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Regulation of Attached Bacterial Growth by Adsorbed Proteins

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12. ABSTRACT (Maximum 200 words)

The general objective of this project was to examine one component of the primary biofilm, protein, which has been hypothesized to be a major component of both dissolved and adsorbed organic pools in seawater. In previous work we found that surface energy was important in determining adsorption of protein to surfaces in seawater and degradation rates by bacteria and bacterial growth. In the last phase of this work, we examined the chemical nature of actual protein in seawater using HPLC techniques which we developed, standard chemical assays, and bioassays. We showed that protein in seawater is not the same chemically as cellular protein. Bacteria appear to treat nearly all seawater protein as if it were glycolated and degrade it at much lower rates than unmodified, "fresh" protein. Other experiments showed that cellular protein introduced into seawater is quickly modified by abiotic reactions and becomes less easily hydrolyzed by bacterial proteases within hours. The abiotic reactions appear to include adsorption to small colloids. These results begin to explain the growth dynamics of microorganisms on surfaces and the origin of refractory organic matter which is highly abundant in seawater.

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FINAL REPORT QUESTIONNAIRE
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Principal Investigator Name: David L. Kirchman

Institution: University of Delaware

Project Title: Regulation of Attached Bacterial Growth by Adsorbed Protein

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No. Grad. Students:	3			
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No. Undergraduates:	1	1		

AWARDS/HONORS TO PI AND/OR TO MEMBERS OF PI'S RESEARCH GROUP (please describe):

P.I. was appointed editor of Limnology and Oceanography. P.I. was Chair of Division N of American Society of Microbiology.

Equipment purchased on grant (number and description of items costing >$1,500):

None

List of Papers in Refereed Journals Published During Project

May 1990- June 1993.

*Montgomery, M.T., N.W. Welschmeyer, and D.L. Kirchman. 1990. A simple assay for chitin: Application to sediment trap samples from the Subarctic Pacific. Mar. Ecol. Prog. Ser. 64: 301-308.

*Nagata, T. and D.L. Kirchman. 1990. Filtration-induced release of dissolved free amino acids: application to cultures of marine protozoa. Mar. Ecol. Prog. Ser. 68: 1-5.

*Samuelsson, M-O. and D.L. Kirchman. 1990. Degradation of adsorbed protein by attached bacteria in relationship to surface hydrophobicity. Appl. Environ. Microbiol. 56: 3643-3648.

*Keil, R.G. and D.L. Kirchman. 1991. Dissolved combined amino acids in marine waters as determined by a vapor-phase hydrolysis method. Mar. Chem. 33: 243-259.

*Nagata, T. and D.L. Kirchman. 1991. Release of dissolved free and combined amino acids by bacteriovorous marine flagellates. Limnol. Oceanogr. 36(3): 433-443.

*Keil, R.G. and D.L. Kirchman. Contribution of dissolved free amino acids and ammonium to the nitrogen requirements of heterotrophic bacterioplankton. Mar. Ecol. Prog. Ser. 73: 1-10.

Logan, B.E. and D.L. Kirchman. Increased uptake of dissolved organics by marine bacteria as a function of fluid motion. Mar. Biol. 111: 175-181.

*Keil, R.G. and D.L. Kirchman. 1992 Bacterial degradation of methylated protein and uniformly labelled protein. Appl. Environ. Microbiol. 58: 1374-1375.

*Montgomery, M.T. and D.L. Kirchman. 1993. Role of chitin-binding proteins in the specific attachment of the marine bacterium Vibrio harveyi to chitin. Appl. Environ. Microbiol. 59: 373-379.

*Keil, R.G. and D.L. Kirchman. 1993. Dissolved combined amino acids: chemical form and utilization by marine bacteria. Limnol. Oceanogr. In press.

*Keil, R.G. and D.L. Kirchman. Abiotic transformation of labile protein to refractory protein in seawater. Mar. Chem. In press.

*Students or postdoc's in P.I.'s lab (D.L. Kirchman)

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