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Final Report

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FINAL REPORT ON CONTRACT N0014-90-J-1351

PRINCIPAL INVESTIGATOR: Dr. Patrick L. Ahl

CONTRACTOR: Hahnemann University

CONTRACT TITLE: Structure and Function of Polymerized Protein/Lipid Bilayers

START DATE: 1 January 1990

RESEARCH OBJECTIVE:

The long range goal was to develop "rugged" polymerized phospholipid bilayers suitable for biosensor applications. The specific objective of this project was to examine the how the addition a non-polymerizable phosphatidylcholines of various acyl chain lengths effects the polymerization of the diacetylenic phosphatidylchoine, 1,2-bis(tricoso-10,12-dinoyl)-sn - glycerol-3-phosphocholine (DC8,9PC).

PROGRESS (8 MONTHS):

This project was proposed to cover a period of one year. I am terminating this project after 8 months because I am leaving Hahnemann University to take a research position with a biotechnology company which specializes in medical applications for liposomes. This report will summarize the progress made during this 8 month period.

During my tenure at the Naval Research Laboratory, Dr. Alok Singh and myself, developed a method to incorporate membrane proteins into polymerized bilayers composed of the polymerizable lipid DC89PC and the non-polymerizable lipid dinonanoyl-phosphatidylcholine (DNPC). We found that the short acyl chain phosphatidylcholine DNPC significantly improved the polymerization of DC89PC in the bilayer membrane. One of the principle goals of this project was to determine molecular basis for how a non-polymerizable lipid improves the polymerization of the diacetylenic lipid.

During this project, I examined what effect varying the acyl chain length of the non-polymerizable phosphatidylcholine had on the polymerization efficiency of DC89PC. The extent of polymerization was determined by UV/visible spectroscopy using a specially modified 4800 SLM fluorometer. The lipid samples were contained in a special variable pathlength, temperature controlled, CaF2 sample cell. The samples were polymerized in the sample cell at 4 C with UV irradiation from a 100 watt Hg lamp. High signal to noise UV/visible difference spectra were obtained with relatively small amounts of sample. For example, polymerization of 2:1 mole ratio DNPC/DC89PC membranes (10 mg/ml total lipid) produced absorbance changes of 0.6 to 0.7 a.u., even when the measuring light pathlength was only 100 microns. This extremely short pathlength CaF2 sample cell was used so that absorbance changes following polymerization could also be measured in the IR region of the spectrum. The ultimate goal was to examine the spectra changes induced by polymerization in both the UV/visible and IR regions. Although, preparations for IR measurements using a FTIR spectrometer were in progress, I was not able to make these measurements because of my departure from Hahnemann University.

