

UPCI SUMMER ACADEMY 2011 FINAL REPORT

EXECUTIVE SUMMARY



The 3rd annual University of Pittsburgh Cancer Institute (UPCI) Summer Academy was successfully completed after eight weeks (from June 20 to August 12, 2011) of experiential and didactic learning activities designed

specifically for rising high school seniors. After a successful pilot program in 2009, the academy was federally funded by the National Cancer Institute to continue in the summer of 2010 as a supplement to our P30 Cancer Center Support Grant. This year, the UPCI Summer Academy was expanded even further with support again from the University of Pittsburgh Cancer Institute, Bayer, the UPCI Volunteer Office, and the National Cancer Institute to provide research opportunities for 26 local and national high school students. Through continued collaborations with Pittsburgh Public Schools, the Pittsburgh Tissue Engineering Initiative, Bayer Material Sciences, the Jack Kent Cooke Foundation and the University of Pittsburgh's Office of Diversity, scholars were immersed in science research learning experiences that included: 1) daily studies in an individual mentor's research laboratory; 2) clinical and basic science cameo appearances from cancer professionals, 3) field trips to scientific activities and to the National Cancer Institute; and 4) weekly didactic sessions led by qualified graduate, medical students, postdoctoral fellow, and faculty.

Our program grew substantially this year, in an effort to enhance the types and qualities of experience, and to continue to service academically successful minority or disadvantaged students. We collaborated closely with the Department of Computational and Systems biology and with the Department of Biomedical Informatics as well as the Women's Cancer Research Center (WCRC) at the University of Pittsburgh to develop two new educational components to our program: Computational Systems Biology and Biomedical Informatics (CoSBBI) and the Magee Womens Research Institute (MWRI). The academy now encompasses three distinct sites: the Hillman Cancer Center in Shadyside, the Magee Womens Research Institute, and the Biomedical Science Tower-3 on the Oakland campus. With these expanded academic interests and the dedication of the Hillman, CoSBBI and MWRI faculty, we are able to offer scholars increased areas of research interests as well as reach out to a larger number of underrepresented and minority students in the region.

Hillman Site Overview

Scholars' interest and knowledge in cancer careers developed and increased significantly throughout the summer, as they were exposed to innovative and specific knowledge of cancer

biology and clinical care. The Academy proposed the following goals to help prepare high school rising seniors to further their studies in science, technology, engineering, and mathematics (STEM) subjects and to consider careers in cancer care and research. Through immersion in our dedicated laboratories with qualified faculty mentors (see **appendix A**), scholars showed an increased knowledge of (1) STEM careers in cancer care and research, (2) education in cancer biology and therapeutic strategies, and (3) development of research and communication skills.

Along with the time spent in the laboratory, scholars attended a comprehensive series of didactic cancer biology lectures presented by program academic staff and mentors. They attended presentations from clinicians and researchers from across UPCI disciplines focusing on clinical care, career options, and career preparation. Scholars were led on tours of a variety of clinical and research facilities at UPCI and UPMC Shadyside. Activities were designed specifically to promote scholars' interest, knowledge and awareness about cancer care and careers.

CoSBBI Site Overview

Scholars' awareness and knowledge of careers in basic sciences, such as Systems and Computational Biology, as well as in applied sciences, such as Biomedical Informatics and Bioinformatics, expanded throughout the course of this Academy. Through class-based didactic lectures, work in our dedicated laboratories, and interactions with faculty and students, our scholars achieved, through this Academy, (1) increased understanding of the variety of careers in Computational & Systems Biology (CSB) and in Biomedical Informatics (BI); (2) education in mathematical modeling of biological processes as well as in selected aspects of Biomedical Informatics, such as genomics and proteomics; (3) greater development of research and presentation skills; and (4) better awareness of strategies and approaches for selecting undergraduate institutions to apply to, how to maximize their success in the application process, and how to be successful throughout their undergraduate studies.

This academy was composed of several components, among which we can cite (1) a class-based, didactic component in which the scholars were taught by the University of Pittsburgh's world class faculty, (2) a learning-on-site component, in which scholars visited and received instruction at facilities such as a *Drosophila* lab at CMU, the NMR lab at Pitt, the supercomputer machine room at the Pittsburgh Supercomputing Center, etc, and a (3) mentoring component, in which the scholars interacted with undergraduate students both at CSB's REU program and at the Graduate School of Public Health MIDAS Program. All of these activities were designed to instruct scholars on the rich diversity of CSB and BI, and to expose them to the variety of careers within these fields. Unique aspects included a weekly research roundtable and a commitment to integrated computational solutions to the problems of cancer.

MWRI Site Overview

The UPCI Scholars placed at MWRI were exposed to various aspects of research in women's health, focusing on cancer, which has become a major strength at the MWRI with the recent generation of the Womens Cancer Research Center (WCRC). Research projects and presentation centered around critical research projects in breast and ovarian cancer, and state-of-the-art technologies and approaches for the studies, such as novel methods in mass spectrometry. The scholars were exposed to class-based didactic courses, to extensive research program in individual mentors' laboratories, and to a number of visits at clinical and core support

components of the Magee Hospital, and MWRI. The cancer-focused coursework was designed to give the scholars a rigorous introduction to the complexity of cancer, but at the same time helped them to better understand the lab projects they were working on under the direction of the Faculty mentors.

Scholars' knowledge of the fields relating to cancer related to women's health increased significantly in depth throughout the summer as they participated in (1) a daily didactic component taught by students from the University of Pittsburgh Medical School centered on Robert Weinberg's *The Biology of Cancer* textbook, (2) a laboratory experience with a dedicated MWRI faculty mentor, and (3) cameo experiences which included tours, guest lectures, and clinical shadowing of doctors at Magee Women's Hospital. These components of the Magee Academy helped scholars to achieve the following goals: (1) an increased understanding of the science behind cancer, (2) an improved ability to understand, discuss, and present scientific research, (3) an understanding of specific laboratory techniques, and (4) a greater appreciation for the breadth of the field of oncology and how it translates to innovations and progress in women's health.

Cameo experiences included guided tours of MWRI facilities such as the Histology Core Facility and Mass Spectrometry platform, as well as visit to other University of Pittsburgh core facilities such the Genomics and Proteomics Core Facility. To provide further insight into the biomedical research community, the UPCI Summer Academy Scholars were afforded a special presentation from the School of Medicine Office of Diversity Programs, as well as numerous informal career guidance lectures from clinicians and researchers in the Magee Womens Hospital and Research Institute.

The scholars' understanding of women's health with a focus on cancer and oncology was evaluated based on daily essay-style quizzes and quarterly exams. The scholars were also expected to discuss their lab's current research by participating in a weekly journal club in which they presented relevant scientific articles. The scholars not only improved significantly throughout the summer in their knowledge of the basic science behind cancer, but also improved in their ability to analyze, share and present their knowledge to others.

RECRUITMENT

Eleventh-grade [rising seniors] students are especially recruited from the Pittsburgh Public Schools (PPS), the largest of 43 school districts in Allegheny County and the second largest in Pennsylvania. According to 2009-2010 data, PPS has 7,956 students (grades 9-12) enrolled in 9 high schools, approximately 56% of whom are African-American (32% white, 2% Asian, 1% Hispanic). Approximately 70% of the graduates go on to enroll in higher education. Over 70% of Pittsburgh Public School students (K-12) are eligible for free or reduced price lunch. In addition, the Pittsburgh Public Schools opened a new high school, the Pittsburgh Science & Technology Academy, in the fall of 2009 which was a source of a single student (rising junior) for the UPCI Cancer Academy this year. The Pittsburgh Science & Technology Academy was created for students with an interest in science, technology, engineering, or math to help them develop skills for careers in life science, environmental science, computing, or engineering. The SciTech Academy is located in the heart of Oakland which gives students access to the Hillman Cancer

Center and Oakland, and offers valuable educational resources and facilities. We expect to engage more students and faculty from SciTech in the academy.

Targeting these urban schools immediately surrounding the University of Pittsburgh and Hillman Cancer Center provides the appropriate geographic, minority, and economic focus to our program. Access to public transportation hubs and the central location of the Shadyside and Oakland campuses and Hillman Cancer Center throughout the city obviates our need to provide residential or on-campus housing for local student participants. The MWRI building in Oakland and the BST-3 in Oakland are less than 2 miles from the Hillman Cancer Center in Shadyside, and utilizes University of Pittsburgh and UPMC dedicated shuttles to transport scholars between sites. On campus housing in the dormitory provides out of state students with an opportunity for working with our faculty and mentors.

We have continued our unique partnership with the **Jack Kent Cooke Foundation**, a private, independent foundation established to help exceptionally promising scholars with modest family means reach their full potential through education. The Foundation's scholarship and direct service programs support the education of approximately 650 remarkable scholars each year. This past summer, our program hosted three out-of-state scholars under the JKCF's Young Scholars Program to spend the summer in Pittsburgh; the Hillman hosted two JKCF Young Scholars and the third student spent the summer working in computational systems biology in Oakland with the CoSBBI program. We plan to expand the number of Jack Kent Cooke Foundation student participants next summer to five or more scholars, in our core program as well as in the CoSBBI and MWRI programs. We will work with the JKCF Education Director, Rebecca Stover, as well as JKCF educational advisors to help identify qualified students and facilitate their attendance in the program.

We continued collaborations with local organizations such as the Pittsburgh Tissue Engineering Initiative, Bayer Material Sciences and the University Of Pittsburgh Office Of Diversity. Our contacts in the Office of Diversity provided our scholars with unique opportunities to participate in shared activities (National Cancer Institute field trip) with the University of Pittsburgh School of Medicine Summer Premedical Academic Enrichment Program (SPAEP).

PROGRAM LEADERSHIP AND MENTORSHIP

We recruited many graduate, undergraduate and medical students to serve as teaching mentors who provided weekly mentoring and tutoring sessions to the scholars, so that all scholars had the opportunity to manage assigned coursework in an appropriate and timely manner. Offering a one-on-one experience with scholars led to overall better understanding of the material and more interactive didactic sessions and experiences in the laboratory. Staff mentors for each site are listed below.

PERSONNEL AND OVERSIGHT

The Hillman program leadership team was comprised of:

- Dr. Michael Lotze, MD – a UPCI clinician/researcher. Program Director and Instructor. Provided overall logistics and support for the program; developed funding requests and interactions with outside agencies and promoted the expansion of the current program.

- Ms. Megan Seippel, MPA – Program Administrator. Recruited scholars and provided student support. Coordinated guest speakers, tours, application and recruitment development, advisory meetings, and program management.
- William Buchser, PhD – Postdoctoral Fellow. Academic Administrator. Developed curriculum for the Hillman and Magee sites, oversaw didactic sessions, served as assessment consultant and instructor. Worked daily with scholars on developing research projects and laboratory experiments.

The Magee Womens Cancer Research Center leadership team was comprised of:

- David Malehorn, PhD - David E. Malehorn, PhD. Research Assistant Professor, (SOM Pathology) UPCI Mass Spectrometry Platform Laboratory. Dr. Malehorn served as UPCI faculty liaison for Summer Academy at MWRI, to coordinate the program's logistical needs with both Magee Womens Hospital and the Magee Womens Research Institute; and to communicate program information to Summer Academy faculty and students. In addition, Dr. Malehorn recruited scientists and professionals to provide content deepening, through facility tours and presentations. Finally, Dr. Malehorn served directly as mentor in hosting one Academy student in the MSP laboratory.
- Steffi Oesterreich, PhD – Dr. Oesterreich is the Director of Education at the newly established Womens Cancer Research Center. She took an active role in the education of the scholars in the biology of women's cancer. She was also involved in the organization of the social activities of the program, a team-building exercise for the scholars.
- Amy An, Pitt medical student - Developed curriculum for the Magee site, oversaw didactic sessions, served as assessment consultant and instructor. Worked with scholars on developing research projects and laboratory experiments.
- Erica Schwotzer, college student – Served as an assistant to Amy An. Ms. Schwotzer taught basic biology classes, created test questions, did one-on-one tutoring with the students, and organized many of the cameo experiences. She is a rising sophomore at Washington and Lee University in Lexington, VA

And the CoSBBI leadership team was comprised of:

- Dr. Claudia Mello-Thoms, MS, PhD – a Pitt professor of Biomedical Informatics and Radiology. Program Director and Instructor. Recruited scholars, provided student support, prepared schedule, tours, advisory meetings, and program management.
- Dr. Joseph Ayoob, PhD – a Pitt professor of Computational and Systems Biology. Program Co-Director and Instructor. Recruited scholars, provided student support, prepared schedule, tours, advisory meetings, and program management.
- Ricardo Cabello and Juan Mendez, Pitt medical students. Oversaw every didactic session, worked with scholars that needed special assistance.

Teachers

Led by Dr. Buchser, Amy An and Ricardo Cabello the following personnel served as program mentors and coordinated regular didactic and tutoring sessions with the scholars:

Hillman:

Philip Vernon, Graduate Student Researcher

Adriana Forero, Graduate Student Researcher
Reety Arora, Graduate Student Researcher
Cheryl Clauson, Postdoctoral Fellow
Wei Qiu, Postdoctoral Fellow
Carlos Lopez, Medical Student
Nadeem Kolia, Medical Student
Erica Nakajima, Medical Student
Philip Pavlik, Undergraduate at Pitt in Bioengineering Program
Jillian Bonaroti, Undergraduate at Pitt in Bioengineering Program
Annie Geller, University of Pennsylvania Undergraduate

CoSBBI:

Dr Chakra Chennubhotla, PhD – Assistant Professor of Computational & Systems Biology
Dr Tim Lezon, PhD - Assistant Professor of Computational & Systems Biology
Dr Bino John, PhD - Assistant Professor of Computational & Systems Biology
Dr David Koes, PhD – Research Assistant Professor of Computational & Systems Biology
Dr Carlos Camacho, PhD – Associate Professor of Computational & Systems Biology
Dr Vanathi Gopalakrishnan, PhD - Assistant Professor of Biomedical Informatics
Dr Shyam Visweswaran, MD, PhD - Assistant Professor of Biomedical Informatics

MWRI:

Erica Schwotzer
Brian Ahn (textbook lectures)
Randall Mcauley (textbook lectures)
Xuan Ding (guest cameos)
Natalie Gentile (guest cameos)

Ms. Alexandra Ashley, who participated in our pilot program as a rising junior in 2009, recently completed her freshman year at the University of Pittsburgh and is majoring in Biology. Since her experience in her first summer, she has worked throughout the school year and each summer with the Thorne laboratory. She was enthusiastic to play a leadership role in our program this summer and served as a resource to the scholars in a variety of capacities. Ms. Ashley played a role in facilitating meal vouchers, poster presentations, survey collection and feedback analysis, and daily activities. Ms. Ashley also attended faculty mentor meetings and served as a contact for scholars at the Hillman site.

CURRICULUM

HILLMAN GOALS

Specific Aim 1: Awareness of Science, Technology, Engineering, and Mathematics (STEM) Careers in Cancer Care and Research. The primary aim was to motivate high school scholars to continue their study of STEM subjects by introducing them to the many STEM disciplines that are employed by professionals working in a Comprehensive Cancer Center. This was pursued through presentations by professionals recruited to represent the diversity of opportunities in the cancer field, focusing on the roles, skills, and educational backgrounds of cancer team members.

Specific Aim 2: Education in Cancer Biology and Therapeutic Strategies. Our secondary aim was to educate scholars in the biology of cancer and the strategies in use and under development for its prevention, diagnosis, and treatment. This was pursued through a variety of lectures, textbook readings, and guest presentations.

Specific Aim 3: Development of Research and Communication Skills. Our tertiary aim was to educate scholars in the process of scientific research. This was pursued through participation in a project under the supervision of a cancer researcher and by preparing an oral/visual presentation to their peers and mentors describing their research goals, methods, and results.

Specific Aim 4: Participation of Underrepresented Minorities and Disadvantaged Students. The Office of Diversity, Health Sciences (ODHS) and the School of Medicine's Office of Student Affairs/Diversity Programs have played a major role over the past year in helping us to identify and reach out to local talented, disadvantaged youth. These programs and leaders are experienced in supporting scholars who come from economic, social or educational disadvantaged background, and those who are underrepresented in Medicine and Science. The director of these programs (Paula Davis) have been instrumental in working with us during the application and recruitment process to create avenues by which scholars can be appropriately paired with a science and/or medicine internship. Additional collaborations with Brian Corr, Director of Pittsburgh Public Schools Science and Edwina Kinchington, Teacher at the Pittsburgh & Science Technology School have been an important resource as we expand our outreach and look to recruit more disadvantaged and minority scholars.

We will continue to work closely with Brian Corr and Steven Pellathy from the Pittsburgh Public Schools Science Curricula Department to advertise our program to rising seniors in local high schools. Over the next academic year, we plan to visit various science classes within PPS high schools to talk about our program and identify eligible and high-achieving scholars for 2012.

SYLLABUS – HILLMAN AND MAGEE SITE



The syllabus was based on Weinberg and Hanahan's revised hallmarks of Cancer.

- Chapter 1. Biology Review. The Body / Organ systems, Anatomy, Physiology, The Cell
- Chapter 1. Goals of Cancer Research, Lab Organization, Scientific Method, (provide handouts for lab math)
- Chapter 1. Biology Review. Cell biology: DNA, Genes, Genetics, Proteins, Transcription, Translation, ATP (1.2, 1.4, 1.6, 1.7, 1.8, 1.10)
- Chapter 1. Lab Math, Lab Materials (Flasks, Tubes), Techniques, Sterility
- Chapter 2. Overview of Cancer. 2.1 Where do tumors arise, 2.2 Specialized cells, 2.4 Cancer Progress, 2.5 Monoclonal
- Chapter 2.6. Cancer etiology and epidemiology (2.6, - 2.11), Clinical/ Epidemiologic. 2.6 Frequency in human populations. 2.7 Lifestyle risks, 2.8 chemical agents, Carcinogens vs. Mutagens, Ames test
- Chapter 3. Tumor Viruses. 3.2 Transformation, 3.3 RSV, 3.6 Integration, 3.8 src, 3.9, 3.12. Transfection.
- Chapter 4. Oncogenes. 4.3 Oncogenes discovered, 4.4 Proto-oncogenes, 4.5 myc oncogene, 4.6 changes that make oncogenes
- Chapter 5. Growth Factors. 5.1 cell-cell signaling, 5.2 Kinases, 5.3 Growth factors, 5.4 Growth Factor Receptor, 5.6 Transphosphorylation and RTKs, 5.9 Basic Pathway to RAS (talk about signaling cascade in general, not very specific)
- Chapter 6. Cytoplasmic Signaling. 6.1 Cell surface to nucleus, 6.2 Ras protein, 6.3 Tyrosine phosphorylation, 6.4 SH2 domain, phosphatases, specific proteins, either 6.6 Akt, 6.8 Jak-STAT, or 6.9 Wnt pathway. Or have groups look into one of cascades and talk about it. Mention phosphatases.
- Chapter 7. Tumor suppressor genes. 7.2 Pedigrees and recessive phenotype, 7.3 Retinoblastoma, 7.7 Familial cancers, 7.6 Loss of Heterozygosity, 7.8 Promoter Methylation, 7.11 APC and colon cancer, 7.12 VHL.
- Chapter 8. Cell Cycle and pRb. Cell Cycle, phases, ppMAT 8.1 External signals trigger, 8.3 Cyclins and CDKs, 8.5 Viral oncoproteins and Rb block, 8.9 Myc and pRb
- Chapter 9. Apoptosis, p53. 9.2 p53 is a tumor suppressor gene, 9.3 mutant p53, 9.5 p53 Induction, 9.7 MDM2 and Arf, 9.9, 9.13 Apoptosis, 9.14, 9.15
- Chapter 10. Immortality, senescence. 10.1 Cell generations, 10.2 Immortality, 10.3 senescence, 10.4 telomeres, 10.6 telomerase, 10.11 connection with human tumors. Introduction to AUTOPHAGY
- NA. Breast Cancer, Ovarian Cancer, and Women's Health Perspective

- Chapter 11. Tumor Progression, Tumorigenesis. 11.1 Develop over decades, 11.2 Histology and Multistep, 11.3 Colon cancer, 11.4 Familial Polyposis, 11.6 Cancer stem cells, 11.9 Normal cells resistant to transformation, 11.12 Human cells are resistant to immortalization and transformation, 11.15,11.16 Chronic Inflammation
- Chapter 12. Genomic Integrity and effects of mutagens (12.1, 12.2, 12.3, 12.4, 12.5)
- Chapter 12.8. Inherited defects in genomic integrity (12.8, 12.19, 12.12)
- Chapter 13. Heterotypic Interactions. 13.1 TME, 13.2 Cell lines are not like real cancers, 13.3 Tumors resemble wound healing sites, 13.4 Stromal cells, 13.5 Macrophages. Talk about Breast Cancer and Bystander effect.
- Chapter 13.6. Angiogenesis. 13.6 Requirement of blood vessels, endothelial cells, 13.7/8 Angiogenic Switch, 13.9 Angiogenic Inhibitors, 13.10 Therapies
- Chapter 14. Metastasis. 14.1 Steps of metastasis, 14.2 Cascade, 14.3/4 Epithelial-mesenchymal transition, 14.6 Proteases, 14.7 Small GTP-ases, 14.8 Lymphatics, 14.9 Seed and Soil, 14.12 Micromets.
- Chapter 15. Immunology Overview. 15.1-6, Innate and Adaptive Immune System. 15.7 Immunosurveillance
- Chapter 15.9. Tumor Immunology. 15.9 Protection against cancer, 15.10,12,13 Tumor antigens, 15.11 Recognition may be late, 15.4 Cancers evade detection, 15.15 Cancers evade NK mediated, 15.16,17,18 Cancer counter-attacks, Tregs.
- NA. Mitochondria (pg 337) and Metabolism. Glycolysis, OxPhos, Warburg, Redox, Autophagy. Mitochondrial biogenesis Fission/Fusion.
- Chapter 15.19. Cancer Vaccines/Immunotherapies (15.19 -15.23) / Leukemia Rituximab CD20 / Breast Cancer Herceptin / Dendreon, Rosenberg's TILs, anti-CTLA4, other cool immunotherapies.
- Chapter 16. Drug Development (16.0 - 16.5) and Clinical Trials (16.6 - 16.9), Classic Cancer Chemotherapies
- Chapter 16.1. Current Cancer Chemotherapeutics (16.10 - 16.11, 16.13 - 16.16), targeted, also future therapies

CURRICULAR ACTIVITIES

The Hillman scholars participated in a wide variety of learning activities, including lectures, textbook readings, guest speaker presentations, tours of clinical and research facilities, laboratory research, lab meetings, research seminars, discussions, and their own presentations. The scholars found the majority of these categories of learning activities beneficial.

- Opening reception, orientation to labs, administrative orientation
- Pathology and Genomics Facility Tour - Dr. Sheldon Bastacky
- Molecular and Cellular Biology Lecture - Dr. Richard Steinman
- Flow and Imaging Cytometry Tour (William Buchser and Michael Meyer)
- Joe Newsome - guest lecturer and tour of the animal facility
- Field trip to RiverQuest/Bayer Material Sciences/Baywood Country Club
- Lyn Robertson - Community health education and screening
- Beth Dudley - Genetic counseling and familial centers
- Bone marrow biopsy observations - Dr. Chris Lindberg
- Trip to the National Institute of Health, NCI

- Operating Room Observations
- Michael Becich - BioInformatics
- Nathan Bahary - Zebrafish facility tour

Specific Feedback on learning activities

I thought that it was difficult to review Ch. 5&6 on the same day, since they were the most difficult chapters so far. The lectures were helpful and well presented, but we can only cover so many details in two hours.

The lectures were easy to follow even though the chapter was difficult to understand, especially for Ch. 8. I would have liked to cover more details on Apoptosis. I liked the details about p53, but we didn't cover many other specific pathways involved in apoptosis.

Ch. 10 was less interesting because I was already familiar with the material. The Ch. 11 lecture was very thorough and interesting. It was difficult to understand all of the DNA mechanisms in Ch. 12 because there were so many, so I was glad that the chapter was split into two days.

I really enjoyed the trip to NIH. However, I would have like to know we weren't going back to the Hillman ahead of time.

I loved the lectures! They are always well-done and very informative. The presenters themselves are always clear in their explanations and willing to answer our questions. The NIH trip was so amazing, and I am so glad that we were able to go and meet the researchers there. Thank you so much!

Learning about cancer treatments is one of the most important things I hoped to get out of this summer

About Posters:

A little more guidance about the content of the posters would be helpful at the beginning, but I thought we had the right amount of time to practice in our small groups before the final presentations.

About Oral Presentations:

It was really great being able to practice in the small groups with just a few classmates and a mentor first before going on to present in front of the whole class.

Classroom, invited lecturers, tours feedback

About Zebrafish Fieldtrip

Very interesting--definitely keep it, but I think it would have been more beneficial had we gone earlier.

amazing!

The zebrafish were really cute and it was amazing to learn about all the different ways that they can be used to further our understanding of cancer where other animal models cannot.

COSBBI CURRICULUM, INCLUDING SYLLABUS, GOALS, ACTIVITIES AND FEEDBACK

CoSBBI Aims:

Aim 1: Awareness of Careers in Computational and Systems Biology and in Biomedical Informatics: The primary aim of the CoSBBI site was to introduce the scholars to the many career options available in these fields, and to make them aware of the incredible rewards available in a career dedicated to health care research in a computational environment.

Aim 2: Education in Modeling of Biological Processes and in Selected Topics in Biomedical Informatics: The secondary goal of this site was to introduce the scholars to concepts such as genomic and proteomic research, computational modeling of disease, bioinformatics, cognitive and translational informatics. Albeit these represent only a few of the research tracks available in both fields, they are very important in a cancer research context, because understanding of disease biology and complex interactions, as well as clinical applications, is crucial for early diagnosis and successful treatment.

Aim 3: Development of Research and Communication Skills: This site's third goal focused on the development of research skills through one-on-one interactions with faculty mentors in the development of individual projects, as well as in the development of communication skills needed to carry out such projects and to present them to the entire group at the end of the eight weeks.

CoSBBI Syllabus

- Computer Use, Ethics, and How to Keep a Notebook (Ayoob)
- Introduction to Research Methodology (Mello-Thoms)
- Introduction to Molecular Biology (Mustata)
- Genomes and sequencing technologies (Kadri)
- Introduction to Bioinformatics (Day)
- Introduction to Imaging Informatics (Mello-Thoms)
- Human-Computer Interaction in Medicine (Hockheiser)
- Introduction to Biomedical Informatics and to Clinical Informatics (Cooper)
- Introduction to Public Health Informatics (Cooper)
- Scales of Systems and Experimental Models (Ayoob)
- Computer Vision for Bioimaging (Chakra)
- Cells as Networked Systems (Maly)
- Signaling Pathways (Hogg)
- Introduction to Biostatistics (Day)
- Biomarker Discovery from Clinical Proteomics Mass Spectra (Gopalakrishnan)
- Novel approaches to liver transplant (Mendez)
- Biology of cancer (Cabello)

- Structure Determination (Lezon)
- Structure Prediction and Dynamics (Lezon)
- Protein-Protein interactions and drug design/discovery (Koes)
- Introduction to Cognitive Informatics (Mello-Thoms)
- Introduction to Artificial Intelligence and to Bayesian Modeling (Visweswaran)

CoSBBI Activities

The CoSBBI scholars participated in a number of different learning activities, including didactic lectures, guest speaker presentations, tours of clinical and research facilities, laboratory research, lab meetings, research seminars, research round tables, and their own presentations at the end of the Academy. The scholars found the majority of these categories of learning activities beneficial.

- Opening reception, orientation to labs, administrative orientation
- Supercomputer Machine Room Tour - Drs. Joe Ayoob and John Urbanic
- University of Pittsburgh Ethics Forum – Dr. Joe Ayoob and Dr. Peggy Heely
- Health Sciences Diversity Awareness Workshop - Dr. Claudia Mello-Thoms
- Shadow MIDAS scholars – Dr. Claudia Mello-Thoms
- CMU's Drosophila lab Tour – Dr. Joe Ayoob
- Panel Discussion on College Life with MIDAS scholars – Dr. Claudia Mello-Thoms
- Field trip to Bayer Material Sciences/Baywood Country Club
- DDI and NMR Tours – Drs. Joe Ayoob, Judith Klein, James Conway, and Andreas Vogt
- Trip to the National Institute of Health, NCI
- Panel discussion on College Admissions with REU scholars – Dr. Joe Ayoob
- Opportunities in Biomedical Informatics – Dr. Michael Becich
- Zebrafish facility tour – Dr. Nathan Bahary
- Workshop on preparing and presenting scientific research talks – Dr. Joe Ayoob
- Closing meeting and informal feedback session with scholars (student feedback and comments listed immediately below) – Dr. Joe Ayoob

By providing a balanced curriculum of didactic training, mentored research experiences, demonstrations, hands-on training, special guest lectures, presentation opportunities, and field trips, we were able to provide a graduate-level experience to our cohort of 6 students to better prepare them for careers in cutting-edge research and related fields. By all accounts, our inaugural CoSBBI Academy was a singular success. We were able to achieve many of the goals that we initially set out to attain with the end result of a more highly trained and more prepared cohort of students. In order to grow and improve our efforts of training the next generation of scientists and physicians, students provided candid feedback on the various elements of the program as well as their overall satisfaction of the experience. Overall, the students' feedback was very positive, but also indicated several areas that could be improved upon. A synopsis of the students' comments on the various topics is listed below.

Classes – Scholars requested that the number of lecture-based classes be reduced, and that the lecture sessions be designed to be more engaging. Having graduate and medical students participate in the teaching from a defined textbook may be relevant.

Weekly Quizzes – Scholars were given a quiz on the materials that they were introduced to every week as a means to promote their engagement in the lectures sessions. The students would have preferred to have the sessions be less like the everyday education that they receive during the school year, and suggested that eliminating the quizzes would be one way to achieve that, especially since their participation in the classes were in no way affected on whether or not they were to be quizzed at the end of the week. An alternative would be to have the quizzes support a Scholar of the Summer award.

Reading Materials – Scholars were given a review paper and a primary research article, both relevant to their research projects, prior to their arrival at the academy. They requested that additional guidelines on how to read a scientific paper, or more basic background materials, also be provided. Earlier faculty involvement in this process would have also been helpful. Additionally, scholars in the CoSBBi site were given a copy of the Weinberg cancer textbook that all students received, and from which the lectures in the other 2 academies were taken. Scholars requested a more relevant text for their classroom sessions.

Interaction with Students – Scholars indicated that they greatly benefited from interactions with the undergraduate, graduate, and medical students associated with the program. They were in favor of increasing those interactions, and also requested greater interactions with scholars from the other associated sites in the Academy.

Research Roundtable – Each week, the scholars would write a summary of the work they performed and briefly present their work in a weekly roundtable meeting. This activity was generally received well, with students indicating that it was very useful for organizing their thoughts and experiments, while also helping them prepare for their presentations, abstracts, and posters that they assembled at the end of the program.

Professional Development Opportunities – Scholars were given advice on undergraduate admissions and what to expect academically in college. This was a great benefit to the scholars, but they also requested that we provide more insight into graduate and medical school admissions, academics, etc, plus discussions of different career paths and career options in biomedical research and related fields.

Tours, Field Trips, and Social Activities – Scholars were very pleased with the variety and number of the different enrichment activities that were made available to them. One suggestion was to have the different tours and special guest lectures earlier in the program since the students indicated that these events helped put things into perspective for them, plus having them earlier would give them more time to follow-up with and meet with the presenters if they happen to be interested in that particular field.

MWRI CURRICULUM, INCLUDING SYLLABUS, GOALS, ACTIVITIES AND FEEDBACK

General Aims:

In its first year, the UPCI Summer Academy-MWRI Pilot Program sought primarily to mirror the programming of the established Hillman Cancer Center site. This was achieved using MWRI site-specific instructional staff; site-specific research mentors; and a combination of site-specific and joint content-deepening experiences with the other two sites.

- An ancillary aim was to establish the administrative mechanisms to permit these activities within MWRI, while not interfering with the long-running Magee Womens Hospital summer internship program, which also places high school students within select MWRI research laboratories.

Specific Aim 1: Education in Cancer Biology and Therapeutic Strategies.

Our foremost aim was to educate scholars in the biology of women's cancer; and in the strategies currently employed or under development for its prevention, diagnosis, and treatment. This was achieved through a variety of lectures, textbook readings, guest presentations, physician shadowing, visits to research core facilities and operating rooms, and most importantly direct mentoring in laboratory research (see Aim 2)

- An ancillary aim was to provide nuanced understanding of gynecological and breast oncology in the greater context of women's reproductive health.
- An ancillary aim was to monitor the impact on success of the didactic instruction of using frequent "retrieval practice," through the administration of regular written quizzes and examinations; and to compare resulting performance with the other two sites which did not employ frequent retrieval practice.

Specific Aim 2: Development of Research and Scientific Communication Skills.

Our second aim, which supported the first, was to provide scholars with hands-on experience in laboratory scientific women's cancer research. This was achieved through participation in a project under the supervision of a cancer researcher (faculty, post-doctoral or other dedicated laboratory staff) including: literature research and reading on a specific topic; extensive practicum in laboratory bench methods; experiment design and performance; analysis of results; and communication of findings through oral and poster presentations.

Specific Aim 3: Establishing Awareness of STEM disciplines; Fostering Significant Connection to Post-secondary Education or Employment in STEM.

Our third aim - which emerged from pursuit of the first two aims - was fostering awareness of (and lasting connection to) the many science, technology, engineering, and mathematics (STEM) disciplines which are involved in performing cancer research at a collaborative research institutes such as UPCI and MWRI.

- This was achieved by incorporating many diverse researchers, clinicians and professional staff in oral presentations, laboratory tours, physician shadowing and OR observation experiences for Summer Academy students, as described above.
- Connection to STEM careers was supported by arranging permission to attend twice-weekly lunchtime presentations at MWRI by clinicians and researchers, who are

- encouraged to speak informally about their own paths through higher education and professional career development.
- This was also supported by the use of near-peer mentors (undergraduates, graduate students, postdoctoral fellows and early medical students) as course instructors, who could contribute guidance on transitioning to undergraduate STEM education and thereafter to medical school.
 - This was also supported (D. Malehorn) by arranging a personal tour by an Academy scholar of the University of Pittsburgh Benedum School of Engineering

Specific Aim 4: Service to Underrepresented Minorities and Disadvantaged Students.

An aim of the entire UPCI Summer Academy is to extend their unique scientific experience to minority and disadvantaged students in the Pittsburgh city and region.

- This has previously been supported through UPCI Summer Academy consulting The Office of Diversity, Health Sciences (ODHS) and the School of Medicine's Office of Student Affairs/Diversity Programs on how best to identify and reach out to local talented, disadvantaged youth.
- The UPCI-MWRI Pilot has supported this aim
 - by hosting one such student (D. Malehorn), and
 - arranging an extracurricular experience in engineering for this student (see above)
 - by (D. Malehorn) consulting both the Director of the Pittsburgh Regional Center for Science Teachers (Jane Konrad) and the University of Pittsburgh Health Sciences Associate Vice Chancellor for Science Education Outreach (Joan Lakoski)
 - by (D. Malehorn) arranging a special presentation of a newly modified version of the University of Pittsburgh School of Medicine Diversity Workshop, for secondary students considering Health Sciences professions.

EXTRACURRICULAR ACTIVITIES

To create a close-knit community among the scholars, teachers and faculty we created a weekend activities schedule where scholars would sign up on a weekly basis to attend weekend social outings. The academy went on a number of outings: kayaking at the Point, rock wall climbing, attending a Pirates game, touring Falling Water, group dinners and lunches, biking, going whitewater rafting, watching movies at Flagstaff park and the final Harry Potter movies, and other fun activities. Drs. Lotze, Buchser and Oesterreich as well as the JKCF resident advisors, Annie Geller and Jillian Bonaroti, were instrumental in organizing these events and coordinating transportation for the scholars.

Student's Comments about Extracurricular Activities

Yes, I attending the Ohiopyle rafting and kayaking. Laser tag would also be really nice and a good way to meet new people, since I feel like the different programs didn't get a chance to bond that well.

Yes, I did attend some & they were great!! I think everyone did a very nice job.. maybe a little bit more planning could help make things easier to coordinate.

I attended the BBG, Indian Festival, and Fallingwater. I think that the activities were a lot of fun, but more advanced notice and/or an updated weekend calendar at the beginning would have been helpful for scheduling conflicts.

No, I would have liked to, but I wasn't able to find the time on top of school work.

I did not attend many of the weekend activities because I spent my weekends doing things with my own friends and family.

Couldn't attend due to some family issues

Yes!

Yes I attended Harry Potter.

CLOSING RECEPTION AND POSTER PRESENTATIONS

The closing receptions and poster presentations took place on Friday, August 12. Each site, Hillman, CoSBBi and MWRI, conducted their own, distinct oral presentations and ceremonies in the morning, where scholars presented their projects and faculty had an opportunity to speak about their scholars' work and their time in the laboratories and facilities. Following the oral presentations and closing ceremonies, all sites came together at the Hillman Cancer Center atrium to participate in an open house poster session. The entire UPCI community of faculty and staff were invited to see the scholars' posters and talk with them about their individual projects, research findings and work completed throughout the summer (**see Appendix B for program and abstract booklet**). This year, we formed a poster review committee consisting of faculty from the UPCI and across the University of Pittsburgh campus and various departments. The judges viewed their assigned posters and ranked them according to experimental methods, scientific thought, analytic approach, and oral presentation.

The following faculty members served on the **Poster Review Committee**:

- 1 Pam Hershberger, Chair
- 2 John Kirkwood
- 3 Lisa Butterfield
- 4 Stergios Moschos
- 5 Dana Bovbjerg
- 6 Robert Edwards
- 7 William Bigbee
- 8 Bennett Van Houten
- 9 Jian Yu
- 10 Madhavi Ganapathiraju

11 Herbert J. Zeh, III

ASSESSMENT

In order to measure behavioral outcomes, scholars were evaluated at regular intervals by their research mentors and teachers throughout the program using a short survey form. Mentors then reported back to the program director and administrator feedback on scholars’ enthusiasm, interest, punctuality, understanding of topics, attention to detail in conducting research, ability to follow instructions, compliance with safety standards, grasp of scientific content, and discipline in completing assigned readings. Scholars were also surveyed to assess their overall satisfaction with the program and to identify its strengths and weaknesses so that we may continue to improve upon program design for future years.

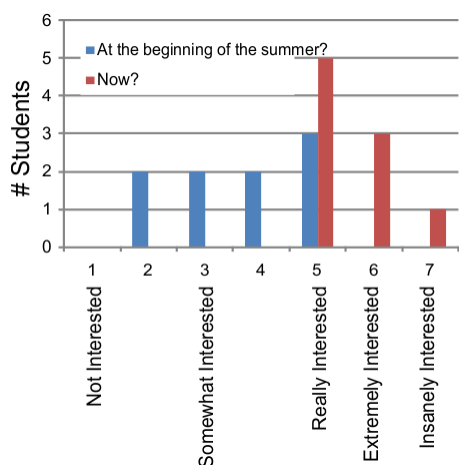
Assessment of program performance was conducted using two methodologies: feedback surveys using Survey Monkey (weekly and cumulative surveys) and a pre-/post test given by all sites.

Follow-Up Evaluation

Both scholars and faculty mentors who participated in the 2011 UPCI Summer Academy have also been asked to provide feedback via an electronic survey to determine their overall satisfaction and learning experience from the program. These surveys have been designed to gauge the increased knowledge of the scholars, their increased interest in cancer careers, the faculty’s perception of the scholars’ success, and ways in which we can further improve and build upon our program.

STUDENT FEEDBACK

How interested in Research?



If your interest has changed, what are two primary experiences that swayed your interest, for the better or the worse?

Seeing the NIH and how research really wasn't just limiting myself to a track of tenure and professorship. Meeting everyone from my lab and seeing all the cool things they were doing

Working in the lab with my great mentor, Hannah Chen, made all the difference. It's also interesting to learn about all the different approaches to cancer treatment - there's a world of opportunity out there!

I really loved working in the animal facility and my mentor was very supportive.

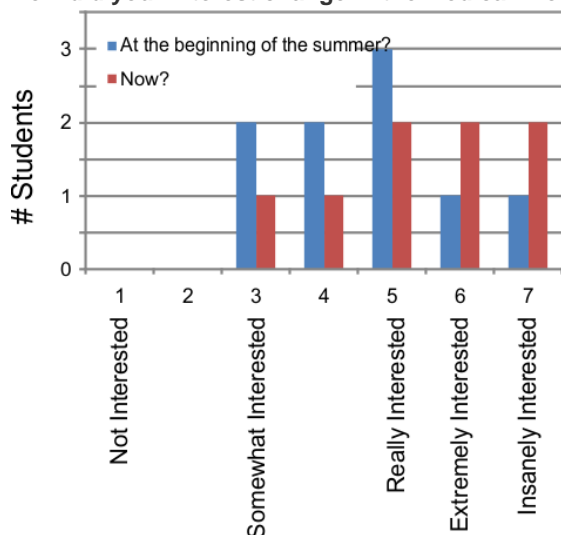
The knowledge gained in a relatively short period of time and being able to interact with others who share my interest in science on a daily basis.

Now that I know how research is done (techniques) and published (posters and journals), I feel more comfortable learning about other research projects.

Testing out hypothesis turned out to be exciting when the experiment worked (especially when our western blots worked!)

I've been drawn in by the anxiousness and suspense of waiting to prove or disprove a hypothesis. When you find new data its like an adrenaline rush with out having to do something extremely dangerous or insane.

How did your interest change in the Medical Profession?



If your interest has changed, what are two primary experiences that swayed your interest, for the better or the worse?

I LOVED the OR tour - It was the most exciting thing ever! I brag about it constantly... It's so amazing to see a surgery first hand. It is wonderful that we have the technology to save lives. I also really enjoyed when Lyn Robertson shared her work with us; her passion is inspiring.

Looking at gene expressions in actual human tumors really made me think more about the research side of health care. Also, going to the OR was very interesting.

The bone marrow observation and operating room tour increased my already high interest in healthcare.

I am still incredibly interested in becoming a physician, but seeing this other side of healthcare has been valuable and enriching because it is what drives progress in medicine.

Going to the OR, seeing Bone marrow biopsy, and going to NIH

Learning what cancer patients go through physically made me really want to reach out and help them. though I'm still leaning toward psychology I believe that I can still reach out and help cancer patients and other terminally ill patients.

IMPACT

Scholars, their families, their research mentors, teachers and other professionals witnessing these scholars' presentation all had significant praise for the quality of the scholars' research and their articulation of it to audiences.

Below are just some of the testimonials provided by this year's scholars:

From parent of scholar: "Thank you so much for the wonderful experience that you created and provided for our daughter and the other teenage scholars at the Hillman Center. You have planted so many seeds for those young scholars and nurtured their dreams to come true. I was so amazed and grateful to see the passion of science and questioning sparked in so many ways."

"This summer has honestly been my best so far, all thank to you and your efforts towards the UPCI Summer Academy. I've gained so much from this program including knowledge, love for biology of cancer and confidence." - Scholar

"It's amazing to have an opportunity as we were given this summer. I looked forward to coming every morning and learning about the wonders of the cell. You have given me the mental tools to be the best I can and reach my limits." - Scholar

"It was wonderful: I met awesome people and learned about professions that I didn't even know existed." - Scholar

"It's always great to hear about a new treatment & how it's going to "cure cancer" , but I think that it is even more important to understand all the extensive research, time, and dedication that makes it all possible! Spending eight weeks with the UPCI Summer Academy was a great learning experience & a real eye-opener that I am definitely thankful for!" -Melissa Bigger

"The Summer Academy was really my first experience with molecular biology basic research. Going into it, I was still pretty certain that I wanted to study a social science like psychology. Working in the lab at Hillman this summer, however, really showed me that lab-based research can actually be really fun. I'm beginning to consider neuroscience now as a possible college major." - Scholar

"The hard work and dedication this program brought out in me proved how enriching these past eight weeks were and unquestionably reinforced my biomedical career goals." -Jarrod Ellis

"Although this experience was quite intense and demanding, thinking how much I have learned and how much fun I had makes every moment worthwhile. For seriously dedicated students, the academy will thoroughly teach you about the biology of cancer formation and treatment as well as provide a valuable opportunity for you to pursue your own research project. This exceeded my expectations and was by far the most enriching activity of my life." - Michael

Appendix A. Faculty mentors and scholars

Student Name	Faculty Mentor/Lab Name
Magee	
Sivaprakash Sivaji	Dr. Steffi Oesterreich
Soyoung Kwak	Dr. Adrian Lee
Cieayra Boozer	Dr. David Malehorn
Remy Niman	Dr. Anda Vlad
Matthew Evan Miklasevich	Dr. Kyle Orwig
Michael Kochis	Dr. Xin Huang
CoSBBi	
Edward Nguyen	Dr. Shyam Visweswaran
Vicky Li	Dr. Chakra Chennubhotla
Aung Naing	Dr. Timothy Lezon
Natalie Nash	Dr. Vanathi Gopalakrishnan
Miguel Camacho-Horvitz	Dr. Bino John
Samuel Rest	Dr. Koes and Dr. Camacho
Hillman	
Andrew Shin	Dr. Charles Horn
Maria Sierra	Dr. Hideho Okada
Melissa Ann Bigger	Dr. Stephen Thorne
Chareeni Kurukulasuriya	Dr. Robert Ferris
Sarah Porter	Dr. Per Basse
Bhavini Patel	Dr. Julie Eiseman
Dilafuz Khakimova	Dr. Christopher Bakkenist
Luis Carlos Espinoza-Delgado	Dr. Richard Steinman
Jarrold Thomas Ellis	Dr. Shivendra Singh
Swati Rajprohat	Dr. Anthony Brickner
Ishan Chatterjee	Dr. Michael Lotze
Katherine Callaway	Dr. Lin Zhang/Dr. Monica Buchanan
Hong Ye	Dr. Donnerberg Lab/Michael Meyer

Appendix B. Program and Abstract Booklet

Appendix C. Student Certificate Back

