Award Number: DAMD17-01-1-0121

TITLE: Breast Cancer Research Summer Training Program

PRINCIPAL INVESTIGATOR: Thomas T. Anderson, Ph.D.

CONTRACTING ORGANIZATION: Albany Medical College
Albany, New York 12208

REPORT DATE: June 2003

TYPE OF REPORT: Annual Summary

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2003	Annual Summary (14 May 02 - 13 May 03)

4. TITLE AND SUBTITLE
Breast Cancer Research Summer Training Program

5. FUNDING NUMBERS
DAMD17-01-1-0121

6. AUTHOR(S)
Thomas T. Anderson, Ph.D.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Albany Medical College
Albany, New York 12208

E-Mail: anderst@mail.amc.edu

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 Words)

The vision of the Summer Undergraduate Training Program in Breast Cancer Research (BCR) at Albany Medical College is to recruit highly talented undergraduates to careers 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 42 different colleges applied in 2002), the quality of the matriculants (average GPA 3.72), and the number of applications (81 applications for 5 position in 2002). Students spent 90% of their time in the laboratory of a funded investigator doing authentic, meaningful, mentored BCR. Students also participated in enrichment activities, including an overview of BCR, sessions to meet investigators involved in BCR, career sessions, and others. Updated data from previous cohorts indicate that the program is guiding students to careers in BCR. It is necessary to have a cadre of talented investigators whose careers are dedicated to studies of prevention, treatment, and early detection of BC. By investing in young people before they make their career choices, and by providing them with first-hand experiences in modern BCR laboratories, we provide opportunities for these talented students to discover an interest in, and an awareness of, the career opportunities in BCR that will position them to join the fight against breast cancer.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Undergraduate training program in Breast Cancer	11
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

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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 2002. At the time of report writing, two years of training is complete and recruitment (but not training) of the third cohort of students is complete. To comply with the request (in the critiques of last year's progress report) for cumulative data, information is provided about the first two cohorts (and the report is a little longer than specified).

Body

Relevance: This 2002 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 15 laboratories, funded by at least 16 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. One student from this cohort will matriculate in the graduate school this fall and will be involved actively in Breast Cancer Research.

Overview: The USTP at AMC is designed as a 10-week program to provide opportunities for 5 undergraduates per summer. Talented students are being recruited: 81 applications from 42 different colleges, including applications from as far away as Texas and Wyoming, were received, which provided a competitive applicant pool from which the top 5 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 Responsible Conduct of Research, interactive learning opportunities focusing on an Overview of BCR, seminars to broaden their knowledge of BCR, preparation of their own research presentations, and opportunities to explore BCR career options while at AMC. An important addition for the summer of 2002 was a writing component, which enhanced students' ability to read and write scientific literature. 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

Task 1 Recruitment

a. Select Participating Mentors

Fourteen funded investigators focusing on Breast Cancer Research (BCR) were provided from which students chose. The faculty who were chosen by the students in Year 2 (2002) are shown in Table 1.

Table 1 – Mentors, Funding Status, and Student Projects

2002 Student	Mentor	Mentor Funding	Student Project Title
Kelly Fisher	Charles Lowry, PhD	NSF0114040	"Genetic Characterization of the Regulatory Domain of the Mox 4 Transcriptional Factor in C. cerevisiae"
Roland Jacques	Paul Higgins, PhD	2R01GM057242-05	"The Role of Ras in the Signal Transduction Pathway of PAI-1"
Leroy Joseph *	Thomas Andersen, PhD	5R25GM062460-03 DAMD17-01-1-0472	"Optimal Synthesis of Cyclic Peptides that Prevent the Growth of Human Breast Cancer"
Rebekah Klinger +	Thomas Friedrich, PhD	Albany Molecular Research	"Point Mutations in the Nuclear Localization Signal of SV-40 Large T Antigen"
Alicia Strazza	Lisa Petti, PhD	5R29CA73682-03	"Tyrosine to Phenylalanine Mutations at Autophosphorylation Sites Alter the Neu* Receptor's Ability to Transform Human Diploid Fibroblasts"
Gayani Tillekeratne	Paula McKeown-Longo, PhD	5R01CA058626-11 5R01CA069612-07	Anti-Angiogenic Activity of the First Type III Repeat of Fibronectin"

* Minority Student

+ Supported by AMC, not by grant funds.

All mentors were assessed as contributing and helpful. Still, it is hypothesized that the best mentor-student interactions correlate with amount of time the mentor spends with the student. This hypothesis will be assessed in Year 3 (Summer 2003).

To comply with the request for cumulative data, we also show the information for Year 1 (2001).

Table 2 - Mentors, Funding Status, and Student Projects

2001 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. These materials were appended in last year's report and so are not duplicated this year.

Task 2. Selection of Students

Recruitment efforts led to a large number of applicants of very high quality. Table 3 shows that the program was very selective and very attractive. Six of our top applicants enrolled in the program in the second year. Table 4 shows information about the matriculants in Year 2 (2002). Table 5 updates the Year 1 (2001) cohort.

Table 3 – Recruitment of Students

Year	Number of Applications	Number of Acceptances	Number Enrolling
2002	81	6 – Army, Breast Cancer 5 - NIH, Cross Training	6 – Army, Breast Cancer 5 - NIH, Cross Training
2001	90	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 4 - Data for BCR Matriculated Students, Summer 2002 (Year 2)

Table 4 shows that the quality of the matriculants was very high.

2002 Student	Undergraduate College	Year Completed at time of Acceptance	Major	GPA at time of Acceptance	Current Status
Kelly Fisher	College of Saint Rose	Sophomore	Biology/ Cytotechnology	3.60	Completing Junior year at Saint Rose
Roland Jacques	University of Rhode Island	Junior	Microbiology	3.49	ER Rhode Island Hospital / Applying Medical School fall 2004
Leroy Joseph	Cheney University	Junior	Chemistry	3.97	Graduate School at Albany Medical College
Rebekah Klinger	Hartwick College	Junior	Biology	3.59	Graduate School at Colorado State
Alicia Strazza	College of Saint Rose	Junior	Biology	3.85	Graduate School at Tufts University
Gayani Tillekeratne	Massachusetts Institute of Technology	Junior	Biology	4.8 (on a 5.0 scale)	Medical School at Duke University

Table 5 – Updated Status of 2001 Cohort (Year 1)

2001 Student	Undergraduate College	Year Completed At time of Acceptance	Major	GPA at time of Acceptance	Current Status
Kerri Ann Fraterigo	Russell Sage College	Sophomore	Biology	3.98	Medical School or Physician Assistance Program
Jason Laliberte	University of Massachusetts at Amherst	Junior	Biology	3.27	Graduate School at UMASS
Kate Pettrone	Williams College	Sophomore	Biology	3.36	Working at Easton Associates, NYC
Lisa Schoonmaker	Siena College	Sophomore	Biology	3.34	Albany Medical College – Breast Cancer Research
Adam Stallmer	Rensselaer Polytechnic Institute	Sophomore	Math/ Science	4.0	Medical School at Syracuse
Courtney St. Amour	Brandeis University	Sophomore	Biology	3.88	Graduate School at Cornell

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 that all aspects were successful.

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 6 – Meet the Investigator Series
Evaluations indicated that students appreciated learning about career choices of these investigators, and about their research.

Week #	Investigator
1	Thomas Friedrich, PhD
2	Lisa Petti, PhD
3	James Bennett, PhD
4	Paul Higgins, PhD
5	Dan Mayer, MD
6	Paula McKeown-Longo, PhD
7	J. Andre Melendez, PhD

Table 7 – Responsible Conduct of Research
Students were trained in the Responsible Conduct of Research in accordance with NIH recommendations. 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-Led Role Playing and Case Discussion

Overview of Breast Cancer
The Overview of Breast Cancer didactic series included lectures that provided background information on cancer, oncogenes, angiogenesis, and the causes and treatment of breast cancer. After students were presented with lectures covering a variety of topics encompassing breast cancer, Stephen Grund, MD, from the Cancer Center at Albany Medical Center provided insight on the clinical aspects of breast cancer. Two breast cancer survivors conveyed their personal struggle and thoroughly answered the student inquiries about treatment regimes and the strain it caused on one's lifestyle. The intent of the didactic lectures, breast cancer survivor sessions, and the reading assignment, "Dr. Folkman's War," was to provide students with knowledge to supplement their laboratory research and to ultimately provide the students with a passion to pursue breast cancer research as a career.

Students in the BCR program read the following book and participated in detailed discussion of the BCR implications of the book.

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

Writing Component - In one of the other summer undergraduate research programs at AMC, a writing component had been very successful in 2001. It was adapted and incorporated into the Breast Cancer

Research program for half of the summer of 2002 (and for the whole summer of 2003). In this component, students were asked to use their Search and Retrieval skills to identify and read a paper related to Breast Cancer Prevention, and write a 1 or 2 page summary of the work. Students used their literature search skills, read scientific papers, enhanced their writing skills by providing a description appropriate for the scientific disciplines, and became familiar with a broad range of BCR investigations. Students received individualized feedback promptly, and incorporated the suggestions for the next week's assignment. BCR students wrote 5 (weekly) assignments and made rapid progress in reading and interpreting the scientific literature. The individualized nature of the feedback ensured that each student worked on their own areas of greatest need and this ensured rapid progress. This is, by far, the most successful of all the non-laboratory-based activities, and is of tremendous benefit in preparing students for graduate school. Students need about 10 weeks of this training, and their modification will be incorporated for Year 3 Summer 2003.

Table 8 - 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. Students indicated this session should occur earlier in the summer and this was accommodated for 2003.

Career Opportunities Day	Presenter
The Road to Graduate School	Assistant Dean for Graduate Studies
The Paths after Graduate School	Research Professor of Biochemistry
The Road to Medical School	Assistant Dean for Medical School Admissions
Research in Medical School	Assistant Dean for Medical Student Research
Career Paths after Medical School	PGY2 Resident

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 Format Presentation &
Oral Format Presentation
Dr. C. Michael DiPersio - Writing a Scientific 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 Summer Research Programs at AMC. Students chose to present their results in a poster or oral format. Many students have the opportunity to make presentations at their home campus and were encouraged to select the format that would best suit their needs in upcoming months. Students find this aspect of their training to be as enjoyable as it is challenging.

Evaluation of Program

Aspects of the program were evaluated with multiple, quick, interesting evaluation tools. The intent is to encourage students to respond the evaluation tools they will receive annually for the next decade. Responses to the assessments were made by improving the design of the program, from one year to the next, as well as promptly within a summer.

Key Training Accomplishments

- Recruited 14 funded investigators; 6 served at BCR mentors
- Received 81 applications
- Recruited 6 highly qualified students
- Trained students in Research
- Enriched students with a variety of BCR activities
- Recruited one alumnus to this graduate school
- Of the 11 students who have graduated from their college, 5 have gone on to graduate school (1 at AMC), 3 to medical school, and 3 are working (1 in BCR, 1 or more who plan to apply to medical school for 2004)

Conclusion

All short-term objectives were met; all long-term objectives are being met. The program was very successful.

It was expected that we would be preparing in 2003 a competing continuation application for future funding of this program, but the funding agency did not offer these opportunities in this cycle. This will lead to an interruption in this highly successful, extremely important program, a most disappointing observation.