pressure
 July 15 (C) Cancer Chemotherapy
 July 15 (D) Oral Infections – **BSB 252**
 July 16 (N) Neuroimaging Lab Demonstration
 July 17 (H) Renal Regulation of Homeostasis
 July 18 (H) Imaging the Heart
 July 21 (D) Craniofacial Anomalies – **BSB 252**
 July 22 (N) Addiction & Alcohol
 July 23 (C) Cancer Disparities
 July 23 (N) Your Brain, Stress, and Anxiety
 July 23 (D) Oral Health Community Engagement – **BSB 252**
 July 24 (N) Addiction & Drugs

David Kurtz, PhD
 Lauren Ball, PhD
 Cynthia Wright, PhD
 Jeremy Barth, PhD
 Michael Kern, PhD

John Lemasters, MD,PhD
 Samar Hammad, PhD
 Rupak Mukherjee, PhD
 Robert Gemmill, PhD
 Hai Yao, PhD
 Masahiro Kono, PhD
 Steven Rosenzweig, PhD
 John Hildebrandt, PhD
 Mark Kindy, PhD
 Antonieta Lavin, PhD
 Jonathan Dilgen, PhD
 Perry Halushka, PhD, MD
 Amanda LaRue, PhD
 Narendra Banik, PhD
 Visu Palanisamy, PhD
 Perry Halushka, PhD, MD

Joe Vuthiganon, DMD
 Michael Cummings, PhD
 Heidi Steinkamp &
 Keith Kirkwood, DDS, PhD
 Boyd Gillespie, MD
 Kristen Wallace, PhD

Perry Halushka, PhD, MD
 David Kurtz, PhD
 Caroline Westwater, PhD
 Colleen Hanlon, PhD
 Ed Soltis, PhD
 Joseph Schoepf, MD
 Carlos Salinas, DMD
 Corrigan Smothers, PhD
 Marvella Ford, PhD
 Arthur Riegel, MD
 Renata Leite, DDS
 Patrick Mulholland, PhD

Key: Black – mandatory for everyone
 Red or (C) – Cancer track
 Blue or (H) – Cardiovascular track
 Green or (N) – Neuroscience track
 Pink (D) – Craniofacial Biology
 ***Lecture will be held at 8:00am-9:am

MANDATORY PRESENTATIONS:

July 29 – July 31st 2014 ROOM BSB 100

Conduct Aim 2: Prostate Cancer Research Training (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)

The Student Fellows participated in an intensive 10-week training program in Prostate Cancer Research. Lectures focused on population science, statistical methods in prostate cancer research, prostate cancer clinical research, and basic science research. Other lectures described funding opportunities available to the students, career development opportunities, qualitative research methods, perspectives of prostate cancer among community members, and tips for preparing graduate school applications. In addition, as prostate cancer is a hormone-related cancer and some of the biological mechanisms that influence the etiology and treatment of prostate cancer are also relevant to breast cancer, the curriculum included information pertaining to breast cancer as well.

The schedule also provided time for students to rehearse their research presentations and gain input from their mentors and other scientists at the HCC. Disparities research was a cross-cutting theme in all of the lectures.

The structure of the curriculum provided the students with a better understanding of the different population groups that were included in their research. Therefore, cultural enrichment activities were added to the curriculum, such as the Gullah tour of Charleston, in order to expose the students to the local and historic culture of the Charleston population. The Sea Island (Gullah) population is a subpopulation of African Americans indigenous to the coastal regions of the eastern seaboard. They are the most genetically homogeneous group of blacks in the U.S. Their particularly low rate of European American genetic admixture makes this a unique population for basic, clinical and population-based research. The following tables show the cancer research training curricula for years 2012 – 2014.

**2012 BREAST AND PROSTATE CANCER
SUMMER UNDERGRADUATE RESEARCH TRAINING CURRICULUM
May 29, 2012-August 3, 2012
11:00 am - 12:00 pm
Bioengineering Building (Room is TBD)**

| Week | Topic | Instructor | Date |
|---|---|---|--|
| WEEK 1 | Welcome and Overview of the Training Program | Leadership, Mentors and Planning Team | Tuesday, May 29, 2012 |
| WEEK 1 (Clinical Science Research Lecture) | Anatomy and the Function of the Breast | Rita M. Kramer, MD , Associate Professor, Hematology/Oncology | Wednesday, May 30, 2012 |
| WEEK 2 (Clinical Science Research Lecture) | Controversies in Breast Cancer Screening | Amy S. Campbell, MD , Assistant Professor, Department of Radiology and Radiological Science | Tuesday, June 5, 2012 |
| WEEK 2 (Clinical Science Research Lecture) | Controversies in Prostate Cancer Screening | Jonathan C. Picard, MD , Assistant Professor, Department of Urology | Thursday, June 7, 2012 |
| Mobile Health Unit (MHU) Tour: Campus-Wide Employee Screenings TBD | | | |
| WEEK 3 (Clinical Science Research Lecture) | Anatomy and the Function of the Prostate | Harry S. Clarke, MD, PhD , Professor, Department of Urology | Monday, June 11, 2012 3:00-4:00pm |
| WEEK 3 (Population Science/Epidemiologic Research Lecture) | Epidemiologic Issues in Prostate Cancer Research | Anthony J. Alberg, PhD , Associate Director, Cancer Prevention and Control and Associate Professor, Department of Medicine, Division of Biostatistics and Epidemiology | Tuesday, June 12, 2012 |
| WEEK 3 (Academic Planning Lecture) | Funding Opportunities for Underrepresented Minority Scholars | Joann F. Sullivan, PhD , Assistant Dean for Extramural Programs, Director of Research Development, Professor of Libraries and Information Sciences, MUSC | Thursday, June 14, 2012 |
| WEEK 4 (Population Science Research Lecture) | Project Sugar: Community-based genetic research project among the Sea Islanders (Gullahs) in South Carolina | Ida J. Spruill, PhD , Assistant Professor, College of Nursing | Thursday, June 21, 2012 |
| Cultural Enrichment: Gullah Tour Of Charleston TBD | | | |
| WEEK 5 (Biostatistical Methods Lecture) | Biostatistical Issues in Breast and Prostate Cancer Research | Elizabeth Garrett-Mayer, PhD , Director, Biostatistics Core and Associate Professor, Department of Medicine, Division of Biostatistics and Epidemiology | Tuesday, June 26, 2012 |
| WEEK 5 (Basic Science Research Lecture) | Developmental Transcription Factors in Prostate Cancer | Demetri Spyropoulos, PhD , Associate Professor, Department of Pathology and Laboratory Medicine | Thursday, June 28, 2012 |
| WEEK 6 (Population Science/Epidemiologic Research Lecture) | Epidemiologic Issues in Breast Cancer Research | Joan Cunningham, PhD , Assistant Professor, Department of Medicine, Division of Biostatistics and Epidemiology | Tuesday, July 3, 2012 |
| WEEK 6 (Population Science Research Lecture) | Breast and Prostate Cancer Research: Perspectives of Community Members | Jim Etheredge and Cancer Disparities Board Members , HCC Cancer Disparities Program | Thursday, July 5, 2012 |
| WEEK 7 (Population Science Lecture) | Qualitative Research Methods | Charlene Pope, PhD , Associate Professor, College of Nursing, MUSC | Tuesday, July 10, 2012 |
| WEEK 7 (Basic Science Research Lecture) | Breast Cancer Basic Science Lecture | Dr. Carola Neumann, PhD , Associate Professor, Cell and Molecular Pharmacology and Experimental Therapeutics | Thursday, July 12, 2012 |
| WEEK 8 (Clinical Research Lecture) | Vitamin D and Prostate Cancer | Sebastiano Gattoni-Celli, MD , Professor Radiation Oncology | Tuesday, July 17, 2012 |
| WEEK 8 (Tips for Preparing Graduate School Applications) | Improving Graduate School Admission Rates | Cynthia F. Wright, PhD , Assistant Dean for Admissions and Associate Professor, College of Graduate Studies, MUSC | Wednesday, July 18, 2012 |
| WEEK 9 (Rehearsals) | Research Presentation Rehearsals | Students and Mentors | Tuesday, July 24, 2012 |
| WEEK 9 (Rehearsals) | Research Presentation Rehearsals | Students and Mentors | Thursday, July 26, 2012 |
| WEEK 10 (Rehearsals and Evaluations) | Rehearsals , Evaluations and Cultural Enrichment Dinner | Students, Mentors, Staff | Tuesday, July 31, 2012 |

 CORE COURSE

 BREAST CANCER COURSE

 PROSTATE CANCER COURSE

**2013 BREAST AND PROSTATE CANCER
SUMMER UNDERGRADUATE RESEARCH TRAINING CURRICULUM**
May 28, 2013-August 2, 2013
11:00 am - 12:00 pm

| Week | Topic | Instructor | Location and Date |
|--|---|--|---------------------------------------|
| WEEK 1 | Welcome and Overview of the Training Program | Leadership, Mentors and Planning Team | Tuesday, May 28, 2013 |
| WEEK 1 (Clinical Science Research Lecture) | Breast Health and Breast Disease, The Basics | Rita Kramer, M.D. Associate Professor Hematology / Oncology | Wednesday, May 29, 2013 BE 402 |
| WEEK 2 (Clinical Science Research Lecture) | Controversies in Breast Cancer Screening | Madelene Lewis, M.D. Assistant Professor Radiology | Tuesday, June 4, 2013 BE 402 |
| WEEK 2 (HCC Outreach Lecture) | Hollings Cancer Center Outreach Mobile Unit & Community Compass | Debbie Bryant, DNP, RN Assistant Director Cancer Prevention & Control, Outreach | Thursday, June 6, 2013 BE 402 |
| WEEK 3 (Clinical Science Research Lecture) | Anatomy and the Function of the Prostate | Harry S. Clarke, M.D., Ph.D Professor Urology Services | Monday, June 10, 2013 3-4pm BE402 |
| WEEK 3 (Academic Planning Lecture) | Funding Opportunities for Underrepresented Minority Scholars | Joann F. Sullivan, Ph.D Assistant Dean for Extramural Program Development | Tuesday June 11, 2013 BE 112 |
| WEEK 3 (Research Lecture) | Tissue Biorepository | Kiwana Gibbs, MA Operations Manager of Tissue Biorepository and Analysis | Thursday, June 13, 2013 BE402 |
| WEEK 3 (Clinical Science Research Lecture) | Controversies in Prostate Cancer Screening | Jonathan Picard, M.D. Assistant Professor Urology Services | Tuesday, June 18, 2013 BE 402 |
| WEEK 3 (Cultural Enrichment) | Cultural Enrichment Event Angel Oak Tree & Etiquette Seminar | Cultural Enrichment Event (ALL DAY) | Wednesday, June 19, 2013 |
| WEEK 4 (Population Science/Epidemiologic Research Lecture) | Epidemiologic Issues in Breast Cancer Research | Joan Cunningham, Ph.D Research Assistant Professor Public Health Sciences | Thursday, June 20, 2013 BE402 |
| WEEK 4 (Biostatistical Methods Lecture) | Biostatistical Issues in Breast and Prostate Cancer Research | Elizabeth Garrett-Mayer, Ph.D Professor Public Health Sciences | Tuesday, June 25, 2013 BE 402 |
| WEEK 5 (Population Science Research Lecture) | Community-based genetic research project among the Sea Islanders (Gullahs) in SC | Ida J. Spruill, Ph.D Assistant Professor College of Nursing | Thursday, June 27, 2013 BE402 |
| WEEK 5 (Tips for Preparing Graduate School Applications) | Improving Graduate School Admission Rates | Cynthia F. Wright, Ph.D Associate Dean for Admissions and Career Development | Monday, July 1, 2013 BE402 |
| WEEK 5 (Population Science Research Lecture) | Qualitative Research Methods | Charlene Pope, Ph.D. Associate Professor College of Nursing | Tuesday, July 2, 2013 BE 402 |
| WEEK 6 (Clinical Research Lecture) | Vitamin D and Prostate Cancer | Sebastiano Gattoni-Celli, M.D. Professor Radiation Oncology | Tuesday, July 9, 2013 BE 402 |
| WEEK 7 (Basic Science Lecture) | Genetic Basis of Cancer | Dennis Watson, Ph.D Professor Pathology & Laboratory Medicine | Thursday, July 11, 2013 BE402 |
| WEEK 7 (Basic Science Lecture) | Receptor crosstalk leading to cancer cell invasion | Steven Rosenzweig, Ph.D Professor Pharmacology | Tuesday, July 16, 2013 BE402 |
| WEEK 8 (Population Science/Epidemiologic Research Lecture) | Epidemiologic Issues in Prostate Cancer Research | Anthony Alberg, Ph.D Professor Cancer Prevention & Control Program | Thursday, July 18, 2013 BE 402 |
| WEEK 8 (Cultural Enrichment) | Cultural Enrichment Event Gullah/ Historical Charleston Tour & Downtown Luncheon | Cultural Enrichment Event (ALL DAY) | Tuesday, July 19, 2013 |
| WEEK 9 (Rehearsals) | Research Presentation Rehearsals | All Research Students and mentors | Tues & Thurs July 23 & 25 BE402 |
| WEEK 9 (Rehearsals) | Research Presentation Rehearsals | All Research Students and mentors | Tuesday, July 30, 2013 BE402 |
| WEEK 10 (Rehearsals and Evaluations) | Evaluations and Cultural Enrichment Dinner | All Research Student and Staff | Wednesday, July 31, 2013 |

 CORE COURSE

 BREAST CANCER COURSE

 PROSTATE CANCER COURSE

**2014 BREAST AND PROSTATE CANCER
SUMMER UNDERGRADUATE RESEARCH TRAINING CURRICULUM
May 26, 2014-August 1, 2014
11:00 am - 12:00 pm**

| Week | Topic | Instructor | Location and Date |
|--|--|--|--|
| WEEK 1 | Welcome and Overview of the Training Program | Leadership, Mentors and Planning Team | Thursday, May 29, 2014 BE103E |
| WEEK 2 (Basic Science Lecture) | Breast Health and Breast Disease, The Basics | Rita Kramer, M.D. Associate Professor Hematology / Oncology | Tuesday, June 3, 2014 DD 312 |
| WEEK 2 (Basic Science Lecture) | Genetic Basis of Cancer | Dennis Watson, Ph.D Professor Pathology & Laboratory Medicine | Thursday, June 5, 2014 DD 312 |
| WEEK 3 (Clinical Science Research Lecture) | Anatomy and the Function of the Prostate | Harry S. Clarke, M.D., Ph.D Professor Urology Services | Monday, June 9, 2014 BE 103E |
| WEEK 3 (Clinical Science Research Lecture) | Controversies in Breast Cancer Screening | Madelene Lewis, M.D. Assistant Professor Radiology | Tuesday, June 10, 2014 EL 104 |
| WEEK 3 (Cultural Enrichment) | Cultural Enrichment Event | Cultural Enrichment Event (ALL DAY) | Thursday June 12, 2014 |
| WEEK 4 (Clinical Science Research Lecture) | Controversies in Prostate Cancer Screening | Jonathan Picard, M.D. Assistant Professor Urology Services | Tuesday, June 17, 2014 DD 312 |
| WEEK 4 (Academic Planning Lecture) | Funding Opportunities for Underrepresented Minority Scholars | Joann F. Sullivan, Ph.D Assistant Dean for Extramural Program Development | Tuesday June 19, 2014 DD 312 |
| WEEK 5 (Basic Science Lecture) | Receptor Crosstalk Leading To Cancer Cell Invasion | Steven Rosenzweig, Ph.D Professor Pharmacology | Tuesday, June 24, 2014 DD 312 |
| WEEK 5 (Biostatistical Methods Lecture) | Biostatistical Issues in Breast and Prostate Cancer Research | Elizabeth Garrett-Mayer, Ph.D Professor Public Health Sciences | Thursday June 26, 2014 DD 312 |
| WEEK 6 (HCC Outreach Lecture) | Hollings Cancer Center Outreach Mobile Unit & Community Compass | Debbie Bryant, DNP, RN Assistant Director Cancer Outreach | Tuesday July 1, 2014 DD 312 |
| WEEK 6 (Research Lecture) | Tissue Biorepository | Kiwana Gibbs, MA Operations Manager of Tissue Biorepository and Analysis | Thursday July 3, 2014 DD 312 |
| WEEK 7 (Cultural Enrichment) | Cultural Enrichment Event | Cultural Enrichment Event (ALL DAY) | Tuesday, July 8, 2014 |
| WEEK 7 (Tips for Preparing Graduate School Applications) | Improving Graduate School Admission Rates | Cynthia F. Wright, Ph.D Associate Dean for Admissions and Career Development | Thursday July 10, 2014 BE402 <i>New Location Start</i> |
| WEEK 8 (Population Science Research Lecture) | Community-Based Genetic Research Project Among The Sea Islanders (Gullahs) In SC | Ida J. Spruill, Ph.D Assistant Professor College of Nursing | Tuesday, July 15, 2014 BE402 |
| WEEK 8: Special Lecture | Introduction to Public Health | John Vena Professor and Founding Chair Department of Public Health | Thursday July 17, 2014 BE 402 |
| WEEK 8 (Population Science/Epidemiologic Research Lecture) | Epidemiologic Issues in Prostate Cancer Research | Anthony Alberg, Ph.D Professor Cancer Control Program | Thursday July 17, 2014 BE 402 |
| WEEK 9 (Clinical Research Lecture) | Vitamin D and Prostate Cancer | Sebastiano Gattoni-Celli, M.D. Professor Radiation Oncology | Tuesday July 22, 2014 BE 402 |
| WEEK 9 (Population Science Research Lecture) | Survivorship Issues in Breast Cancer | Katherine Sterba, Ph.D. Assistant Professor Cancer Control Program | Tuesday July 24, 2014 BE 402 |
| WEEK 10 (HCC Outreach Lecture) | Cultural Competency | AHEC Video | Thursday July 29, 2014 BE402 |
| WEEK 10 (Rehearsals) | Research Presentation Rehearsals | All Research Students and mentors | |
| WEEK 10 (Rehearsals and Evaluations) | Evaluations and Cultural Enrichment Dinner | All Research Student and Staff | |

 **CORE COURSE**

 **BREAST CANCER COURSE**

 **PROSTATE CANCER COURSE**

(c) Sponsor the Student Fellows' Participation in a Graduate Record Examination (GRE) course (Year 1, months 6-8; Year 2, months 6-8; Year 3, months 6-8)

During the summers of 2012 – 2014, all 12 Student Fellows (plus an additional eight students who were supported using leveraged funds) took the 8-week Princeton Review GRE Test Preparation Course. The Princeton Review is a standardized test preparation company. The course met on Wednesday evenings from 5:30 pm – 8:30 pm. The course seamlessly adjusts classwork and homework to the skill level of each student. This is accomplished by focusing on the areas where each student needs the most improvement. The course provides instruction in test-taking skills, and provides opportunities for dynamic group discussions and collaborative drills.

Task 2 Deliverables: From 2012 – 2015, state-of-the art comprehensive prostate cancer research education and training opportunities were provided for 12 students from three of South Carolina's HBCUs. Funds were leveraged from two other federally-funded training grants and from the MUSC Hollings Cancer Center to provide the same level of education and training to an additional 8 students from HBCUs in South Carolina. We are developing a cadre of scientists who are well-prepared to play a significant role in discovering and testing new prostate cancer biomarkers. In the future, these investigators will likely conduct research spanning the continuum from basic science to clinical science to population-based research.

Task 3. Prepare Tangible Scientific Products

(a) Prepare and present scientific abstracts based on the Student Fellows' prostate cancer research (Year 1, months 10-12, Year 2, months 1-12, Year 3, months 1-12)

(b) Prepare manuscripts that will be submitted to peer-reviewed journals (Year 1, months 10-12, Year 2, months 1-12, Year 3, months 1-12)

(c) Develop manuscripts to describe the scope and outcomes of the project (Year 3, months 9-12)

From 2012 – 2015, each Student Fellow prepared a scientific research paper that will form the basis of a peer-reviewed publication. The Student Fellows are completing manuscripts with their research mentors.

In addition, each Student Fellow gave a scientific presentation based on the results of his or her work. Also, in 2013, Ms. Franshawn Mack gave a presentation on November 15 at the Southeast Regional Research Conference in Little Rock, AR. The title of her presentation was "Evaluating the Reliability of an Instrument Assessing Cancer Clinical Trial Perceptions in a Predominantly African American Sample in South Carolina." She was also a co-author of the following presentation:

- Ford ME, Burshell DR, **Mack F**, Wei W, Garrett-Mayer E. Evaluating the Reliability of an Instrument Assessing Cancer Clinical Trial Perceptions in a Predominantly African American Sample. Poster presented at the Sixth American Association for Cancer Research Conference: The Science of Cancer Health Disparities in Ethnic Minorities and the Medically Underserved, December 6-11, 2013, Atlanta, GA.

Summaries of each Student Fellows' research projects are included in **Appendix D**. A manuscript describing the scope and outcomes of the Training Program was published in 2015 (**APPENDIX F**). Several other manuscripts that include Student Fellows as co-authors are published or in process, including:

- Ford ME, Bauza CE, Turner DP, Magwood G, Kramer RM, Alberg AJ, Bolick S, Hurley D, Mosley C, **Mack F**, Knight KD, Cunningham JE. Evaluating the prevalence of overweight/obesity and physical activity in three ethnic groups of breast cancer survivors: European Americans, African Americans, and Sea Islanders.
- Ford ME, Wei W, Burshell D, Cannady K, Moore L, **Mack F**, Ezerioha N, Ercole K, Garrett-Mayer E. Evaluating the reliability of the Attitudes to Randomized Trial Questions (ARTQ) in a predominantly African American sample. SpringerPlus. 2015. 4:411.

Deliverables: A total of 24 scientific presentations were made by the DoD Student Fellows plus those Student Fellows supported through leveraged funds, including two presentations at national scientific meetings.

Task 4. Evaluate the Training Program

- (a) Assess the number of applicants to the Training Program (Year 1, months 1-4; Year 2, months 1-4; Year 3, months 1-4)**

From 2012 – 2015, 12 Student Fellows were selected who were funded through the DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program. An additional eight Student Fellows were selected. Their participation in the Training Program was supported through leveraged funds from a DOD Southeastern Virtual Institute for Health Equity and Wellness grant (W81XWH-10-2-0057), an NIH/NCI P20 South Carolina Cancer Disparities Research Center grant (P20 CA157071), and the MUSC Hollings Cancer Center.

- (b) Assess the number of Student Fellows who apply to graduate school (Year 2, months 1-12; Year 3, months 1-12)**

The majority of Student Fellows (n=12) have either taken the GRE test or are expecting to take a standardized test later this year. Additionally, the Student Fellows have applied or are in the process of applying to graduate/professional school (n=8). Others are completing their junior or senior years of college. As described below, we are employing several strategies to monitor the Student Fellows' progression through their academic careers.

- (c) Assess the number of Student Fellows who are admitted to graduate school (Year 2, months 1-12; Year 3, months 1-12) and (d) Assess the number of graduate schools to which Student Fellows are admitted (Year 2, months 1-12; Year 3, months 1-12)**

We are actively keeping track of the progress of the Student Fellows using the strategies that are described below.

- (d) Employ several tracking mechanisms to monitor the scientific progress of the students, including:**
- 1. Searching the MUSC graduate program databases to identify whether any of the students applied, were offered, or accepted positions at MUSC.**
 - 2. Contacting the participating universities' alumni offices.**
 - 3. Employing other internet based search tools/communications (Google, Twitter, Facebook, and Historically Black College/University Connections, etc.) to identify students' current locations, contact information, and academic achievements (Years 2, 3, and beyond)**

We have implemented several steps for tracking student scientific progress. Communication and assistance from the Associate Directors and Faculty Advisors have proved to be very effective. Additionally, social media tools such as Facebook have also been useful for engaging the students and opening a venue for communication. Another method we have found useful is text messaging. We have found that students respond more quickly to text messages than to emails and telephone calls. We will utilize and build upon these methods to improve continued student tracking. These multiple tracking strategies will be used to update the table that is included in **Appendix E**, which lists the academic accomplishments of the Student Fellows.

- (e) Identify the number of scientific abstracts presented and peer-reviewed publications that result (Year 1, months 10-12; Year 2, months 1-12; Year 3, months 1-12)**

The Student Fellows gave a total of 24 scientific presentations, including two presentations at national scientific meetings. The mentors of the Student Fellows have confirmed that manuscripts that include some of the Student Fellows as co-authors are underway.

Deliverables: Eight of the students have applied to graduate or professional schools and seven were accepted. The others are completing their junior or senior years of college and will apply to graduate or professional schools. The Student Fellows gave a total of 24 scientific presentations, including those that were made at two national scientific meetings. Also, each year, we asked the Student Fellows to evaluate the Training Program. The results from the 2012 – 2014 Student Fellows are presented in the following tables.

| SUMMARY RESULTS OF STUDENTS EVALUATIONS 2012 (n=7)* | | | | | | | | | | |
|--|-------------------|-----|----------|-----|----------|-----|-------|-----|----------------|------|
| Survey Item | Strongly Disagree | | Disagree | | Not Sure | | Agree | | Strongly Agree | |
| | N | % | N | % | N | % | N | % | N | % |
| 1. Overall, the summer program was a good research experience. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 29% | 5 | 71% |
| 2. The summer program helped me learn the fundamentals of breast and prostate cancer and research. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 29% | 5 | 71% |
| 3. The Princeton Review Graduate Record Examination (GRE) Course was effective in helping me to learn GRE test preparation strategies. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 29% | 5 | 71% |
| 4. The seminar schedule was convenient. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4 | 57% | 3 | 43% |
| 5. The seminar topics were of interest to me. | 0 | 0.0 | 1 | 14% | 1 | 14% | 3 | 43% | 2 | 29% |
| 6. Participating in the program helped to strengthen my desire for a career in cancer research. | 1 | 14% | 1 | 14% | 1 | 14% | 3 | 43% | 1 | 14% |
| 7. The Program Director (Dr. Ford) was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 29% | 5 | 71% |
| 8. The Program Assistant (Ms. Hazelton) was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 7 | 100% |
| 9. My research mentor was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 43% | 4 | 57% |
| 10. I would recommend this program to other students at my college/university. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 14% | 6 | 86% |

*The evaluations include data from other students whose participation in the Training Program was supported by leveraged funds.

SUMMARY RESULTS OF STUDENTS EVALUATIONS 2013 (n=7)*

| Survey Item | Strongly Disagree | | Disagree | | Not Sure | | Agree | | Strongly Agree | |
|--|-------------------|-----|----------|-----|----------|-------|-------|-----|----------------|-------|
| | N | % | N | % | N | % | N | % | N | % |
| 1. Overall, the summer program was a good research experience. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 7 | 100% |
| 2. The summer program helped me learn the fundamentals of breast and prostate cancer and research. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 7 | 100% |
| 3. The Princeton Review Graduate Record Examination (GRE) Course was effective in helping me to learn GRE test preparation strategies. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 14% | 6 | 86% |
| 4. The seminar schedule was convenient. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 43% | 4 | 57% |
| 5. The seminar topics were of interest to me. | 0 | 0.0 | 1 | 14% | 0 | 0.0 | 3 | 43% | 3 | 43% |
| 6. Participating in the program helped to strengthen my desire for a career in cancer research. | 0 | 0.0 | 0 | 0.0 | 2 | 28.5% | 3 | 43% | 2 | 28.5% |
| 7. The Program Assistant (Ms. Hazelton) was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 7 | 100% |
| 8. My research mentor was accessible and assisted me when needed. | 1 | 14% | 0 | 0.0 | 1 | 14% | 1 | 14% | 4 | 57% |
| 9. I would recommend this program to other students at my college/university. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 14% | 6 | 86% |

*The evaluations include data from other students whose participation in the Training Program was supported by leveraged funds.

SUMMARY RESULTS OF STUDENT EVALUATIONS 2014 (n=6)*

| Survey Item | Strongly Disagree | | Disagree | | Not Sure | | Agree | | Strongly Agree | |
|--|-------------------|-----|----------|-----|----------|-------|-------|-------|----------------|--------|
| | N | % | N | % | N | % | N | % | N | % |
| 1. Overall, the summer program was a good research experience. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 16.7% | 5 | 83.3% |
| 2. The summer program helped me learn the fundamentals of breast and prostate cancer and research. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 16.7% | 5 | 83.3% |
| 3. The Princeton Review Graduate Record Examination (GRE) Course was effective in helping me to learn GRE test preparation strategies. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 50.0% | 3 | 50.0% |
| 4. The seminar schedule was convenient. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 50.0% | 3 | 50.0% |
| 5. The seminar topics were of interest to me. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 5 | 83.3% | 1 | 16.7% |
| 6. Participating in the program helped to strengthen my desire for a career in cancer research. | 0 | 0.0 | 0 | 0.0 | 1 | 16.7% | 2 | 33.3% | 3 | 50.0% |
| 7. The Program Director (Dr. Ford) was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 100.0% |
| 8. The Program Assistant (Ms. Varner) was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 100.0% |
| 9. My research mentor was accessible and assisted me when needed. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 16.7% | 5 | 83.3% |
| 10. I would recommend this program to other students at my college/university. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 100.0% |

*The evaluations include data from other students whose participation in the Training Program was supported by leveraged funds.

REPORTABLE OUTCOMES

Student Summer Research Summaries

Each Student Fellow prepared a research paper and gave a scientific presentation to their peers, mentors and other faculty at MUSC. Details regarding the manuscripts and scientific presentations developed by the Student Fellows are included in **Appendix D**.

CONCLUSIONS

During the three years of funding of the DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program, the tasks outlined in the Statement of Work were successfully met. Twelve Student Fellows were recruited from Claflin University, SC State University, and Voorhees College. Each Student Fellow conducted research and prepared a research paper that was presented at the conclusion of the program. The Student Fellows also presented their work at national conferences and were included as co-authors on peer-reviewed scientific publications, based on their summer research.

As shown in **Appendix C**, eight additional students participated in the DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program using funds leveraged from another DOD grant that was funded in 2010 (DOD Grant Number W81XWH-10-2-0057, Southeastern Virtual Institute for Health Equity and Wellness), from an NIH/NCI grant that was funded in September 2011 (P20 CA157071), and from MUSC Hollings Cancer Center funds in 2015. The DOD SE VIEW grant provided funding for four additional students per year from 2012-2013, and the P20 grant provided funding for one additional student per year from 2012-2014.

Appendix A: Ernest E. Just Symposium Agenda



**THE 2012 ERNEST E. JUST SYMPOSIUM
FEBRUARY 24, 2012
DRUG DISCOVERY AUDITORIUM**

WWW.MUSC.EDU/GRAD/JUST/



Part I: Introduction

8:00 - 9:00

Registration and Breakfast

9:00 - 9:10

Opening

Stephen Lanier, Ph.D., Associate Provost for Research
Professor of Pharmacology, MUSC
Etta D. Pisano, M.D. Dean, College of Medicine
Vice President for Medical Affairs, MUSC

Greeting

Sabra Slaughter, Ph.D., Chief of Staff
Office of the President, MUSC



9:15 - 9:40

"The Biology of Just the Cell Surface-then and now"

Gary Wessel, Ph.D.
Professor of Biology and Medicine
Department of Molecular and Cellular Biology & Biochemistry
Brown University

Part II: Role Models



9:45 - 10:10

"Career Path and Research in Stem Cell Tissue Engineering"

Treena Livingston Arinze, Ph.D.
Professor of Biomedical Engineering
New Jersey Institute of Technology

10:15 - 10:30

BREAK

Part III: Science



10:35 - 11:15

Ernest E. Just Symposium Keynote Speaker

"Implementation Science in Surgery"

Selwyn O. Rogers Jr., M.D., MPH
Associate Professor of Surgery
Division Chief, Trauma, Burn & Surgical Critical Care
Brigham and Women's Hospital



11:20 - 11:35

"Lupus: An Independent Risk Factor for Endothelial Dysfunction"

Joy N. Jones Buie
Ph.D. Candidate
Medical University of South Carolina

11:35 - 12:20

Breakout Sessions

Campus tour for visiting students
Undergraduate Advisors meet with MUSC
College Admissions Officers

12:25 - 12:55

Lunch

(Afternoon sessions are in the Bioengineering Building Rm 112)



1:00 - 1:50

"Matrix Regulation of Lung Inflammation and Fibrosis: Lessons from Mouse and Man"

Paul Noble, M.D.
Professor of Medicine
Chief, Division of Pulmonary, Allergy and Critical Care Medicine
Duke School of Medicine



2:00 - 2:50

"Enhancing Mammalian Regeneration"

Nadia Rosenthal, Ph.D.
Professor of Medicine
Head of Outstation and Senior Scientist
Adriano Buzzati-Traverso



3:00 - 3:50

"Pluripotency, Etc, The Biomedical Promise of Stem Cell"

Ihor Lemischka, Ph.D.
Professor of Development and Regenerative Biology
Professor of Pharmacology and Systems Therapeutics
Director of The Black Family Stem Cell Institute
Mount Sinai School of Medicine

For more information contact: Mrs. Keisha Vaughn brownka@musc.edu, Dr. Perry V. Hahn hahnper@musc.edu, Dr. Tina A. Reeves reeveta@musc.edu
Sponsored by: MUSC Department of Regenerative Medicine and Cell Biology * MUSC College of Graduate Studies * SC EPSCoR/IDeA
MUSC Office of the Provost * Student Diversity * Marine Biomedicine * MUSC College of Dental Medicine * Health Professions * Medicine * Nursing * SC
College of Pharmacy * Avery Research Center for African American History and Culture (College of Charleston) * SC NASA Space Grant

ERNEST E. JUST

Ernest Everett Just (1883–1941) was born and raised in a family of dockworkers in Charleston, SC. He left to prepare for college at the Industrial School of State College in Orangeburg and the Kimball Hall Academy, NH. Subsequently, he graduated in 1907 from Dartmouth College, magna cum laude, Phi Beta Kappa, with honors in botany, history, and sociology. That same year, Dr. Just accepted a teaching post at Howard University, where he later advanced to the rank of full professor and head of the Department of Physiology. In 1909, he served as a summer research assistant at the Marine Biological Laboratory at Woods Hole, MA. In 1915, his research attracted the attention of the National Association of the Advancement of Colored People, who conferred upon him the first Spingarn Medal, an annual prize given to an outstanding African-American. In 1916, Ernest Just received his PhD in experimental embryology, magna cum laude, from the University of Chicago, with a dissertation on the mechanics of fertilization. In 1919, he worked at the marine biological laboratories in Naples and Sicily.

Dr. Just's achievements earned him the role of adjunct researcher at the Kaiser Wilhelm Institute für Biologie in Berlin-Dahlem (1920–1931) as the Julius Rosenwald Fellow in Biology of the National Research Council. A gift from the Rosenwald Fund to Just for \$80,000 annually for several years offered him protected time for research and graduate teaching. So significant was his work that several of the crowned heads of Europe offered him use of their laboratories.

Dr. Just eventually returned to Woods Hole, where he spent almost twenty years at the research bench. In 1924, he was selected by leading German biologists to write a treatise on fertilization, one of a series of monographs by experts on cell structure and function.

Dr. Just coauthored *General Cytology* (published in 1924) and contributed to a series on colloid chemistry. He was vice president of the American Zoological Society, a member of the Ecological Society, National Research Council, and La Societe Nationale Des Sciences Naturelles Et Mathematiques, the founder of Omega Psi Phi and faculty advisor at Howard University (1911); Editor of *Protoplasm, Biological Zoology, and Physiological Zoology*; and a collaborator for *Cytologia*. In 1930, Dr. Just lectured at the 11th International Congress of Zoologists, Padua, Italy, basing his talk on his fifty published papers. In 1936, he spent three years on *The Biology of the Cell Surface*, a book summarizing his scientific observations. In 1939, early in WWII, Dr. Just was captured in France by Germans and held briefly in a prisoner-of-war camp. In 1940, he returned to the U.S. planning to resume teaching at Howard University. Unfortunately, an illness, which proved to be cancer, intervened and Dr. Just succumbed to his disease in 1941.

Ernest E. Just Scientific Symposium Medical University of South Carolina



February 22, 2013
110 Drug Discovery Auditorium

Thank you to our Sponsors:

MUSC Dept. of Regenerative Medicine, College of Graduate Studies, Office of the Provost, SC EPSCoR/IDeA, SC NASA Space Grant Consortium, College of Dental Medicine, College of Health Professions, College of Medicine, College of Pharmacy, College of Nursing, Avery Research Center for African American History and Culture (College of Charleston), U.S. Department of Energy, MUSC Public Information Community Outreach, MUSC Hollings Cancer Center, NIH/NCI P20 SC CaDRe Grant

For more information contact:

Dr. Perry V. Halushka halushpv@musc.edu or

Dr. Titus Reaves reaves@musc.edu

Phone: 843-876-2411 Website: <http://academicdepartments.musc.edu/grad/ernestjust/>



| | |
|------------------|---|
| 8:00-9:00 am | Registration and Breakfast Drug Discovery Lobby |
| 9:00-9:10 am | Opening Stephen Lanier, Ph.D. Associate Provost for Research Professor of Pharmacology, MUSC Etta D. Pisano, M.D., Dean, College of Medicine Vice President for Medical Affairs, MUSC |
| | Greeting Perry V. Halushka, Ph.D., M.D. Distinguished University Professor, MUSC Dean, College of Graduate Studies |
| 9:10-9:40 am | "The Creativity of Ernest Everett Just" William McDade, M.D., Ph.D. Deputy Provost for Research and Minority Issues Office of the Provost University of Chicago |
| 9:40-10:10 am | "Finding it in All Academic Medicine" Samantha E. Kaplan, M.D., M.P.H. Assistant Professor of Obstetrics and Gynecology Assistant Dean for Diversity and Multicultural Affairs Boston University School of Medicine |
| 10:10 – 10:30 am | BREAK |
| 10:30 – 11:20 am | Just Symposium Keynote Speaker "Science: A Powerful Tool for Justice" Griffin P. Rodgers, M.D. Director of National Institute of Diabetes and Digestive and Kidney Diseases |
| 11:20 – 11:40 am | "What's Wrong with my Heart? Improving Left Ventricular Function Following Myocardial Infarction" Denise Kimbrough, Ph.D. Candidate Molecular, Cellular Biology and Pathobiology Program Medical University of South Carolina |

Kapil Mehta, Ph.D.

Dr. Kapil Mehta received his Ph.D. in 1981 from Postgraduate Institute of Medical Education & Research at Chandigarh, India and came to the United States for postdoctoral training at the University of Texas Health Science Center in Houston, Texas. Two years later, he joined MD Anderson Cancer Center as a faculty member and moved through the ranks to full tenured professorship. Major areas of his research include the use of liposomes as a drug delivery system and understanding molecular mechanisms associated with inflammation regulated progression and pathogenesis of cancer. Dr. Mehta has been awarded 12 patents for various cancer related discoveries. Three of the formulations that he invented or co-invented have made it to the clinic for treatment of various ailments. The first FDA approved liposome-based antifungal formulation that he co-invented is currently being marketed under the trade name of Abelcet®. His group developed Atragen® which is able to induce long-term remissions in APL patients and intravenous formulation of curcumin for treatment of pancreatic cancer that is currently in clinical trials. Dr. Mehta identified a novel inflammatory pathway that promotes invasion and drug resistance in transformed epithelial cells. Central to this pathway is aberrant expression of the stress-response gene, called TGM2. Expression of TGM2 in multiple tumors is associated with early disease relapse and poor therapeutic outcome. He is working on developing inhibitors that can bind and inhibit oncogenic functions of TGM2. He has filed 2 patents to cover intellectual property related to blocking TGM2 functions for treating advanced stage cancer. Dr. Mehta serves on seven editorial boards of various scientific journals and has chaired or co-chaired several scientific meetings. He has published more than 170 scientific publications, reviews, editorials, and book chapters in the area of his research. He has edited three books, including the most recent one on chemoresistance in cancer cells and is internationally recognized for his scientific achievements.

Carl Blobel, M.D., Ph.D.

Dr. Carl Blobel has been Senior Scientist and Program Director of the Arthritis and Tissue Regeneration Program at the Hospital for Special Surgery since 2004. He is also Professor in the Department of Medicine and Professor in the Department of Physiology & Biophysics at Weill Cornell Medical College as well as serving as Virginia F. and William R. Salomon Chair in Musculoskeletal Research since 2005. Prior to that, Dr. Blobel was an Assistant member of Cellular Biochemistry and Biophysics Program at Memorial Sloan-Kettering Cancer Center. Dr. Blobel is an editorial board member of the following journals: *Developmental Biology*, *Cancer Research*, and *the Journal of Biological Chemistry*. He has also served as the Research Chair of the Gordon Conference on Matrix Metalloproteinases and a member of the NIH intercellular interactions study section. He has nearly 70 publications.

Jennifer Elisseeff, Ph.D.

Dr. Jennifer Elisseeff received her bachelor degree in Chemistry from Carnegie Mellon University and a PhD in Medical Engineering from the Harvard-MIT Division of Health Sciences and Technology. After her doctoral studies, Dr. Elisseeff was a Fellow at the National Institute of General Medical Sciences Pharmacology Research Associate Program. Her interdisciplinary laboratory comprises surgical fellows, biologists, chemists, and engineers that work together to develop new biomaterials, study stem cells and design new technologies for regenerative medicine. Clinical collaborations at Johns Hopkins University extend to plastic surgery, otolaryngology, orthopedics, and ophthalmology. In 2004, Elisseeff cofounded Cartlix, Inc., a startup that is translating adhesive and biomaterial technologies for treating orthopedic disease. Dr. Elisseeff is a Professor, Wilmer Eye Institute and Department of Biomedical Engineering, Department of Materials Science and Engineering, Chemical and Biological Engineering and Orthopedic Surgery; Director, Translational Tissue Engineering Center at Johns Hopkins University. She serves on the Scientific Advisory Board of Bausch and Lomb, Kythera Biopharmaceutical, and Cellular Bioengineering Inc. Dr. Elisseeff received multiple awards including the Carnegie Mellon Young Alumni Award, Arthritis Investigator Award for the Arthritis Foundation, Yasuda Award from the Society of Physical Regulation in Medicine and Biology and was named by Technology Review magazine as a top innovator under 35 in 2002 and top 10 technologies to change the future. In 2008, Dr. Elisseeff was elected a fellow in the American Institute for Medical and Biological Engineering and a Young Global Leader in the World Economic Forum. She has published over 110 articles, book chapters and patent applications and given over 130 national and international invited lectures.

11:40 – 12:00 pm

Presentation of The EE Just Undergraduate Award for Excellence in Research
Recipient: Ms. Melissa Carr-Reynolds
 Spelman College

12:00 - 3:00 pm

BREAKOUT SESSIONS/LUNCH
 Campus tours for visiting students
 Undergraduate Advisors meet with MUSC College Admissions Officers (Drug Discovery Bldg Rm 111)

BREAKOUT SESSIONS

Visiting students meet with MUSC College Admissions Officers:

College of Graduate Studies: Dr. Cynthia Wright – Bioengineering Bldg Rm 201
College of Medicine: Myra Haney Singleton and Wanda Taylor – Basic Science Bldg Rm 302
College of Dental Medicine: Veronica Mack – Library Bldg Rm EL 121
College of Pharmacy: Christine Faye Ratliff – Pharmacy Bldg Rm 302B
College of Nursing: Mardi Long – Library Bldg Rm EL 107
College of Health Professions: Lauren Smith and Cami Taylor - CHP Bldg A Rm 201

1:00-1:50 pm

“The Role of *iRhom2/ADAM17* in *EGFR* Receptors Signaling and *TNF*-dependent Pathologies”
Carl Blobel, M.D., Ph.D.
 Professor of Medicine
 Professor of Physiology & Biophysics
 Weill Cornell Medical College

2:00-2:50 pm

“Creating the Optimal Environment: Biomaterials in Regenerative Medicine”
Jennifer Elisseeff, Ph.D.
 Professor of Ophthalmology and Biomedical Engineering
 Director of Translational Tissue Engineering Center
 Wilmer Eye Institute and Department of Biomedical Engineering
 Johns Hopkins University

3:00-3:50 pm

“CANCER-The Close Cousin of Wound Healing”
Kapil Mehta, Ph.D.
 Professor, Department of Experimental Therapeutics
 Cancer Medicine (Biochemistry)
 The University of Texas MD Anderson Cancer Center

William McDade, M.D., Ph.D.

Dr. William McDade is an Associate Professor of Anesthesia and Critical Care and Deputy Provost for Research and Minority Issues at the University of Chicago. In 2005, Dr. McDade founded the James E. Bowman Society, an academic medicine mentoring society that provides support for the advancement of minority individuals. Previously, Dr. McDade was the Associate Dean for Multicultural Affairs in the Pritzker School of Medicine. He is a member of the American Medical Association Council on Medical Education and a Board Director for the Accreditation Council for Graduate Medical Education. Dr. McDade's doctorate is in Biophysics and Theoretical Biology and his research interest centers on molecular therapies for sickle cell disease. He chaired the AMA's Minority Affairs Consortium and received the first AMA award to Recognize Excellence in Eliminating Health Disparities. Dr. McDade serves as the director of three Pritzker Pipeline Programs designed to introduce local high school and undergraduate students to research and clinical medicine with the aim of helping them develop careers in the biomedical sciences. He also leads two additional pipeline programs for the University that are designed to increase diversity in the professoriate. He also serves as a Deputy Provost for the University where he focuses on enhancing campus diversity among the faculty.

Samantha E. Kaplan M.D, M.P.H

Dr. Samantha E. Kaplan received her medical degree from the University of Virginia in Charlottesville, Virginia and completed her residency training at the University of Rochester at Strong Memorial Hospital and her Masters in Public Health from Harvard University, through the Commonwealth Fund Harvard University Fellowship for Minority Health Policy. Prior to completing her medical education, Dr. Kaplan worked as a fundraiser at First Nations Development Institute, Fredericksburg, Virginia, a non-profit organization dedicated to supporting culturally consistent Native American indigenous economic development, and served on the Board of Directors at the Washington Free Clinic, Washington, D.C. Dr. Kaplan joined the medical staff and faculty at Boston University Medical Campus in 2001. Dr. Kaplan's clinical interest is the practice of General Obstetrics and Gynecology with emphasis on adolescent care and the disparities apparent in both gynecologic and obstetric health outcomes. While at Boston University Medical Campus she has been consistently involved in medical education at the undergraduate and graduate level. Dr. Kaplan has an interest in the impact racially and culturally concordant care has on health disparities. Currently, she is the Director of the Early Medical School Selection Program at Boston University School of Medicine.

Griffin P. Rodgers, M.D.

Dr. Griffin Rodgers received his undergraduate, graduate, and medical degrees from Brown University in Providence, Rhode Island. He performed his residency and chief residency in internal medicine at Barnes Hospital and the Washington University School of Medicine in St. Louis. His fellowship training in hematology was in a joint program of the NIH, George Washington University and the Washington Veterans Administration Medical Center. In addition to his medical and research training, he earned an MBA, with a focus on the business of medicine/science, from Johns Hopkins University in 2005. Dr. Rodgers was named Director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) on April 1, 2007. As the Director of NIDDK, Dr. Rodgers provides scientific leadership and manages a staff of over 600 employees and a budget of \$2.0 billion. Dr. Rodgers is a member of the American Society of Hematology, the American Society of Clinical Investigation, the Association of American Physicians, the American Academy of Arts and Sciences, and the Institute of Medicine of the National Academy of Science, among others. He served as Governor to the American College of Physicians and as Chair of the Hematology Subspecialty Board and a member of the American Board of Internal Medicine Board of Directors. Dr. Rodgers has been an invited professor at medical schools and hospitals both nationally and internationally. He has been honored with many named lectureships at American medical centers and has published over 200 original research articles, reviews, and book chapters, has edited four books and monographs, and holds 3 patents.

Denise Kimbrough, Ph.D. Candidate

Ms. Denise Kimbrough received her Bachelors of Science degree in Biomedical Engineering with a minor in Chemistry from the University of Alabama in Birmingham, Alabama. In 2009, she entered into the Molecular, Cellular Biology and Pathobiology doctoral program with a focus in cardiovascular biology. As an IMSD scholar she joined the laboratory of Dr. Donald Menick and earned a cardiovascular pre-doctoral fellowship. Ms. Kimbrough's research focuses on how therapeutic manipulation of epigenetic modifications can improve left ventricular function following myocardial infarction. Ms. Kimbrough has presented her research at the American Heart Association's Basic Cardiovascular Sciences conference and was the recipient of the Cardiovascular Outreach Award. She received first place recognition in the Medical University of South Carolina's Perry V. Halaushka Student Research day award competition twice. She has also received a Deans' Scholarship and Earl B. Higgins Diversity Scholarship. Ms. Kimbrough also mentored undergraduate students and tutors high school and middle school age youth in efforts to improve her community and inspire a career in science for those she helps. Ultimately, she would like to bring together her undergraduate education in Biomedical Engineering and her Ph.D. education in biomedical sciences to address coronary artery disease, a pathology that significantly affects the African American community, in hopes of improving on current modes of therapy.

ERNEST E. JUST

Ernest Everett Just (1883–1941) was born and raised in a family of dockworkers in Charleston, SC. He left to prepare for college at the Industrial School of State College in Orangeburg and the Kimball Hall Academy, NH. Subsequently, he graduated in 1907 from Dartmouth College, magna cum laude, Phi Beta Kappa, with honors in botany, history, and sociology. That same year, Dr. Just accepted a teaching post at Howard University, where he later advanced to the rank of full professor and head of the Department of Physiology. In 1909, he served as a summer research assistant at the Marine Biological Laboratory at Woods Hole, MA. In 1915, his research attracted the attention of the National Association of the Advancement of Colored People, who conferred upon him the first Spingarn Medal, an annual prize given to an outstanding African-American. In 1916, Ernest Just received his PhD in experimental embryology, magna cum laude, from the University of Chicago, with a dissertation on the mechanics of fertilization. In 1919, he worked at the marine biological laboratories in Naples and Sicily.

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Dr. Just eventually returned to Woods Hole, where he spent almost twenty years at the research bench. In 1924, he was selected by leading German biologists to write a treatise on fertilization, one of a series of monographs by experts on cell structure and function.

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Ernest E. Just Scientific Symposium Medical University of South Carolina



February 28, 2014
110 Drug Discovery Auditorium

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For more information contact:

Dr. Titus Reaves reaves@musc.edu

Phone: 843-876-2411 Website: <http://academicdepartments.musc.edu/grad/ernestjust/>



| | |
|------------------|---|
| 8:00-9:00 am | Registration and Breakfast Drug Discovery Lobby |
| 9:00-9:10 am | Opening Mark Sothmann, Ph.D., Interim President Vice President for Academic Affairs and Provost, MUSC Etta D. Pisano, M.D., Dean, College of Medicine Vice President for Medical Affairs, MUSC |
| | Greeting Stephen Lanier, Ph.D. Associate Provost for Research Professor of Pharmacology, MUSC Jacqueline McGinty, Ph.D. Interim Dean, College of Graduate Studies Professor of Neuroscience, MUSC |
| 9:10-9:50 am | "The Importance of the Liberal Arts in a Scientific Education and Career" Stephon H.S. Alexander, Ph.D. The Ernest E. Just 1907 Professor of Natural Sciences Director of the Ernest E. Just Program Associate Professor of Physics and Astronomy Dartmouth College |
| 9:50 – 10:40 am | Just Symposium Keynote Speaker "Understanding Racial Group and Education Differences in Obesity" James Jackson, Ph.D. Director, Institute for Social Research Daniel Katz Distinguished Professor of Psychology University of Michigan |
| 10:40 – 11:00 am | BREAK |
| 11:00 – 11:20 am | "Genetic and Environmental Factors Leading to Lupus in the South Carolina Gullah Population" Sybil Prince-Nelson, Ph.D. Candidate Department of Public Health Sciences Medical University of South Carolina |

Boris Hinz, Ph.D.

Dr. Hinz received his Ph.D. in Cell Biology and Theoretical Biology from the University of Bonn in Germany. Dr. Hinz is an Associate Professor at the Matrix Dynamics Group, Faculty of Dentistry at the University of Toronto and cross-appointed Professor with the Faculty of Medicine, Department of Surgery and the Institute of Biomaterials and Biomedical Engineering at the University of Toronto. From 1999 to 2002, he was a postdoctoral fellow of Dr. Giulio Gabbiani, Department of Experimental Pathology, Centre Medical Universitaire, University of Geneva, Switzerland. Dr. Hinz then moved on to lead a research group at the Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, joining the worlds of Cell Biology, Biophysics, and Bioengineering. In 2006, he was nominated Maître d'enseignement et de recherche (Assistant Professor level). Dr. Hinz is Past President and Board Member of the European Tissue Repair Society, Secretary and founding member of the Canadian Connective Tissue Society, Associate Editor of the journal *Wound Repair and Regeneration* and Associate Member of the Faculty of 1000. Dr. Hinz's research aims are to understand the role of contractile myofibroblasts in physiological tissue repair and in causing pathological tissue fibrosis.

Joan S. Brugge, Ph.D.

Dr. Brugge is currently the Chair of the Department of Cell Biology and Co-Director of the Ludwig Center at Harvard Medical School. She joined the faculty of the Harvard Medical School as a Professor in July 1997. A graduate of Northwestern University, she did her graduate work at the Baylor College of Medicine, completing her PhD in 1975. She then performed her postdoctoral training at the University of Colorado with Dr. Raymond Erikson. Dr. Brugge has held full professorships at the State University of New York, Stony Brook, and the University of Pennsylvania, where she was also named as an investigator at the Howard Hughes Medical Institute. From 1992-1997, Dr. Brugge was Scientific Director of the biotechnology company ARIAD. She then joined the HMS faculty in 1997 as the Louise Foote Pfeiffer Professor of Cell Biology; became the Chair of Cell Biology in 2004; and was appointed Co-Director of the Ludwig Center at Harvard in 2014.

Sybil Prince-Nelson Ph.D. Candidate

Ms. Prince-Nelson received her bachelor's degree in Mathematics and Music from Washington and Lee University in Lexington, Virginia. She then received her Master of Science degree in Mathematics and the title of her thesis was "Dynamics of nearly circular Vortex Filaments". Currently, she is a Ph.D. candidate in the Department of Public Health Sciences and graduates in May 2014. Mrs. Prince-Nelson's research interests are in random forests, methodological issues in logic regression and classification and regression tree analysis and statistical genetics. Mrs. Prince-Nelson was invited to speak at Proctor and Gamble in Cincinnati, Ohio. The title of her talk was "Logic: An Extension of Logic Regression". Mrs. Prince-Nelson placed second at the 2013 Perry V. Halushka MUSC Student Research Day. Her presentation title was "A Method for Predicting Disease Outcome".

Jennifer West, Ph.D.

Dr. West received her Ph.D. from University of Texas at Austin in Austin, Texas. Upon completion of her doctorate, she spent time at the California Institute of Technology as a postdoctoral fellow. Dr. West stands as a true pioneer in the development of polymeric biomaterials with applications ranging from targeted cancer therapeutics to vascular grafts. She holds 15 patents, which are licensed with 8 different companies. Dr. West has been recognized for numerous awards, honors and distinctions. In 2006, she received the Quantum Award from the National Institute for Biomedical Imaging and Bioengineering at National Institute of Health. In 2010, Dr. West was recognized as the Inventor of the Year in an award from the State Bar of Texas. Her research interests are in biomaterials, nanotechnology and tissue engineering involving the synthesis, development, and application of novel biofunctional materials, and the use of biomaterials and engineering approaches to study biological problems. Dr. West has over 140 publications in her research area.

11:20 – 12:00 pm

The E.E. Just Undergraduate Excellence in Research Presentations

"G-Protein Coupled Receptor Kinase 5 Knockdown Sensitizes Prostate Cancer Cells to Docetaxel Treatment"
Ms. Cassie Hobbs
Florida A&M University
1st Place Recipient of The E.E. Just Undergraduate Award for Excellence in Research

"Effects of Polycyclic Aromatic Hydrocarbons in MDA-MB-231 Cells"
Ms. Joycelyn Smith
Benedict College
2nd Place Recipient of The E.E. Just Undergraduate Award for Excellence in Research

"Representation of Black Men in Randomized Control Clinical Trials from 1992-2011"
Mr. Michael Dumas
Florida A&M University
3rd Place Recipient of The E.E. Just Undergraduate Award for Excellence in Research

12:00 - 3:00 pm

BREAKOUT SESSIONS/LUNCH

Campus tours for visiting students
Undergraduate Advisors meet with MUSC College Admissions Officers (Drug Discovery Bldg Rm 111)

BREAKOUT SESSIONS

Visiting students meet with MUSC College Admissions Officers:

- College of Graduate Studies:** Dr. Cynthia Wright – Bioengineering Building Room 112
- College of Medicine:** Myra Haney Singleton and Wanda Taylor – Basic Science Building Room 100
- College of Dental Medicine:** Cindy Oliver and Pearl Givens – Basic Science Building Room 451
- College of Pharmacy:** Christine Faye Ratliff – Pharmacy Building Room QF 302B
- College of Nursing:** Dr. Ida Johnson-Spruill – College of Health Professions Building A Room 102A
- College of Health Professions:** Lauren Smith and Cami Taylor – College of Health Professions Building A Room 201

1:00-1:50 pm

"Biomimetic Microfabrication to Manipulate Cells"

Jennifer West, Ph.D.
Fitzpatrick Family University Professor of Engineering
Duke University of School of Medicine

2:00-2:50 pm

"Mechanics and Fibrosis"

Boris Hinz, Ph.D.
Associate Professor Matrix Dynamics Group
Faculty of Dentistry
University of Toronto

3:00-3:50 pm

"Modeling Morphogenesis, Tumorigenesis and Drug Sensitivity in 3D Cultures"

Joan Siefert Brugge, Ph.D.
Chair and Professor of Cell Biology
Professor, Department of Experimental Therapeutics
Harvard Medical School

Stephon Alexander, Ph.D.

Dr. Stephon Alexander received his Ph.D. in Physics from Brown University in Providence, Rhode Island. Dr. Alexander held postdoctoral fellowships at Imperial College, London and The Stanford Linear Accelerator Center in Menlo Park, California. Dr. Alexander is a theoretical physicist specializing in the interface between cosmology, particle physics and quantum gravity (String Theory and Loop Quantum Gravity). He is currently the Ernest Everett Just 1907 Professor of Natural Sciences. Dr. Alexander has lectured at the Annual International Society of Young Astronomers Winter School (Haverford College and Dartmouth College) on Graduate General Relativity, Undergraduate General Relativity, Quantum Physics History of Science, Graduate Level and Advanced Quantum Mechanics, Solid State Physics, Modern Physics, Elementary Particle Physics, Quantum Field Theory, Graduate Standard Model of Elementary Particles. Dr. Alexander has mentored undergraduate, graduate and post-doctoral fellows nationally and internationally.

James Jackson, Ph.D.

Dr. Jackson is the Daniel Katz Distinguished University Professor of Psychology, Professor of Afroamerican and African Studies, and Director of the Institute for Social Research, all at the University of Michigan. His research focuses on issues of racial and ethnic influences on life course development, attitude change, reciprocity, social support, and coping and health among blacks in the Diaspora. He is past Director of the Center for Afroamerican and African Studies and past national president of the Association of Black Psychologists. He is a fellow of the Gerontological Society of America, the Society of Experimental Social Psychology, the American Psychological Association, the Association of Psychological Sciences, AAAS, and the W.E.B. Du Bois Fellow of the American Academy of Political and Social Science. He has received numerous awards, including the Distinguished Career Contributions to Research Award of the Society for the Psychological Study of Ethnic Minority Issues, the James McKeen Cattell Fellow Award for Distinguished Career Contributions in Applied Psychology of the American Psychological Association, and the Medal for Distinguished Contributions in Biomedical Sciences of the New York Academy of Medicine. He is the President of the Consortium of Social Science Associations (COSSA). He is a member of the Institute of Medicine and a fellow of the American Academy of Arts and Sciences. He is currently directing the most extensive social, political behavior, and mental and physical health surveys on the African American and Black Caribbean populations ever conducted. He serves on several Boards for the National Research Council and the National Academies of Science and is a founding member of the new "Aging Society Research Network" of the MacArthur Foundation.

Appendix B: Ernest E. Just Symposium Student Attendees

Schools that Participated in the 2012 Ernest E. Just Symposium

| Name of School | # of Students |
|---|---------------|
| Anderson University | 21 |
| Benedict College | 25 |
| Charleston Southern University | 4 |
| Clayton University | 30 |
| Clark Atlanta University | 16 |
| Clemson University | 7 |
| Florida A&M University | 51 |
| Fayetteville State University | 20 |
| Morehouse College | 13 |
| Savannah State University | 15 |
| South Carolina State University | 15 |
| Spelman College | 17 |
| The Citadel | 7 |
| University of Maryland Baltimore County | 7 |
| Voorhees College | 11 |
| Winthrop University | 1 |
| Wofford College | 3 |
| TOTAL | 263 |

HBCU
 HBCU in SC

Schools that Participated in the 2013 Ernest E. Just Symposium

| Name of School | # of Students |
|--|---------------|
| Anderson University | 18 |
| Benedict College | 40 |
| Bowie High School | 1 |
| Charles Herbert Flowers High School | 11 |
| Claflin University | 14 |
| Clark Atlanta University | 23 |
| Clemson University | 6 |
| Coastal Carolina University | 6 |
| Fayetteville State University | 15 |
| Gwynn Park High School | 13 |
| Morehouse College | 7 |
| Savannah State University | 6 |
| Spelman College | 18 |
| The Citadel | 2 |
| University of Maryland Baltimore County | 4 |
| University of North Carolina at Pembroke | 6 |
| University of South Carolina Aiken | 4 |
| University of South Carolina Upstate | 6 |
| Voorhees College | 13 |
| Winthrop University | 3 |
| TOTAL | 216 |

HBCU
 HBCU in SC

Schools that Participated in the 2014 Ernest E. Just Symposium

| Name of School | # of Students |
|---|---------------|
| Anderson University | 18 |
| Benedict College | 24 |
| Claflin University | 20 |
| Clark Atlanta University | 15 |
| Clemson University | 10 |
| Coastal Carolina University | 7 |
| Fayetteville State University | 25 |
| Florida A&M University | 50 |
| Furman University | 10 |
| Morehouse College | 15 |
| Savannah State University | 6 |
| South Carolina State University | 7 |
| Spelman College | 15 |
| The Citadel | 3 |
| University of Maryland Baltimore County | 5 |
| University of South Carolina Aiken | 10 |
| University of South Carolina Upstate | 6 |
| Voorhees College | 5 |
| TOTAL | 251 |

HBCU
 HBCU in SC

Appendix C: Additional Students Supported by Leveraged Funding Sources

Summer 2012 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Additional Students, Mentors, Funding Sources, and Research Topics

| Student Name | Academic Institution | MUSC Research Mentor | Funding Source | Research Topic |
|---------------------|-----------------------------|-----------------------------|---|--|
| Ms. Sylvia Bridges | SC State University | Victoria Findlay, PhD | DOD - Southeastern Virtual Institute for Health Equity and Wellness (PI: Slaughter; Project PI: Ford) | The Effects of MiRNA on Prostate Cancer |
| Ms. Laila Green | Claflin University | Marvella E. Ford, PhD | DOD - Southeastern Virtual Institute for Health Equity and Wellness (PI: Slaughter; Project PI: Ford) | Improving Perceptions of Cancer Clinical Trials in South Carolina |
| Ms. Deidra White | SC State University | Dave Turner, PhD | NIH/NCI P20 South Carolina Cancer Disparities Research Center (PIs: Ford and Salley) | Implications of DNA Glycation Affecting Correlation of Racial Disparities in Prostate Cancer |

Summer 2013 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Additional Students, Mentors, Funding Sources, and Research Topics

| Student Name | Academic Institution | MUSC Research Mentor | Funding Source | Research Topic |
|---------------------|-----------------------------|-----------------------------|---|---|
| Ms. Bobbie Blake | Claflin University | Jennifer Wu, PhD | DOD - Southeastern Virtual Institute for Health Equity and Wellness (PI: Slaughter; Project PI: Ford) | NKG2D Signaling Pathways Analysis |
| Ms. Franshawn Mack | SC State University | Marvella E. Ford, PhD | DOD - Southeastern Virtual Institute for Health Equity and Wellness (PI: Slaughter; Project PI: Ford) | Evaluating the Reliability of an Instrument Assessing Cancer Clinical Trial Perceptions in a Predominantly African American Sample in South Carolina |
| Ms. Jasmine Fox | SC State University | Victoria Findlay, PhD | NIH/NCI P20 South Carolina Cancer Disparities Research Center (PIs: Ford and Salley) | MiR-204 Negative Regulation of IGF2R as a Mechanism Driving Breast Cancer Disparity |

Summer 2014 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program Additional Students, Mentors, Funding Sources, and Research Topics

| Student Name | Academic Institution | MUSC Research Mentor | Funding Source | Research Topic |
|---------------------|-----------------------------|-----------------------------|--|---|
| Ms. Bobbie Blake | Clafin University | Victoria Findlay, PhD | NIH/NCI P20 South Carolina Cancer Disparities Research Center (PIs: Ford and Salley) | miR-204 mediated negative regulation of Cav1 as a mechanism driving cancer disparity |
| Mr. Jamie Lyons | SC State University | Bartholomeus Smits, PhD | MUSC Hollings Cancer Center | Genetic elements associated with breast cancer susceptibility in women of African American and European Descent |

Appendix D: Summaries of Students' Scientific Research from the 2012 - 2014 Summer Research Programs

2012 Student Fellow Abstracts

Myshayla D. Bell
Clafin University
Mentor: Shikhar Mehrotra, PhD

ABSTRACT

xCT Expression in Malignant Melanoma and Normal Skin Tissue

Melanoma is a malignant tumor of the melanocytes. Melanocytes are cells that produce a dark pigment called melanin, which is responsible for the color of the skin. Melanoma can occur in any part of the body that contains melanocytes. It is less common than any other skin cancer; however, it is the most dangerous if not detected early. It causes majority (75%) of deaths related to skin cancer. Melanoma is more common in women than in men; in women the melanoma site appears more on the legs and in men the site occurs on the back. There are a few treatments to cure or slow down the cancer. These treatments include: chemotherapy, immunotherapy, radiation, and/ or surgery. Chemotherapeutic agents are used to kill cancer cells. It is usually given if the melanoma has returned or spread. An example of a chemotherapeutic agent is Dacarbazine (DTIC). Immunotherapy is used to help your immune system fight the cancer. Examples of immunotherapy include interleukins, Interferon, or Cytokines. Radiation treatments may be used to relieve pain or discomfort caused by cancer that has spread. Surgery is another option to slow down the cancer that has spread to other parts of the body. If the melanoma found early, while it is still small and thin, and if it's completely removed the chances are high.

xCT is a glutamate/ cystine transporter that allows the cells to bypass the G1 / S arrest in the cell cycle. xCT carries out the rate of controlling the step of glutathione synthesis in cells. Also xCT is responsible for the uptake of cysteine in exchange for glutamate in most human cancer cells. The cystine/glutamate transporter consists of two components, the light chain and the heavy chain; another name for the light chain is xCT and another name for the heavy chain is CD98. The hypothesis is that xCT is overexpressed in the tumor cells and the neighboring T regulatory cells in human melanoma as compared to normal skin tissues. In the immune system, when something that is foreign attacks your body the T effector cells comes in to kill disease; but whenever a tumor is formed the T regulatory cells act as suppressor cells by regulating the T effector cells. This allows the tumor to proliferate and one possible reason is through overexpression of xCT allowing cancer cells to proliferate. xCT has been shown to be significant in the proliferation and multidrug resistance of cancer cells. Therefore, we would like to test our hypothesis that tumor cells promote the progression by allowing both tumor cells and the Treg cells to survive in the tumor environment. The proliferation of the Treg cells in the tumor environment will then allow the tumor to evade the immune system.

Jasmine Fox
South Carolina State University
Mentor: Erika Brown, PhD

ABSTRACT

IRS 1 Modulation of the DNA Repair Protein RAD51 in Cancer

An appreciable number of African-American women are diagnosed with both breast cancer and metabolic syndrome (such as Type I/Type II diabetes). And, it is imperative to determine the molecular basis for this correlation. Moreover, African-American (AA) women are disproportionately diagnosed with Triple Negative Breast Tumors (TNBTs) (cells lack expression of estrogen, progesterone and Her2 receptors) at a significantly higher rate than Caucasian (CA) women. Approximately 25% of AA women diagnosed with breast cancer will have the TNBT classification, compared to only 11% of Caucasians (CA). The focus of this study was to determine the role of the DNA repair protein RAD51 in TNBT progression and in the relationship between breast cancer and metabolic syndrome. TNBT tumors generally express mutated BRCA1, which mediates the ability of RAD51 to effectively repair double-strand DNA breaks. Furthermore, IRS 1 (insulin receptor substrate 1) in the IGF (Insulin Growth Factor) insulin signaling pathway attenuates the nuclear translocation of RAD51 into the nucleus to repair damaged DNA—and BRCA1 regulates the transcription of IRS 1. Therefore, RAD51 appears to be the common protein in the breast cancer and metabolic syndrome pathways and deregulation of RAD51 may contribute to the dual diagnosis of both conditions. In the study, we have quantified IRS 1 expression and activity, and its effect on RAD51 expression and DNA repair activity in breast cancer cell lines mimicking TNBT status and having mutated BRCA1. These observations have been performed before and after induction of DNA damage. The preliminary results imply that mutated BRCA1 and estrogen receptor negative cells have inefficient DNA repair, which has known implications on cancer progression, but may also influence metabolic syndrome. Therefore, RAD51 could potentially be the common protein linking the dual diagnosis of both breast cancer and metabolic syndrome.

Claudia Thompson
South Carolina State University
Mentor: Danyelle Townsend, PhD

ABSTRACT

Targeting Protein Folding as a Therapeutic Strategy in Prostate Cancer

S-glutathionylation is the post translational modification of the protein cysteine and this modification is often triggered by oxidative and nitrosative stress on cells. Oxidative and nitrosative stress cause reactions that often time alter protein structures which in turn causes an interference of normal body functions. Protein disulfide isomerase (PDI) is the most abundant isomerase in the endoplasmic reticulum (ER) of cancer cells and it is very important for protein folding. When using targeted drug therapy the idea is to pick a target that is more abundant or only found in cancer cells, so PDI is an ideal target because of its abundance. PDI inhibitors are used as the target drug because they block PDI from doing its job in the cells. PDI inhibitors cause stress on the cells which causes the cysteine residues of PDI to be S-glutathionylated, which reduces isomerase activity. Without PDI assisting in the folding and unfolding of proteins there is an increase in the number of unfolded proteins and an activation of the unfolded protein response (UPR). The activation of UPR will then lead to UPR induced cell death, therefore killing the cancer cell. This mechanism is thought to work with all cancers including prostate cancer (PC), which is the topic of interest for my research. PC is one of the most common cancers in American men as the chance of having it increases with age. Despite its high rate of incidence PC has a rather low rate of mortality because most cases of PC are slow growing and not very aggressive. The PC-3 cells that were used in the study were collected from a bone metastasis of grade four cancer from a Caucasian male 62 years of age. During the study we treated the PC-3 cells with two different PDI inhibitors (drugs), PABA/NO and PAO. We treated the cells with various concentrations of the two drugs and used MTT drug assays to determine the toxicity of the drugs and we also used western blots to detect the levels of PDI in the cells.

ABSTRACT

Cancer Epigenetics: Combining LSD1 and DNA methylation inhibitors for targeted cancer treatment

- Based on all the background information, a proposal that the LSD1 inhibitors will decrease cancer cell growth in breast cancer tissue cells
- Also, based on the epigenetics, the introduction of a DNA methylation inhibitor in combination with the LSD1 inhibitor will yield a greater outcome in reducing cancer cell growth in the breast cancer cells
 - Cell adaption

Hypothesis

- Cell growth was inhibited in the presence of the LSD1 inhibitor, as well as in the DNA methylation inhibitor as well
- In the combination plates, specifically for the MDA-MB-231 cells, a great decrease was shown
- The MCF7 cells, however, did not have the same trend; there was a higher decrease in cell growth in the BP-107-15 drug alone versus the cells containing both drugs
 - There is little to no change in 5-AC aspect
- The results show us, also, that all cell lines are different
- MCF7 are ER+ and the MDA-MB-231 are ER-; in this case the results are great due to the fact the MDA-MB-231 cells are more tumorigenic

Conclusion

2013 Student Fellow Abstracts

Keira Addison
South Carolina State University
Mentor: Danyelle Townsend, PhD

ABSTRACT

Redox Signaling is deregulated in Cancer

Reactive Oxygen Species (ROS) releases oxidative stress in cells which disturbs cellular immunity in the body leading to an unbalanced cellular environment and cancer. Factors that influence ROS are radiation, UV exposure, other environmental factors and the mitochondria in cells. When cells have high levels of oxidative stress, there are antibodies that are released to detoxify the cells, balancing out the cellular environment. Redox signaling is the process of reducing oxidative stress through the release of antibodies and the opening of different signaling pathways. In this work we studied the differential expression of antibodies (Thioredoxin, Sulfiridoxin, GST π and Peroxiredoxin) in breast cancer (MCF-7) and normal breast cells (MCF-10) by western blots. Our results show that the antibodies are expressed more in normal cells than breast cancer cells. According to these preliminary results, redox signaling is deregulated in breast cancer cells.

Evelyn Martinez
South Carolina State University
Mentor: Steven Rosenzweig, PhD

ABSTRACT

Growth Factor Contribution to Epithelial Mesenchymal Transition

Oral cancer is ranked among the top ten most common cancers and it is estimated that more than 90% of all oral cancers are squamous cell carcinoma (OSCC). Epithelial-mesenchymal transition (EMT) is a process in which epithelial cells lose their cell adhesion, restructure the cytoskeleton, and take on a mesenchymal phenotype. It has been suggested to be an important component in cancer invasion and metastases because transformed epithelial cells take on mesenchymal-traits, such as a loss of cell adhesion, allowing them to more effectively invade nearby structures. The aim of this research is to study how overexpression of the signaling proteins vascular endothelial growth factor (VEGF) and endothelial growth factor (EGF) stimulate EMT in OSCC cell lines at various time intervals. Epithelial cells express a high level of E-cadherin while mesenchymal cells express N-cadherin. Western blot analyses were conducted to determine if there was a downregulation of E-cadherin and an increase in N-cadherin expression after growth factor treatment, indicating that the cells became mesenchymal and more invasive. Western blot analysis indicated no change in either E-cadherin or N-cadherin, suggesting that VEGF does not stimulate EMT and induce migration and invasion in oral cancer cells.

Tomesha Nesbitt
Voorhees College
Mentor: Shikhar Mehrotra, PhD

ABSTRACT

The Effect of Vitamin D3 on T cell Activation and Death

Vitamin D plays an important role in the human body. It helps the body absorb the calcium and phosphate needed. In humans, the most important compounds in this group are vitamin D3 also known as cholecalciferol and vitamin D2, which is also known as ergocalciferol. Vitamin D3 stops the growth of T cells. Active T cells up regulate vitamin D and non-active T cells do not. In T cells, vitamin D expression is triggered through engagement of T cell receptor leading to activation of a mitogen- activated protein kinase pathway, and the expression of vitamin D in T cells correlates with greater T cell responsiveness. Up regulation of vitamin D, like CD69 is an early response to stimulation that occurs in T cells. Vitamin D3 stops the growth of T cells; vitamin D3 also has the ability to decrease T cell activation. Vitamin D regulates the expression of more than 900 genes involved in a wide array of physiology functions.

Sadia M. Robinson
South Carolina State University
Mentor: David P. Turner, PhD

ABSTRACT

Examining the AGE-RAGE Signaling Axis as a Mechanism of Prostate Cancer Disparity

Nationally, African American prostate cancer patients are two and a half times more likely to die of prostate cancer than their European counterparts. However in the State of South Carolina, minority African Americans are three times more likely to die from prostate cancer. It is now apparent that a racial disparity in cancers exists due to molecular variances in tumor biology as well as consequence of stress, socioeconomic and environmental problems.

Glycation is the non-enzymatic glycosylation of sugar moieties to macromolecules which produces vastly reactive metabolites known as advanced glycation end products (AGE's). Elevated AGE levels drive the serious complications observed in diabetes and Alzheimer's patients and AGE's are now emerging as possible intermediaries of cancer. Cancer and dietary sugars are possible mechanisms of cancer health disparities because of associated biological and socioeconomic links. Research studies have been found that lack of exercise and high fat and sugar filled diets aid greatly to the aid of AGE pools. Foods containing abundant AGE's promote obesity and men who are obese are more likely to die because of prostate cancer than thinner men. A higher proportion of African American are overweight or obese and do not exercise compared to European American men.

Harmful effects of AGE's are facilitated in part through its transmembrane receptor RAGE (receptor for advanced glycation end products) which can activate signaling cascades promoting signaling pathways such as NFkB and AKT. This increases excretion of pro-inflammatory cytokines and increases oxidative stress which both promote aggressive cancer.

2014 Student Fellow Abstracts

Casseanna Holmes
Voorhees College
Mentor: David P. Turner, PhD

ABSTRACT

Targeting RAGE Expression in Cancer

RAGE is associated with breast cancer pathways. RAGE is a transmembrane receptor for Advanced Glycation End products (AGEs). AGEs are proteins or lipids that become non-enzymatically glycosylated and oxidized. RAGE is a receptor found on the surface of a cell that can be bound by AGEs. This leads to the activation of signal transduction pathways that cause inflammation associated with many diseases including cancer. Inflammation is a sign associated before the onset of cancer and after. RAGE expression is incremented in many tumor types including breast. We examined RAGE in MCF7 cells after using shRNA viruses to knock down RAGE. That will allow us to provide initial evidence that the transmembrane receptor RAGE promotes cancer associated pathways in breast cancer. We reduced the expression of RAGE using lentiviral mediated shRNA in MCF7 breast cancer cell lines. We confirmed the loss of expression of RAGE using Real Time PCR analysis (mRNA) and Western blot (Protein). We used a colorimetric sulforhodamine B (fluorescent dye) growth assay to examine the ability of MCF7 breast cancer cell lines to grow with reduced RAGE expression.

When examined by real time PCR we saw successful reduction of RAGE mRNA in the 165,528 and 963 clones, but saw increase mRNA expression in 572 and 878 clones. When examined by the western blot we saw that shRNA virus successfully reduced RAGE protein expression using the 582,528,963 and 878 clones. There was a total knock down of RAGE in the four clones. The data supports that RAGE was successfully knocked down in the MCF7 cells and that RAGE is associated with pathways of breast cancer.

Franshawn Mack
South Carolina State University
Mentor: Marvella E. Ford, PhD

ABSTRACT

Evaluating the Prevalence of Overweight/Obesity and Physical Activity in a Diverse Sample of South Carolina Cancer Survivors

BACKGROUND: High body mass index (BMI) is linked to poorer survival after breast cancer diagnosis. Physical activity (PA) could moderate this association.

OBJECTIVES/HYPOTHESIS: Prevalence of high BMI (overweight/obesity) and level of PA were evaluated in a statewide sample of women within 18 months of breast cancer diagnosis.

METHODS: In an ongoing study, 73 women (35 EA and 38 AA) were identified through the SC Central Cancer Registry, and were interviewed to obtain their self-reported body weight, height, PA and other data.

RESULTS: *Age:* Age ranged from 26 to 90 years (mean 61 years, SD 13.0), with AAs 2.1 years younger than EAs ($p=0.49$). *Education:* 62% had more than a high school (HS) diploma (58% of AAs and 66% of EAs, $p=0.49$). *BMI:* 77% were overweight/obese; 42% of AAs and 31% of EAs were overweight, 45% of AAs and 34% of EAs were obese ($p=0.03$). *PA:* 23% reported no PA (29% of AAs and 17% of EAs, $p=0.23$). Only 38% met CDC PA guidelines of at least 150 min/week of moderate PA (29% of AAs and 47% of EAs; $p=0.11$). *PA and BMI:* PA <90 min/week was associated with 4-fold higher risk of overweight/ obesity ($p=0.023$). No significant associations were seen by race. *PA and Education:* No significant association was observed between >HS education and meeting PA guidelines ($p=0.15$), or between >HS education and greater PA per week ($p=0.57$). *Education and BMI:* No significant association was seen ($p=0.77$).

CONCLUSIONS: Prevalence of overweight/obesity was high, especially among AAs.

FUTURE RECOMMENDATIONS: It is imperative to identify strategies to reduce obesity/overweight in BRCA survivors.

Jagreet Singh
Clafin University
Mentor: Shikhar Mehrotra, PhD

ABSTRACT

Antioxidant Capacity of MDSCs: Potential Target For Immunotherapy

Myeloid-derived suppressor cells (MDSCs) are present in most cancer patients and are potent inhibitors of T-cell-mediated anti-tumor immunity. Their inhibitory activity is attributed to production of an array of immunosuppressive cytokines and reactive oxygen species (ROS). Given that ROS are highly detrimental and can induce apoptosis to variety of cells including T cells, it is still obscure how MDSCs resist the oxidative stress mediated death in oxidative tumor microenvironment. To gain insight into the mechanism of how MDSCs withstand oxidative insult, MDSCs were generated from bone marrow cells and characterized them using flow cytometry. The expression of various genes associated with anti-oxidant potential of the cells was evaluated in MDSCs using real time PCR. The data suggest that bone marrow cells differentiated to MDSCs mimic the characteristic of tumor derived MDSCs and suppress the proliferation of T cells in vitro suppression assay. We also observed that MDSCs have very high surface expression of glutamate-cystine transporter (xCT) which has been shown to transport cysteine inside the cells and thus maintain high intracellular glutathione (GSH) level, an important anti-oxidant of the cells. Our study indicate that selective apoptosis can be induced in MDSCs by inhibiting xCT which in turn deplete GSH level by limiting the availability of cysteine. Thus the present study opens up a new avenue of overcoming tumor microenvironment induced suppression of anti-tumor T cells response by targeting MDSCs by targeting its anti-oxidant status.

Khaalida Poindexter
South Carolina State University
Mentor: Victoria J. Findlay, PhD

ABSTRACT

miRNA-510 as a Non-Invasive Biomarker in Cancer

Breast cancer is a very diverse disease that can be classified into different subtypes based on the expression of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). These receptors are not present in a subtype known as triple negative breast cancer (TNBC), making it resistant to targeted therapies against these receptors; therefore cytotoxic chemotherapy remains the standard of care for these patients. Cisplatin is a chemotherapeutic agent that is being investigated for treating TNBC patients, however not all patients respond to cisplatin. Therefore it is important to identify potential biomarkers to differentiate sensitive patients to help improve treatment outcome for this aggressive subtype of breast cancer. MicroRNAs (miRNA) are small, non-coding RNA involved in post-transcriptional gene regulation and dysregulation of miRNAs has been shown to be involved in cancer. Drug cytotoxicity data have shown that miR-510 overexpression increases sensitivity to cisplatin in in vitro breast cancer cell lines, as well as in vivo. MicroRNAs can be detected in many biological fluids, including serum samples; therefore miR-510 may be a potential non-invasive biomarker to help predict response to the cisplatin in TNBC patients. Quantitative PCR analysis of mouse serum and tumor RNA showed that serum expression of miR-510 positively correlates with its matched tumor expression and may be a potential, non-invasive biomarker of cisplatin sensitivity in TNBC.

Appendix E: Academic Accomplishments to Date of the 2012-2015 Student Fellows

Year of Program Participation: 2012

These are Student Fellows who participated in the 2012 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program.

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|---|---|------------------------------|--|---|--|
| Ms. Myshayla Bell Claflin University | Mentor: Shikhar Mehrotra, PhD Research Project: Overexpression of an Antigen in Melanoma Tumors and the Surrounding T Regulatory Cells using Immunohistochemistry | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program | Has not taken the GRE. | Graduated from Claflin University May 2015 |
| Ms. Jasmine Fox (Dual Year Participant 2012/2013) SC State University | Mentor: Erika T. Brown, PhD Research Project: The Role of RAD51 in Triple Negative Tumor Progression/Relationship Between Cancer and Metabolic Syndrome | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate 2012 Perry Halushka Student Research Day | Has not taken the GRE. Took the MCAT in 2013 | Accepted to Georgetown University |
| Ms. Claudia Thompson (Dual Year Participant 2011/2012) SC State University | Mentor: Danyelle Townsend, PhD Research Project: The Effects of PDI Inhibitors on S-Glutathionylation in Prostate Cancer Cells | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program | Has taken the GRE | Enrolled in a Master of Science Degree in Transportation (MST) at SC State University. |
| Ms. Britney White Claflin University | Mentor: Patrick Woster, PhD Research Project: Cancer Epigenetics: Using MTS Assays to determine cytotoxicity in drugs containing LSD1 and DNA methylation inhibitors | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program 2013 July - Oral Presentation at Claflin University Summer Symposium 2014 Feb - Second place Oral Presentation at Emerging Researchers National Conference in STEM, Washington DC. | Took the GRE in September 2014 | Accepted into the Masters in Biotechnology Program at Claflin University |

Year of Program Participation: 2012 (Continued)

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|---|---|--|---|------------------------|---|
| Ms. Sylvia Bridges SC State University | Mentor: Victoria Findlay, PhD Research Project: The Effects of MiRNA on Prostate Cancer | Department of Defense (SE VIEW) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program | Has taken the GRE | Currently enrolled in a Doctor of Chiropractic Program at Life University in Marietta, GA |
| Ms. Laila Green Claflin University | Mentor: Marvella E. Ford, PhD Research Project: Improving Perceptions of Cancer Clinical Trials in South Carolina | Department of Defense (SE VIEW) | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program | Has not taken the GRE | Graduated from Claflin University in 2014 |
| Ms. Deidra White SC State University | Mentor: Dave P. Turner, PhD Research Project: Implications of DNA Glycation Affecting Correlation of Racial Disparities in Prostate Cancer | National Institutes of Health/ National Cancer Institute | Publication: No publications to date Presentation: 2012 MUSC Summer Undergraduate Research Program | Has not taken the GRE. | Graduated from SC State University in 2015 |

Year of Program Participation: 2013

❖ These are Student Fellows who participated in the 2013 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program. Therefore it may be too early to report additional accomplishments at this time for some individuals. Many accomplishments are expected to occur during the course of the next few years following their participation.

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|--|--|--|---|---|---|
| Ms. Keira Addison SC State University | Mentor: Danyelle Townsend, PhD Research Project: Redox Signaling is deregulated in Cancer | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Has not taken the GRE | Still enrolled at SC State University. Expected to graduate in 2016 |
| Ms. Evelyn Martinez SC State University | Mentor: Steven Rosenzweig, PhD Research Project: Growth Factor Contribution to Epithelial Mesenchymal Transition | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Took the GRE in 2015 | Graduated from SC State University. |
| Ms. Tomesha Nesbitt Voorhees College | Mentor: Shikhar Mehrotra, PhD Research Project: The Effect of Vitamin D3 on T cell Activation and Death | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Took the MCAT in 2014 | Applied to MUSC and USC School of Medicine |
| Ms. Sadia Robinson SC State University | Mentor: Dave P. Turner, PhD Research Project: Examining the AGE-RAGE Signaling Axis as a Mechanism of Prostate Cancer Disparity | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Took the GRE in 2014 | Accepted to the University of South Florida |
| Ms. Bobbie Blake (Dual Year Participant 2013/2014) Claflin University | Mentor: Jennifer Wu, PhD Research Project: NKG2D Signaling Pathways Analysis | Department of Defense (SE VIEW) | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Has not taken the GRE | Still enrolled at Claflin University |
| Ms. Jasmine Fox (Dual Year Participant 2012/2013) SC State University | Mentor: Victoria Findlay, PhD Research Project: MiR-204 Negative Regulation of IGF2R as a Mechanism Driving Breast Cancer Disparity | National Institutes of Health/ National Cancer Institute | Publication: No publications to date Presentation: 2013 MUSC Summer Undergraduate Research Program | Has not taken the GRE. Took the MCAT in 2013 | Accepted to Georgetown University |

Year of Program Participation: 2013 (Continued)

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|--|--|--|--|-------------------------------|--|
| <p>Ms. Franshawn Mack (Dual Year Participant 2013/2014)</p> <p>SC State University</p> | <p>Mentor: Marvella E. Ford, PhD</p> <p>Research Project: Evaluating the Reliability of an Instrument Assessing Cancer Clinical Trial Perceptions in a Predominantly African American Sample in South Carolina</p> | <p>Department of Defense (SE VIEW)</p> | <p>Publication: No publications to date</p> <p>Presentation: 2013 MUSC Summer Undergraduate Research Program</p> <p>Poster presented at the Sixth American Association for Cancer Research Conference: The Science of Cancer Health Disparities in Ethnic Minorities and the Medically Underserved, December 6-11, 2013, Atlanta, GA.</p> <p>Southeast Regional Research Conference in Little Rock, Arkansas on November 15-17, 2013 (oral presentation)</p> <p>Honors: Awarded a 2013-2014 South Carolina State University Achievers Scholarship for \$4,888</p> | <p>Has not taken the GRE.</p> | <p>Still enrolled at SC State University</p> |

Year of Program Participation: 2014

These are Student Fellows who participated in the 2014 DOD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program. Therefore it may be too early to report additional accomplishments at this time for some individuals. Many accomplishments are expected to occur during the course of the next few years following their participation.

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|---|---|--|--|----------------------------------|--|
| Ms. Casseanna Holmes Voorhees College | Mentor: David P. Turner, PhD Research Project: Targeting RAGE Expression in Cancer | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2014 MUSC Summer Undergraduate Research Program | Has taken the GRE | Accepted into Pharmacy School at Campbell University |
| Ms. Franshawn Mack (Dual Year Participant 2013/2014) SC State University | Mentor: Marvella E. Ford, PhD Research Project: Evaluating the Prevalence of Overweight/Obesity and Physical Activity in a Diverse Sample of South Carolina Cancer Survivors | Department of Defense (HBCU) | Publication: Ford et. al., Evaluating the reliability of the Attitudes to Randomized Trial Questions (ARTQ) in a predominantly African American sample. SpringerPlus. 2015. 4:411 Presentation: 2014 MUSC Summer Undergraduate Research Program Honors: Awarded a Central Carolina Community Foundation Links Scholarship \$500 Awarded a Estelle Jones Memorial Scholarship \$1000 MG James Russo Scholarship \$2300 | Took the GRE in Fall 2015 | Graduated SC State University in Fall 2015 |
| Ms. Khaalida Poindexter SC State University | Mentor: Victoria Findlay, PhD Research Project: miRNA-510 as a Non-Invasive Biomarker in Triple Negative Cancer | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2014 MUSC Summer Undergraduate Research Program | Has not yet taken the GRE | Still enrolled at SC State University |
| Mr. Jagreet Singh Claflin University | Mentor: Shikhar Mehrotra, PhD Research Project: Antioxidant Capacity Of MDSCs: Potential Target For Immunotherapy | Department of Defense (HBCU) | Publication: No publications to date Presentation: 2014 MUSC Summer Undergraduate Research Program | Took the DAT in 2015 | Graduated in May 2015 |
| Ms. Bobbie Blake (Dual Year Participant 2013/2014) Claflin University | Mentor: Victoria Findlay, PhD Research Project: miR-204 mediated negative regulation of Cav1 as a mechanism driving breast cancer disparity | National Institutes of Health/ National Cancer Institute | Publication: No publications to date Presentation: 2014 MUSC Summer Undergraduate Research Program | Took the GRE in the Fall of 2013 | Accepted into the Masters in Biotechnology Program at Claflin University |

Year of Program Participation: 2014 (Continued)

| Student Name | Summer Research Project | Funding Source | Publications, Presentations and Honors | GRE Status | Graduate School Admission |
|--|--|-----------------------------|---|-------------------|---|
| Mr. Jamie Lyons SC State University | Mentor: Bartholomeus Smits, PhD Research Project: Genetic elements associated with breast cancer susceptibility in women of African American and European Descent | MUSC Hollings Cancer Center | Publication: No publications to date Presentation: 2014 MUSC Summer Undergraduate Research Program | Plans to take GRE | Graduated from SC State University May 2015 |

Appendix F: Peer-reviewed Manuscript Describing the Design of the Training Program and Tangible Products

Mentoring Strategies and Outcomes of Two Federally Funded Cancer Research Training Programs for Underrepresented Students in the Biomedical Sciences

Marvella E. Ford¹ · Latecia M. Abraham² · Anita L. Harrison³ · Melanie S. Jefferson⁴ · Tonya R. Hazelton⁵ · Heidi Varner⁶ · Kimberly Cannady⁶ · Carla S. Frichtel⁷ · Omar Bagasra⁸ · Leroy Davis⁹ · David E. Rivers¹⁰ · Sabra C. Slaughter¹¹ · Judith D. Salley¹²

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Abstract The US is experiencing a severe shortage of underrepresented biomedical researchers. The purpose of this paper is to present two case examples of cancer research mentoring programs for underrepresented biomedical sciences students. The first case example is a National Institutes of Health/National Cancer Institute (NIH/NCI) P20 grant titled “South Carolina Cancer Disparities Research Center (SC CaDRe)” Training Program, contributing to an increase in the number of underrepresented students applying to graduate school by employing a triple-level mentoring strategy. Since 2011, three undergraduate and four graduate students have participated in the P20 SC CaDRe program. One graduate student published

a peer-reviewed scientific paper. Two graduate students (50 %) have completed their master’s degrees, and the other two graduate students will receive their degrees in spring 2015. Two undergraduate students (67 %) are enrolled in graduate or professional school (grad./prof. school), and the other graduate student is completing her final year of college. The second case example is a prostate cancer-focused Department of Defense grant titled “The SC Collaborative Undergraduate HBCU Student Summer Training Program,” providing 24 students training since 2009. Additionally, 47 students made scientific presentations, and two students have published peer-reviewed scientific papers. All 24 students took a

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GRE test preparation course; 15 (63 %) have applied to graduate school, and 11 of them (73 %) are enrolled in grad./prof. school. Thirteen remaining students (54 %) are applying to grad./prof. school. Leveraged funding provided research-training opportunities to an additional 201 National Conference on Health Disparities Student Forum participants and to 937 Ernest E. Just Research Symposium participants at the Medical University of South Carolina.

Keywords Triple-level mentoring strategy · Mentoring programs · Outcomes · Diversity · Underrepresented minority students · Biomedical sciences · Cancer research training programs · Education

Introduction

The US is currently experiencing a shortage of biomedical research scientists. This shortage is experienced most dramatically among diverse populations, where young adults are not entering science, technology, engineering, and mathematics (STEM) careers at significant rates. Diversity in this case refers to young adults who are racially and ethnically diverse, from rural areas, and from low socioeconomic-position backgrounds [1]. Since 2000, the percentage of underrepresented minorities receiving degrees in engineering and the physical sciences has been flat, and participation in mathematics has dropped [1, 2].

Compounding these problems, the demand for cancer prevention, screening, and treatment services will grow over the next two decades as the proportion of older adults in the USA increases, leading to an anticipated 45 % rise in the number of new cancer cases by 2030 [2]. To improve outcomes from the growing cancer problem, investigators must understand the science behind the disease.

Given the potential for dramatic workforce shortages due to the reasons mentioned above, it is imperative to leverage strategies to enhance the scope and diversity of the next generation of cancer researchers and physician scientists. As noted by the Institute of Medicine [3], greater diversity among medical researchers and physicians leads to improved access to care among racially and ethnically diverse patients, greater patient choice and satisfaction, improved patient-provider communication, and better educational experiences for biomedical students during their training [4–6].

A landmark review [7] noted that African Americans are 10 % less likely than European Americans to receive NIH R01 funding, a marker of independent investigator status, even after controlling for demographic characteristics, education and training, and research productivity, among other measures. Increasing the number of diverse investigators who are well-trained in the traditional methodological and analytic

principles of research is a critical step toward successfully increasing capacity in cancer health equity research.

The purpose of this paper is to present two case examples of undergraduate student mentoring programs. The case examples are drawn from two federally funded cancer research training grants for underrepresented populations in the biomedical sciences. The first case example is a National Institutes of Health/National Cancer Institute (NIH/NCI) P20 grant titled “South Carolina Cancer Disparities Research Center (SC CaDRe).” The second case example is a prostate cancer-focused Department of Defense grant titled “The South Carolina Collaborative Undergraduate HBCU Student Summer Training Program.” The Student Fellows in the NIH/NCI P20 SC CaDRe and the DoD-funded summer research programs are all students who have racial/ethnic backgrounds that are underrepresented in biomedical and biobehavioral research. The design and outcomes of each program will be highlighted. The unintended consequence of leveraging funds through the programs will also be described.

Methods

Case Example 1. NIH/NCI P20 SC CaDRe Grant

Purpose The South Carolina Cancer Disparities Research Center (SC CaDRe) is a formal collaboration between the Medical University of South Carolina (MUSC) and South Carolina State University (SCSU). The primary goal of SC CaDRe is to create a critical mass of well-trained faculty researchers between the two institutions who conduct disparity-focused feasibility studies and obtain preliminary data that leads to further extramural funding. A secondary goal of SC CaDRe is to enhance the racial and ethnic diversity of emerging scientists at all levels. The Student Fellows’ summer undergraduate research training program is part of the larger scope of activities that are conducted under the auspices of the NIH/NCI P20 SC CaDRe.

Recruitment Pool Undergraduate students at a local historically black university (Student Fellows) are given financial support to participate in SC CaDRe. Minority status is not an eligibility criteria to become a SC CaDRe-supported Faculty and Student Fellow, but the SC CaDRe leadership give priority to minority applicants, based on the following input from the NIH Slavkin Report: [8]

“While it is clear that a researcher need not come from a minority or disadvantaged background to contribute to the understanding and remediation of health disparities, it is reasonable to expect that such individuals as a group would possess greater motivation, persistence, familiarity, sensitivity, and insight into this problem. Therefore,

effective recruiting efforts should tap into this talent pool and focus on bringing underrepresented groups into biomedical research.”

Recruitment Strategies At the beginning of each spring semester, the investigators identify a pool of potential undergraduates at the advanced undergraduate level (sophomores who have taken advanced science classes, juniors, and seniors). Potential Student Fellows are required to have at least a 3.0 grade point average (GPA). The investigators interview prospective students and select the top candidates based on the interviews, transcripts, letters from the students’ academic advisors, and the candidates’ interest or desire to conduct prostate or breast cancer research. Based on this process, two Student Fellows are selected per year. Upon acceptance into the P20 SC CaDRe, the Student Fellows are also accepted into a broader summer undergraduate research training program which is integrated with a SC CaDRe-specific training curriculum in prostate and breast cancer research.

Mentoring Strategy Protected one-on-one time with a research mentor is a crucial aspect to research career growth and development. To identify potential mentors, the graduate faculty database is reviewed. All potential mentors are sent an e-mail message to publicize the opportunity to become a research mentor. The SC CaDRe’s Student Fellows conduct mentored pilot research. Each mentoring team includes a senior cancer researcher from MUSC (individuals with existing NIH or other federal funding in breast and prostate cancer research), a junior faculty member from SCSU, a junior faculty member from MUSC (junior investigators with no NIH funding), graduate students from MUSC, and Student Fellows from SCSU. To optimize the research mentoring strategy, the SC CaDRe employs a *triple-level mentoring strategy* (as shown in Fig. 1) in which the senior cancer researchers mentor junior faculty, junior faculty mentor graduate students, and graduate students mentor the Student Fellows. To accomplish the goals of the SC CaDRe, the Center adopts/adapts a number of existing interactive research training efforts at both MUSC Hollings Cancer Center (HCC) and SCSU as well as developing new initiatives. All SC CaDRe-supported Student Fellows participated in these year-round activities. The SC CaDRe-supported Student Fellows each begin participating in the summer as part of the summer undergraduate research

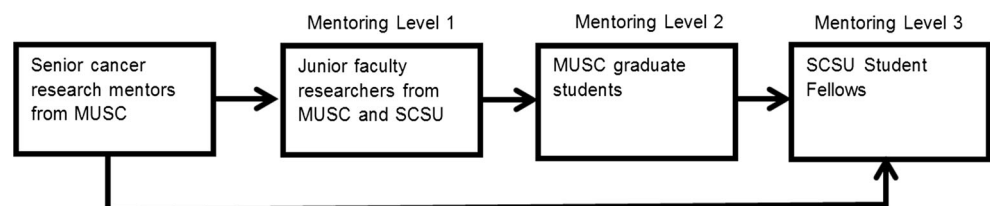
program and then continue through the fall and spring semesters by participating in the following activities:

- SC CaDRe Visiting Scholars—nationally renowned cancer disparities researchers spend a day at MUSC to give presentations and meet with Student Fellows.
- HCC Annual Spring Research Symposium—thematic research conferences are presented such as “Cancer Disparities: Scope of the Problem and Steps Toward the Solutions,” and participants come from around the state, including SCSU.
- HCC Annual Research Retreat—each fall, the HCC hosts a center-wide research retreat where Student Fellows have showcased their research via poster presentations
- Perry V. Halushka Student Research Day—the Perry V. Halushka MUSC Student Research Day is held annually. The SC CaDRe Student Fellows participated in this event, many as oral presenters, an honor that is typically given to graduate students.
- Training in the Responsible Conduct of Research—Student Fellows were required to complete the MUSC Collaborative Institutional Review Board (IRB) Training Initiative (CITI) online program in the responsible conduct of science and ethics and a 4-day Biomedical Ethics class that meets for 2 h per day during the summer.

Case Example 2. Department of Defense-funded South Carolina Collaborative Undergraduate HBCU Student Summer Training Program

Purpose The Medical University of South Carolina (MUSC) and three historically black colleges/universities (HBCUs)—Claflin University (CU), SCSU, and Voorhees College (VC)—are continuing to collaborate under the larger auspices of the South Carolina Cancer Health Equity Consortium (SC CHEC) on the Department of Defense Collaborative Undergraduate HBCU Student Summer Training Program in prostate cancer research. Since the grant’s inception, 24 students (“Student Fellows,” 4 each summer) have participated in a 10-week program of laboratory rotations and weekly research discussions. The Student Fellows also participate in a twice-weekly, 1-h Prostate Cancer Health Equity Research Course. The course lectures span the spectrum from basic science to clinical science to population sciences. The course includes an

Fig. 1 P20 SC CaDRe Triple-Level Research Mentoring Strategy



introduction to the Sea Island/Gullah population of South Carolina, which is a culturally distinct group of blacks, and one of the most genetically homogeneous in the USA. To date, the Student Fellows have given 47 scientific presentations, and two Student Fellows have written peer-reviewed publications, based on their summer research projects. The ultimate goal of the Training Program is to increase the diversity of emerging scientists who may choose prostate cancer research careers in the basic, clinical, and population sciences.

Recruitment Pool At the beginning of each spring semester, the Training Program Director and Associate Program Directors along with the HBCU Faculty Advisors identify a pool of potential Student Fellows at the advanced undergraduate level (sophomores who have taken advanced science classes, juniors, and seniors). During the past 5 years, the four collaborating institutions have worked closely to advertise inter-institutional research training opportunities. Student Fellows are recruited from the large population of enrolled students at CU, SCSU, and VC. The demographic characteristics of students from each institution for the 2013–2014 academic year who are enrolled in biomedical programs in science, technology, engineering, and mathematics (STEM programs) in each of the three collaborating HBCUs are listed in Table 1, which show the depth of the pool from which the Student Fellows are recruited. Only students who have completed their sophomore or junior year of college are eligible to participate in the Training Program.

Selection of Student Fellows Eligibility criteria for the training program include the following: (1) a written statement of career goals related to biomedical research and interest in cancer research; (2) greater than or equal to a 3.0 GPA based on their official transcripts; and (3) two letters of recommendation from faculty at students' home institutions with at least one from a science course instructor. The program leaders evaluate each applicant, based on these review criteria to determine the top candidates. A scoring algorithm is used so that candidates can be ranked objectively. If an additional level of review is required, they conduct interviews to make the final selections. Priority is given to applicants with backgrounds that are underrepresented in the biomedical sciences. The

denominator typically includes approximately 15–20 students. Based on this process, four Student Fellows are chosen each year (ideally, at least one per institution).

Recruitment Strategies During the past 5 years, the four institutions have worked closely to advertise inter-institutional training opportunities, and there are standing protocols in place for advertising summer training opportunities at MUSC through list services, campus newspapers, class announcements, and available packets for each of the faculty advisors to distribute to promising candidates. As an additional recruitment strategy, former Student Fellows are asked to serve as a referral source for interested students, participate in the interview process, and become informal mentors for incoming Student Fellows.

Research Projects and Didactic Training In the Prostate Cancer Health Equity Research Course, each Student Fellow engages in a short-term laboratory prostate cancer research project. This activity is based on the philosophy that a meaningful engagement, involving hands-on applied experiences in a laboratory or research setting with an accomplished cancer researcher will be the most critical catalyst in igniting students' commitment to a biomedical science career. Student Fellows spend up to 35 h per week, earning 15 credits toward graduation, in the laboratory or research offices of an MUSC-based Research Mentor. Guided by the interests expressed by students in their applications, the Leadership Group matches each selected Student Fellow with an appropriate Research Mentor. The Research Mentors shape the Student Fellows' summer experiences to ensure tangible outcomes—presentation of data results (preliminary or final) and submission of scientific abstracts and papers for peer review. Student Fellows are involved in laboratory techniques, data collection and analytic methods, interviewing techniques, data interpretation, and summarizations of results.

Four Student Fellows per year participate in an enriched 10-week summer course that includes an introduction to cancer disparities research, journal clubs, and take-home tests. The Training Program has also been broadened to encompass additional exposure to biomarker development, genetics, survivorship issues, and developmental therapeutics through

Table 1 Demographic characteristics of Biomedical Sciences STEM students in the three collaborating HBCUs

| Institution | No. of undergraduates | No. of undergraduates declaring STEM majors | Demographic characteristics of STEM students in the 2013–2014 academic year | | | | | |
|-------------|-----------------------|---|---|--------|----------------|--------------|-----|-------|
| | | | Gender | | Race/ethnicity | | | |
| | | | Male | Female | AA | Hisp./Latino | EA | Other |
| CU | 1886 | 396 | 37 % | 63 % | 96 % | 1 % | 2 % | 1 % |
| SCSU | 3195 | 909 | 53 % | 47 % | 91 % | 2 % | 5 % | 2 % |
| VC | 533 | 38 | 44 % | 56 % | 100 % | 0 % | 0 % | 0 % |

shadowing experiences in the MUSC Hollings Cancer Center’s (HCC’s) clinics, shared resources/cores, and greater interaction with the Sea Island/Gullah population of South Carolina.

Mentoring Program MUSC faculty Research Mentors each commit to providing summer laboratory research training (up to 35 h/week) for 1–2 students each summer in this enhanced comprehensive prostate cancer research training program. This mentoring pool is continuously deepening with ongoing faculty recruitment efforts, including current searches for endowed chair-level positions in prostate cancer research. Also, the MUSC HCC has developed formal workgroup meetings in prostate cancer, bringing together clinical, basic, and population sciences researchers. At the end of the 10-week summer research period, each student prepares a brief written paper (6–10 pages in length) and gives an oral presentation, describing the research project that he/she worked on and preliminary and/or final research results. Given the short-term nature of the Training Program, not all Student Fellows see a research project to completion and/or publication. However, the Research Mentors give each Student Fellow a discrete research project to complete during the summer program. The Mentors also include the Student Fellows in all laboratory activities such as laboratory-specific journal clubs, maintaining laboratory notebooks and standard operation procedure manuals, research-in-progress meetings, research seminars, community engagement meetings, etc.

In addition to working with their Research Mentors, Student Fellows will actively interact with junior faculty, post-doctoral fellows, pre-doctoral students, and other scientists within each laboratory/research office. Beyond the scope of the Training Program, MUSC Research Mentors contact Student Fellows during the academic year after their summer research experience, and Student Fellows are asked to identify a mentor at their home institution to continue to promote their journey toward graduate school admission.

Results

As part of the evaluation of the cancer education training program, summative and formative data are collected. The summative data include the number of students who apply to graduate or professional school, make scientific presentations, publish peer-reviewed scientific papers, and enroll in graduate or professional school. Formative data include the perceptions of the program, as indicated in the Student Fellows’ testimonials that are included in the Appendix.

Outcomes from Case Example 1. NIH/NCI P20 SC CaDRe Grant

As shown in Table 2, the P20 SC CaDRe cancer research training grant has led to numerous scientific presentations by the students who have participated in this funding mechanism. In addition, 3 (100 %) of the undergraduate Student Fellows who have participated in this training mechanism have taken a grant-sponsored GRE test preparation course, and 2 (67 %) have successfully enrolled in graduate school.

In addition to the training outcomes related to the Student Fellows, to date, the SC CaDRe has facilitated the award of two research project grants—R21 CA176135: Glycation as a Mechanism Promoting Cancer Disparity and R01 MD005892: Improving Resection Rates among African Americans with NSCLC, as well as an NIH/NCI Diversity Supplement to support an underrepresented doctoral student: 3P20 CA157071-03S1 SC Cancer Disparities Research Center in Prostate and Breast Cancer (SC CaDRe) Diversity Supplement.

Outcomes from Case Example 2. DoD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program

As shown in Table 3, the 24 undergraduate Student Fellows who have participated in the DoD SC Collaborative

Table 2 Academic outcomes of the NIH/NCI P20 SC CaDRe Grant

| | 2012 | | 2013 | | 2014 | | Total |
|---|-----------------|------------|-----------------|------------|-----------------|------------|-------|
| | Undergrad (N=1) | Grad (N=1) | Undergrad (N=1) | Grad (N=1) | Undergrad (N=1) | Grad (N=2) | |
| No. of scientific presentations given by Student Fellows | 1 | 0 | 4 | 3 | 4 | 3 | 15 |
| No. of publications by Student Fellows | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| No. of students who took the GRE test preparation course | 1 | 0 | 1 | 0 | 1 | 0 | 3 |
| No. of students who applied/applying to Graduate School | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| No. of students who enrolled in Graduate School | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| No. of students who applied/applying to Professional School | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| No. of students who enrolled in Professional School | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

Table 3 Academic outcomes of the DoD SC Collaborative Undergraduate HBCU Summer Training Program Grant

| | 2009 Undergrad (N=4) | 2010 Undergrad (N=4) | 2011 Undergrad (N=4) | 2012 Undergrad (N=4) | 2013 Undergrad (N=4) | 2014 Undergrad (N=4) | Total 24 |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-------------|
| No. of scientific presentations given by Student Fellows | 4 | 5 | 6 | 7 | 4 | 4 | 30 |
| No. of publications by Student Fellows | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| No. of students who took the GRE test preparation course | 4 | 4 | 4 | 4 | 4 | 4 | 24 |
| No. of students who applied/applying to Graduate School | 3 | 3 | 4 | 2 | 3 | 0 | 15 |
| No. of students who enrolled in Graduate School | 3 | 2 | 3 | 2 | 0 | 0 | 10 |
| No. of students who applied/applying to Professional School | 1 | 1 | 1 | 0 | 1 | 0 | 4 |
| No. of students who enrolled in Professional School | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

Undergraduate HBCU Student Summer Training Program in cancer research have made 47 scientific presentations. All 24 Student Fellows (100 %) took a grant-sponsored GRE test preparation course, 15 (63 %) applied to graduate school, and 11 of them (73 %) enrolled in graduate or professional school. The remaining 9 Student Fellows (38 %) are in the process of applying to graduate or professional school.

Unintended Consequences—Outcomes from Other Leveraged Funds

In addition to completing the work of the P20 SC CaDRe grant and the DoD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program, since 2011, the investigators annually have led the coordination of the Student Research Forum of the National Conference on Health Disparities (NCHD). The all-day Forum includes a poster session, oral presentations, a luncheon keynote speaker, and a roundtable discussion. The Forum also includes an interactive learning module presented by a National Library of Medicine staff member. In 2011, 54 students participated in the Student Forum during the NCHD in Charleston, SC. In 2012, 60 students participated in the Student Forum during the NCHD in Little Rock, AR. In 2013, 87 students participated in the Student Forum during the NCHD in St. Thomas, US Virgin Islands. In 2014, 66 students participated in the Student Forum during the NCHD in Long Beach, CA.

In addition to the Student Forum, since 2011, the investigators have annually contributed to the coordination of the Ernest E. Just Symposium held at MUSC each spring. Dr. Just was an early twentieth century African American embryologist who devoted his career to studying the early development of marine invertebrates.

The Symposium serves as a major vehicle to recruit underrepresented students to enroll in graduate studies at MUSC. The students receive a tour of MUSC while they are on campus for the Symposium and meet with MUSC faculty to discuss graduate research options. These faculty members could become their future research mentors. In 2011, 400 students

participated in the Symposium, representing 17 different colleges and universities, participated in the Symposium. A total of 66 students from HBCUs in SC participated in the Symposium. In 2012, 297 students participated, representing 19 different colleges, and universities. A total of 91 students from HBCUs in SC participated in the Symposium. In 2013, 240 students participated, 67 of whom were from HBCUs in SC. In 2014, 394 students participated, 56 of whom were from HBCUs in SC.

Publication Outcomes from Case Example 1. NIH/NCI P20 SC CaDRe Grant and Case Example 2. DoD South Carolina Collaborative Undergraduate HBCU Student Summer Training Program

- Ford M, Wahlquist A, Blake R, Green C, Streets J, Fuller E, Johnson E, Jefferson M, Etheredge J, Varner H, Johnson S, Glover S, Turner D, Garrett-Mayer E. Assessing an intervention to improve clinical trial perceptions among predominantly African-American communities in South Carolina. *Prog Community Health Partnerships* 2012;6:249-63.
- Ford ME, Wahlquist AE, Ridgeway C, Streets J, Mitchum KA, Harper RR Jr, Hamilton I, Etheredge JJ, Jefferson MS, Varner H, Campbell K, Garrett-Mayer E. Evaluating an intervention to increase cancer knowledge in racially diverse communities in South Carolina. *Patient Education and Counseling* 2011;83:256-60.
- Mack JT, Helke KL, Normand G, Green C, Townsend DM, Tew KD. ABCA2 transporter deficiency reduces incidence of TRAMP prostate tumor metastasis and cellular chemotactic migration. *Cancer Lett*;2010;300(2):154-61.
- Norell H, Martins da Palma T, Leshner A, Kaur N, Mehrotra M, Naga OS, Spivey N, Olafimihan S, Chakraborty NG, Voelkel-Johnson C, Nishimura MI, Mukherji B, Mehrotra S. Inhibition of superoxide generation upon T-cell receptor engagement rescues Mart-1(27-35)-reactive T cells from activation-induced cell death.

Cancer Res. 2009 Aug 1;69(15):6282-9. Epub 2009 Jul 28.

- Norell H, Zhang Y, McCracken J, da Palma TM, Leshner A, Liu Y, Roszkowski JJ, Temple A, Callendar GG, Clay T, Orentas R, Guevara-Patino J, Nishimura MI. CD34-based enrichment of genetically engineered human T cells for clinical use results in dramatically enhanced tumor targeting. *Cancer Immunol Immunother*, online publication, December 2009.

Discussion

The percentage of older adults in the population is increasing commensurately with the projected 45 % increase in cancer incidence rates [2]. Therefore, it is imperative that undergraduate research training programs are implemented to increase the number of underrepresented cancer-focused biomedical research scientists in the STEM careers. This “next generation” of cancer researchers will lead the way in developing discoveries to better treat the anticipated rising number of cancer patients in the USA.

This paper described the results of two Training Programs for underrepresented students. The first Training Program is funded by an NIH/NCI P20 SC CaDRe grant. The second Training Program, funded by the Department of Defense, is titled HBCU Student Summer Training Program. During the NIH/NCI P20 SC CaDRe and DoD-funded summer research programs, the Student Fellows receive didactic, twice-weekly instruction in the etiology of breast and prostate cancer, the genetic basis of cancer, the anatomy and function of the breast and prostate, controversies in breast and prostate cancer screening, and biostatistical and epidemiologic issues in breast and prostate cancer research, among other topics. The Student Fellows also gain hands-on experience working in the research labs/offices of leading cancer researchers in the basic, clinical, and population sciences at the Medical University of South Carolina (MUSC). In addition, the Student Fellows gain scientific presentation skills, which are required when they make presentations at local and national scientific meetings. The NIH/NCI P20 SC CaDRe and the DoD-funded summer research programs are federally funded programs that are conducted with institutional support from MUSC. This support allows the Student Fellows’ mentors and the instructors in the didactic education components of the programs to participate at no charge to the grants. In this paper, case examples for each funding mechanism were presented.

The NIH/NCI P20 SC CaDRe and the DoD-funded programs are offered during the summer only. During the academic year, the Student Fellows are invited to participate in scientific research forums at MUSC. The funding to support the students’ travel to MUSC to present their research is

provided through the grants. Funds to support the students’ travel to local and national meetings to present their research is generally provided by their home academic institutions. In addition, during the fall and spring semesters, many of the summer mentors work with their students on conference presentations and manuscript submissions. Much of this work is completed via email and teleconference.

The P20 SC CaDRe Training Program has contributed to an increase in students applying to graduate school by fostering an environment that employs the *triple-level mentoring strategy*. The triple-level mentoring strategy instills the value of keeping the pipeline alive. A major strategy in increasing the underrepresented researchers is to re-emphasize that minority researchers are expected to help aspiring student researchers to fulfill their purpose. The P20 SC CaDRe Training Program provides an opportunity for students to access mentors one-on-one and conduct cancer research. The one-on-one mentoring allows the Student Fellows to ask seasoned cancer researchers questions that they might be apprehensive of asking in front of other peers and the freedom to ask pertinent questions regarding graduate application and research tips can only benefit Student Fellows’ progress. In addition, Student Fellows have the opportunity to feature the results at the HCC Annual Spring Research Symposium, Perry Halushka Student Research Day, and the Student Research Forum for the National Conference on Health Disparities. The Student Fellows’ participation in symposiums allows them to interact with senior cancer researchers and their student peers and provides an opportunity to gain additional mentors, which could lead to future internships and/or research/grant-writing collaborations.

The Department of Defense HBCU Student Summer Training Program has provided underrepresented students with the opportunity to conduct prostate cancer research, gain laboratory experience, participate in journal clubs, interact with the Sea Island/Gullah SC population, and gain invaluable mentors. This experience will help minority Student Fellows realize the relevance of conducting research within underrepresented populations.

Although the two training programs that have been described in this paper may prove beneficial to academic institutions by demonstrating ways to increase the number of underrepresented cancer researchers, the data from the training programs present some limitations. For example, due to the relatively small number of summer training program participants, statistical analyses of the data were not conducted. However, the measurable outcomes collected from the DoD SC Undergraduate HBCU Student Summer Training Program track the number of Student Fellows who took the GRE, applied to graduate school, completed scientific presentations and publications, and convey that the majority of Student Fellows who participated in these mentoring, research programs are enrolled in undergraduate or graduate programs.

These measurable outcomes will assist MUSC and the HBCUs in applying for additional funding to maintain the summer research programs.

A second limitation is that both of the case studies that are described in this paper are federally funded cancer research training grants for underrepresented populations from HBCUs in South Carolina. Data from only one state were included in the analyses, and the Student Fellows are minority students from colleges and/or universities with a minority European American population. This could potentially limit the generalizability of the findings.

Despite some limitations, the training programs have laid the foundation for other programs to provide training to underrepresented students, with the ultimate goal of increasing the diversity of the biomedical workforce. For example, the investigators recently submitted a NIH/NCI R25E grant which aims to create an innovative, inter-institutional, 14-week cancer health equity course that will be combined with hands-on laboratory research training activities and career mentoring, provided by senior mentors. This new initiative is a collaboration of an academic medical university and three HBCUs in South Carolina. Promoting interest, career development, and commitment from the Millennial Generation (those born in the 1990s) to cancer biomedical research is a critical step to attaining health equity and improved health outcomes in SC and beyond. Additional funding initiatives will be needed to significantly enhance the biomedical workforce over the next several decades.

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Ethical Standards The manuscript does not contain clinical studies or patient data.

Conflict of Interest The authors declare that they have no conflict of interest.

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