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It is necessary to have a cadre of talented investigators whose careers are dedicated to studies of prevention, treatment, and early detection of breast cancer. By investing in young people before they make career choices, and by providing them with first-hand experience in modern breast cancer research (BCR) laboratories, we anticipate that many of these talented young people will discover an interest in BCR and new career options that will position them to join the fight against breast cancer. The vision of the Summer Undergraduate Training Program in BCR at the Albany Medical College is to recruit highly talented undergraduates to careers (either PhD or MD) in BCR so that they can make meaningful contributions to the eradication of this disease. That talented students are being recruited is evident from the diversity of undergraduate schools (students from 70 different colleges applied), the quality of the matriculants (average GPA 3.85), and the number of applications (80 applications for 5 positions per year). Students spend 90% of their time in the laboratory of a funded investigator doing authentic, meaningful, mentored BCR. Students also participate in Enrichment Activities: Overview of BCR; sessions to meet Investigators and to meet breast cancer survivors, and career sessions.

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Introduction

This is an Annual Report for DAMD17-01-1-0121, a training award entitled "Breast Cancer Research Undergraduate Summer Training Program." This training grant is based at the Albany Medical College (AMC) in Albany, NY. The award provides support for 5 students per year; with College supplementation we supported 6 students in the summer of 2001. At the time of report writing, one year of training is complete and recruitment (but not training) of the second cohort of students is complete. Information is provided about the first cohort, in accordance with the format of the Statement of Work: *each aspect from the Statement of Work is listed in italics*, with pertinent information immediately following.

Body

Relevance: This 2001 Undergraduate Summer Training Program (USTP) was focused on breast cancer research (BCR) in all aspects. Research opportunities focused on breast cancer research were available in 13 laboratories and 1 clinical setting, funded by at least 15 different grants among 14 principle investigators. A broad range of disciplines was available from which undergraduates selected research projects, spanning the areas of peptide chemistry, anti-oncotic pharmaceutical development, genetic investigations, cell biology and cell signaling studies, development of screening assays, prevention trials, epidemiologic studies, and translational and clinical investigations. Enrichment Activities all centered around breast cancer, including career planning discussions, research seminars, literature review training sessions, "Meet the Investigator" sessions, and even sessions for training in scientific ethics. Undergraduates were immersed in a summer of breast cancer study, and will be well-prepared to enter a career path that will lead to productive contributions to the efforts to eradicate breast cancer early in this century.

Overview: The USTP at AMC is designed as a 10-week program to provide opportunities for 5 undergraduates per summer. With careful attention and significant effort, recruiting of these Students from 65 colleges in the Northeast, 64 Historically Black Colleges and Universities throughout the Nation, and with special emphasis on recruiting Students from 7 selective colleges within a 200 mile radius of AMC provided a competitive applicant pool from which the 6 top candidates were selected. The Albany Medical College supported one additional student, due to the high quality of applicants. Students spent more than two months in a laboratory doing meaningful, authentic, innovative research on a project specially designed for them, and with the active mentoring of an investigator who was funded and who had sufficient time and inclination to serve as a mentor for an undergraduate student. Funded faculty members were screened by the Program Director for inclusion on the Participating Mentor list based on funding, BCR interests, ability and inclination to serve as a mentor, and past experiences with mentoring undergraduate students. Faculty provided descriptions of BCR opportunities for undergraduates in their laboratory, and these descriptions accompanied the application/recruitment materials so that undergraduate applicants could make choices as to which research topics were of interest to them. Students spent more than 90% of their summer doing research in a laboratory, but also had Enrichment Activities including Safety Training, on-line biomedical information search and retrieval training, training in issues of Scientific Integrity, interactive learning opportunities focusing on an Overview of BCR, seminars to broaden their knowledge of BCR, making their own research presentations, and opportunities to explore BCR career options while at AMC. The program provided extensive tracking and evaluation of the Students, of the Faculty, and of the program as a whole so as to make adjustments when necessary.

Progress as per Statement of Work

Task 1 Recruitment

a. Select Participating Mentors

Fourteen funded investigators focusing on Breast Cancer Research (BCR) were provided from which students could choose, and the students who matriculated in Year 1 worked with 6 different mentors, as shown in Table 1.

Table 1 - Mentor Funding and Student Projects

Student	Mentor	Mentor Funding	Student Project Title
Kerri Ann Fraterigo	James Bennett, PhD	1R21CA87434-01 Elsa U Pardee Fnd	"The Role of TGF-β in the Growth Regulatory Effects of AFP-derived Peptide"
Jason Laliberte	C. Michael DiPersio, PhD	R01CA84238	"Lack of Integrin $\alpha 3\beta 1$ Correlates to Increased Activation of jun-NH_2-terminal Kinase in Keratinocytes"
Kate Pettrone	Lisa Petti, PhD	5R29CA73682-03	"Determination of Amino Acids in the Transmembrane Domain of the *neu* Receptor Required for its Activation Under Conditions of Overexpression"
Lisa Schoonmaker	J. Andre Melendez, PhD	5K01CA77068-03	"Superoxide Dismutase-Dependent Peroxynitrite Production"
Adam Stallmer	Thomas Andersen, PhD	ANDT01 - New York State DAMD17-01-1-0472	Acylated Lysine Analogs of Anti-Breast Cancer Peptides Retain Chemoprophylactic Effect and Serve as Model Ligands for Affinity Chromatography.
Courtney St. Amour	Michael Fasullo, PhD	5R29CA70105-06	"Mitotic Recombination in Yeast Ku Mutants"

b. Develop recruitment materials c. and d.) Distribute materials to colleges

A recruitment poster and application materials were developed and mailed, and application forms were posted on the College web site. A copy of a recruitment poster is included in the Appendix.

Task 2. Selection of Students

The initiation of this program, and our recruitment efforts, led to a huge increase in the number of applicants to our summer research opportunities, and to a very substantial increase in the quality of the matriculants. Table 2 shows that the program was very selective and very attractive. All six of our top applicants enrolled in the program in the first year.

Table 2 – Recruitment of Students

Year	Number of Applications	Number of Acceptances	Number Enrolling
2001	163	6 – Army, Breast Cancer 5 – NIH, Cross Training 8 - Volunteers	6 – Army, Breast Cancer 5 – NIH, Cross Training 8 – Volunteers
2000	34	17	16 - All AMC Undergraduate Programs
1999	21	6	6
1998	18	5	5
1997	26	5	5
1996	24	6	5

Table 3 - Data for BCR Matriculated Students, 2001

Table 3 shows that the quality of the matriculants was very high.

Student	Undergraduate College	Year Completed	Major	GPA	Current Status
Kerri Ann Fraterigo	Russell Sage College	Sophomore	Biology	3.98	Completing Junior year at Russell Sage
Jason Laliberte	University of Massachusetts at Amherst	Junior	Biology	3.27	Graduated 2002, attending Graduate School at UMASS
Kate Pettrone	Williams College	Sophomore	Biology	3.36	Completing Junior year at Williams College
Lisa Schoonmaker	Siena College	Sophomore	Biology	3.34	Completing Junior year at Siena, continuing BCR research at AMC
Adam Stallmer	Rensselaer Polytechnic Institute	Sophomore	Math/ Science	4.0	Completing Junior year at RPI
Courtney St. Amour	Brandeis University	Sophomore	Biology	3.88	Completing Junior year at Brandeis

Task 3. Orientation of Summer Undergraduates
All required training sessions were completed in the first week, and team-building aspects were emphasized. Sessions included Laboratory Safety Training, Radioactivity Safety Training, Care and Use of Animals, and Internet-Based Search-and-Retrieval Training. Evaluation tools indicated general satisfaction with all aspects.

Task 4. Research Training
Students participated actively in research for 10 weeks, guided by their mentor, a well-funded BCR investigator. Each student presented the results of their work at the end of the summer in poster or oral format (titles of these presentation are listed in Table 1). Students met weekly with Investigators to learn more about career paths and discuss research relevant to breast cancer.

Table 4 – Meet the Investigator Series
Evaluations indicated that students enjoyed learning about career choices of these investigators, and about their research. Some sessions were better received than others.

Week #	Investigator
1	Thomas Andersen, PhD
2	Kevin Pumiglia, PhD
3	C. Michael DiPersio, PhD
4	Joseph Schulman, MD
5	Herbert Jacobson, PhD
6	J. Andre Melendez, PhD

Table 5 – Responsible Conduct of Research
Students were trained in the Responsible Conduct of Research in accordance with NIH recommendations. While not the favorite Enrichment Activities of the students, the students perceived the sessions as beneficial.

Sessions #	Title of Session
1	Current topics in Scientific Integrity
2	Introduction to Ethical Thinking
3	Workshop on Case Analysis by Moral Reasoning
4	Analytical Skills Workshop
5-8	Student Lead Role Playing and Case Discussion

Overview of Breast Cancer
An Overview of Breast Cancer didactic series included lectures given by John Lehman, PhD, Professor and instructor in the medical school lecture sequence, Gary Lyman, MD, Director of the Cancer Center at the Albany Medical Center, Patricia Brown, PhD, Professor of Biology at nearby Siena College. Dr. Brown, a breast cancer survivor, led the students in reading papers by Judah Folkman, which tied in with the book they were reading (*vide infra*).

Students in the BCR program read the following two books and participated in detailed discussion of the BCR implications of these books.
Her 2 – The Making of Herceptin, a Revolutionary Treatment for Breast Cancer
Author: Robert Bazell

Dr. Folkman's War – Angiogenesis and the Struggle to Defeat Cancer
Author: Robert Cooke

Table 6 - Career Day
Students were offered an afternoon session in which career options were discussed. Routes to BCR through graduate school and through medical school were outlined. Student evaluations indicated that this was very well received.

Name	Topic
Thomas Andersen, PhD Assistant Dean Graduate Studies	The path to Graduate School
Ms. Sara Kremer Assistant Dean Medical School Admissions	The path to Medical School
Concetta DiRusso, PhD Professor Center Cardiovascular Sciences	Beyond Graduate School: Post-Doctoral and Other Positions
Garrett Wirth, MD PGY3 Resident Alumnus of AMC Graduate Studies Program & Medical School	Medical School and Beyond

Students also met individually with the P.I. on several occasions throughout the summer, and career goals were discussed and optimized.

Presentation Preparation - A session was offered to assist students in preparing for the end-of summer presentations.
Dr. Thomas Andersen - Poster *versus* Oral Presentations
Dr. C. Michael DiPersio - Writing a Good Abstract

Students presented their work (see Table 1 – for titles) before the faculty and students of the College in a Research Day designed especially for the Undergraduate at AMC. This enjoyable activity was extremely well-received by the students.

Task 5. Evaluation of Program
Extensive evaluation of every aspect of the program was provided. Data will be presented at the Era of Hope meeting; Abstract in Appendix.

Key Training Accomplishments

- Recruited 14 funded investigators; 6 served at BCR mentors
- Received 163 applications
- Recruited 6 highly qualified students
- Trained students in Research
- Enriched students with a variety of BCR activities
- All rising seniors (in BCR and all other training programs) applied to Albany Medical College (medical school or graduate school): all were accepted, 1 will matriculate

Reportable Outcomes

- Abstract (appendix) submitted to Era of Hope Meeting (September 2002)

Conclusion

Very good students were recruited; each had a successful research experience. Faculty at AMC were very favorably impressed and eager to have students for the next summer. One student continues to do BCR at AMC during her junior year at a nearby college; one student will matriculate in graduate school at UMASS and be involved in BCR. One student from the other Undergraduate Summer Research program will matriculate in the AMC graduate school in July 2002 and be involved in BCR. All short-term objectives were met; all long-term objectives are being met. The program was very successful.

BREAST CANCER RESEARCH UNDERGRADUATE SUMMER TRAINING PROGRAM

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In order to eradicate breast cancer, it will be necessary to have a cadre of talented investigators whose careers are dedicated to studies of the prevention, treatment, and early detection of the disease. The workplace of the future will be such that attracting the brightest and best minds will, in itself, be a challenge. By investing in young people before they have made their career choices, and specifically by providing them with first-hand experience in a modern breast cancer research laboratory, we anticipate that many of these talented young people will discover an interest in research that they did not know they had, and will discover new career options that will position them to join the fight against breast cancer. Students who experience the excitement of discovery, who face and conquer the challenges of research, and who are rewarded by contributing their best work to the greater scientific community, very often choose to make a career in the scientific or clinical arenas. It is this investment that will pay multiple dividends in the years ahead. Failure to provide this investment may lead many of these bright young students to choose alternate careers or paths from which we may never be able to attract them, thus leaving a personnel void in the war on breast cancer.

The vision of the Undergraduate Summer Training Program in Breast Cancer Research (BCR) at the Albany Medical College is to recruit highly talented undergraduates to careers (either Ph.D. or M.D.) in breast cancer research so that they can make meaningful contributions to the eradication of this disease. It is a long-term goal of the program to have a very high percentage of program alumni(ae) find careers involving BCR. Short-term goals of the program are to see significant numbers of these students matriculate in graduate schools and medical schools and, while in professional school, to contribute their expertise directly to BCR. Additionally, it is a goal to see some of these students matriculate at the Albany Medical College (graduate or medical school).

Data from the first two summer programs will be presented. That talented students are being recruited is evident from the diversity of undergraduate schools (students from 70 different colleges applied), the quality of the matriculants (average undergraduate GPA 3.85), and the number of applications (80 applications for 5 positions per year). Students spend 90% of their time in a laboratory of a funded cancer investigator doing authentic, meaningful, mentored research, and present their results in an end-of-summer Research Day format. Students also participate in a number of Enrichment Activities including an Overview of Breast Cancer series, Meet the Investigator luncheon sessions, sessions to meet breast cancer survivors, career opportunities sessions, and reading and discussing literature about breast cancer research. All aspects of the program are tracked and evaluated.

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