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Advanced Research Training in Marine Molecular Biology
and Biotechnology

N00014-90-J-1978

Rebecca J. Van Beneden

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The ONR sponsored grant entitled "Advanced Research Training in Marine Molecular Biology and Biotechnology" founded a training course to teach students and established scientists the basic principles of modern recombinant DNA technology. The emphasis was on the development of marine models and problems in environmental and ocean sciences. Students were trained in the isolation and characterization of DNA and RNA which included Southern and Northern blotting, DNA sequencing and cDNA libraries. Other techniques taught were the use of the polymerase chain reaction (PCR), in situ hybridization, gene transfer, mtDNA analysis and immunoblotting. These techniques were applied to problems in environmental toxicology, marine microbiology, the development of transgenic organisms, evolution and population studies, developmental biology and gene expression analysis.

training course
marine molecular biology

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FINAL TECHNICAL REPORT

Advanced Research Training in
Marine Molecular Biology and Biotechnology

Grant #: N00014-90-J-1978

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Principal Investigator: Rebecca J. Van Beneden

Institution: Duke University School of the Environment
Marine Laboratory
Beaufort, NC 28516

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I. Summary of all work accomplished

Objective: To train undergraduate, graduate and post-graduate students in the basic principles of current molecular biology and recombinant DNA techniques. The emphasis was on the application of these methods to study processes in biological oceanography and the development of marine organisms as model systems.

Approach: Students were trained in basic techniques of molecular biology, which included: (1) DNA ANALYSIS - (DNA isolation, Agarose gel electrophoresis, Southern blotting, hybridization, plasmid preparation and DNA sequencing); (2) MARINE MICROBIOLOGY - (immunoblotting, antibiotic production, PCR); (3) GENE TRANSFER - (cell culture, electroporation, calcium phosphate precipitation, lipofection, CAT assays); (4) RNA ANALYSIS - (RNA isolation, cDNA libraries, Northern blots); (5) DEVELOPMENTAL BIOLOGY OF SEA URCHINS (in situ hybridization); (6) mtDNA ANALYSIS (mtDNA isolation, PCR).

Staff members:

- Dr. Rebecca Van Beneden, Duke University
- Dr. James Oliver, University of North Carolina at Charlotte
- Dr. Donald Blair, National Cancer Institute
- Dr. Patricia McClellan-Green, Duke University
- Dr. Gary Wessel, Brown University
- Dr. Robert Chapman, East Carolina University

Students (year 01):

- Bodishbaugh, Donovan; Postdoc; Duke University
- Catallo, William; Ph.D.; Louisiana State University
- Heath, Judy; Research Assistant; East Carolina University
- Parker, Heather; Research Assistant; Oberlin College
- Peichel, Catherine; Undergraduate; University of California
- Schlenk, Daniel; Postdoc; Duke University
- Small, Maureen; Graduate Student; Duke University
- Terwilliger, Nora; Ph.D.; Oregon Inst. of Marine Biology
- Wadman, Elizabeth; Research Assistant; Univ. Pennsylvania
- Winn, Richard; Postdoc; Duke University

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Students (year 02):

Alves Gomes, Jose, Graduate Student, Scripps Institute of Oceanography
Andacht, Tracy, Graduate Student, Duke University
Brown, David, Graduate Student, Duke University
Cashon, Robert, Dr., Research Assoc., Duke Univ. Marine Lab
Davis, Greg, Undergraduate, Duke University
Gross, Paul, Graduate Student, George Washington University
Kim, Chang-Hyum, Dr., Professor, Pusan University, Korea
Matese, John, Graduate Student, Duke University
Van Veld, Peter, Dr., Asst. Professor, Virginia Inst. of Marine Sciences
Watson, David, Graduate Student, Duke University
Rainer, Julia, (Independent Study only), Virginia Institute of Marine Sciences

Accomplishments: The course for the first two years was highly successful and well organized. The laboratory participants were limited to 10. Student evaluations indicated that they were very pleased with the general format. Many rated this course as the best they had taken at Duke University. The format allowed for maximum hands-on experience. Lectures emphasized techniques, problem solving and the unique aspects of marine organisms as model systems. The follow-up independent study period allowed students to focus on selected techniques as applied to their individual research efforts.

We have kept in contact with many of the students. One undergraduate became very interested in oncogenes and is now in graduate school. Another has taken a position as research assistant in a molecular biology laboratory at Johns Hopkins University and has future plans to enter graduate school studying marine organisms at this level. One assistant professor has incorporated molecular techniques in her studies of marine snails. Two postdoctoral fellows are making excellent progress using recombinant DNA techniques and aquatic models. Doctoral student David Brown has been studying the Ah receptor in marine invertebrates in my laboratory. Techniques learned here by Mr. Gomes (Scripps) on mtDNA analysis of several fish species have developed into a major part of his thesis work. Ms. Andacht and Mr. Matese, both graduate students of Dr. David McClay at Duke University, are using techniques learned in this course to address different molecular aspects of sea urchin development. Several other graduate students have used these techniques as part of their thesis projects. Mr. Gross (Georgetown University) will be returning this summer to continue some of his studies. Data generated in independent studies of Ms. Rainer have been published (see below) and used as preliminary support in several grant proposals. These examples illustrate the far-reaching impact of this course and the flow of information from molecular biology to problems in the biological ocean sciences.

II. Index of all publications

1. Course Bulletins (years 01 & 02)
2. Independent Study Report - Jose Gomes
3. Independent Study Report - Julia Rainer
4. Publication of Independent Study Report - Rainer, J. and Brouwer, M. Hemocyanin Synthesis in the blue crab *Callinectes sapidus*. *Comp. Biochem. Physiol.* 104B:69-73, 1993.

III. Patents Pending or Filed

Not applicable.

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