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NER: Exploratory Research on Developing a Nanoscale Sensing Device for Measuring the Supply of Iron to Eukaryotic Phytoplankton in Natural Seawater

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Principal Investigator: Wells, Mark L. **Award ID:** 0102334

Organization: University of Maine

Title:

NER: Exploratory Research on Developing a Nanoscale Sensing Device for Measuring the Supply of Iron to Eukaryotic Phytoplankton in Natural Seawater

Project Participants

Senior Personnel

Name: Wells, Mark

Worked for more than 160 Hours: Yes

Contribution to Project:

Post-doc

Name: Orcutt, Karen

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Orcutt was responsible for carying out many of the proposed laboratory experiments, and participated in data interpretation and experiment planning.

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Other Collaborators or Contacts

None specifically associated with the project, although the preliminary findings here led us to contact two other investigators to participate in the follow-up NIRT proposal.

Activities and Findings

Research and Education Activities:

The major research activity of this exploratory project was to assess the likelihood that nanoscale devices could be fabricated to specifically sequester iron bound to the siderophore desferrioxime B. The devices were based on minaturizing bulk liquid membrane technology with synthetic carriers specific for the metal-ligand complex. Experiments targetted different fabrication methodologies and evaluated the stability of the colloidal suspension, the ability to maintain a pH gradient between the inner core of the liposome and the outer media, and the ability to transport Fe into the liposomes.

Findings:

1. It is possible to fabricate liposome nanodevices that retain a pH gradient over periods of months.
2. Adding the carrier molecule lasolid acid to the membranes of these nanodevices enables the recognition and uptake of iron complexed to the siderophore moleucle deferrioximine B.

Training and Development:

This project provide nanoscience research training experience to Dr. Karen Orcutt, who has extensive experience working with phytoplankton and iron. This experience was a direct benefit to Dr. Orcutt as she became a co-PI in the subsequent NIRT project currently underway.

Outreach Activities:

No outreach program was specifically associated with this project.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

The core component of this exploratory project was to ascertain whether bulk liquid membrane technology could be reduced to the size of a nanodevice while maintaining functionality. The work here established that liquid membrane transport systems were transferable to colloidal-sized particles. This preliminary data lended the key scientific support to a subsequent NIRT proposal submission that was funded to continue the work.

Contributions to Other Disciplines:

The project has helped to assess metal availability to marine phytoplankton in coastal waters.

Contributions to Human Resource Development:

None specifically associated with this project.

Contributions to Resources for Research and Education:

There are no specific contributions to education designed as part of this project, although aspects of the work have been incorporated into graduate lectures here at U. Maine.

Contributions Beyond Science and Engineering:

None specfically associated with this project.

Categories for which nothing is reported:

Organizational Partners

Any Journal

Any Book

Any Web/Internet Site

Any Product