

EXAMINING THE FATE OF ANTHROPOGENIC COMPOUNDS IN AQUATIC ECOSYSTEMS

(Faculty Development Summer-2006 Grant: Progress Report)

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The primary objective of the Faculty Development Grant was to obtain funds to start and maintain a sustainable research project suitable for student participation. The proposed research is intended to examine the fate of anthropogenic compounds in aquatic ecosystems. Biology students will be able to gain experience in both laboratory and field data-collection and analysis related to aquatic ecology.

In lotic environments metabolic activities of microorganisms have been found to have a large effect on the systems chemistry and are important in the degradation of terrestrial inputs and environmental contaminants (Hullar et al., 2006). In nature, microorganisms often exist in complex communities associated with surfaces called biofilms. Biofilms are made up of extracellular substances synthesized and excreted by bacterial cells (Donlan et al., 2004), and are important components of aquatic ecosystems. This research will assess the effects of a variety of environmental contaminants on biofilm production by comparing the chemical composition and microbial diversity of biofilms exposed to environmental contaminants to biofilms left in their natural state. The funds acquired through the Faculty Development Grant were used to purchase materials for the preliminary work necessary to start this research.



Figure 1: Installment of biofilm devices.

Biofilm devices were fabricated in the lab then installed in the Squannacook and Nashua Rivers (MA), and Pumpkin Brook in June of 2006 (Fig. 1). After three weeks incubation, the devices were

retrieved from the water and brought into the lab. Polymerase chain reaction (PCR) amplified 16s rDNA and denaturing gradient gel electrophoresis (DGGE) will be used to determine microbial community structure. This requires successful isolation and purification of DNA from the biofilm devices. After assessing three different DNA extraction methods, one technique successfully extracted DNA from the biofilms (Fig. 2). Multiple sets of oligonucleotide primers are presently being used to amplify specific rDNA sequences associated with eubacteria and archaeobacteria.

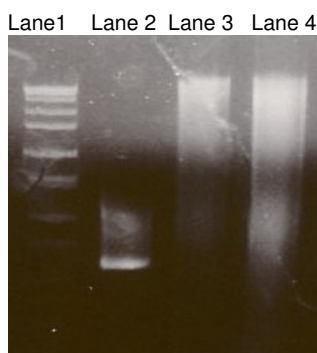


Figure 2: Gel electrophoresis showing extraction of DNA from biofilms. Lane 1: molecular marker; Lane 2: *E. coli* control; Lane 3: Nashua River (sample 1); and Lane 4: Nashua River (sample 2).

Chemical composition of biofilms and detection of contaminants will be measured using GC (gas chromatography) and HPLC (high performance liquid chromatography) analysis. Analytical methods for detecting biofilm components and for monitoring contaminant degradation are being researched and will soon be tested to determine detection limits. When the appropriate methodologies have been identified, an outline of the sampling schedule will be prepared. The first phase of the study will begin this spring starting with the monitoring of water quality and determining biofilm chemical composition and biofilm microbial composition prior to contaminant exposure.

References:

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- Hullar, A. J., Kaplan, L. A., and D. A. Stahl. (2006). Recurring seasonal dynamics of microbial communities in stream habitats. *App. Environ. Microbiol.* **72**: 713-722.

* **SUSAN E. BARBARO**, Ph.D., obtained a Bachelor of Science Degree from Concordia University, Montreal, Quebec, and Master of Science and Doctorate from the University of Waterloo, Ontario. Her desire to understand and protect the environment has always played an important role in determining Susan's research interests. In particular, she is interested in the microbial ecology of fresh water and soil ecosystems. Susan has studied and conducted research related to microbial physiology, biological control, and bioremediation. Her first full-time teaching position was at Delaware State University, a Historical Black College. She joined the faculty at Rivier College in 2003.