



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
ENGINEER RESEARCH AND DEVELOPMENT CENTER, CORPS OF ENGINEERS
CONSTRUCTION ENGINEERING RESEARCH LABORATORY
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

**REQUEST FOR STATEMENTS OF INTEREST (SOI)
NUMBER W9132T-16-SOI-0007
PROJECT TO BE INITIATED in FY 2016**

Project Title: **Controlling Functional Group Architecture in Artificial Cells**

Responses to this Request for Statements of Interest will be used to identify potential investigators for a project to be funded by the Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL), which seeks to create self-assembling functional asymmetric membranes and layers for the production of energy at the small scale and also to address arenas in bioreactors, sensors, and drug delivery vehicles. The objective is to advance the notions of creating new biomimetic membranes imbued with advanced capabilities to direct material transport in controllable directions. Nature employs assembly of complex architectures with careful planning for orientation, positioning, communication and chemical relaying at the nanoscale. Approximately \$60,000 is expected to be available to support this project for a period of twelve (12) months after award.

Note that the CESU F&A rate will be applied to any awards that result from this Request for SOIs.

Background:

The Department of Defense which is a participant of the CESU Network manages nearly 25 million acres of land, and the natural and cultural resources found there, including plants, animals, waterways, and terrestrial environs. While DoD's primary mission is national defense, the DoD conservation program supports this mission by ensuring realistic training areas, and managing its resources in ways that maximize available land, air, and water training opportunities. DoD land management issues and objectives have many similarities to other federal, state, and private land management programs.

Study of natural systems down to the molecular level provides insight into how Nature develops resiliency and adaptability. At a fundamental level, the mechanisms, design, and function of living boundaries with the external world controls how species survive and thrive. Investigations of the structure – function relationships within cellular membranes enables new advanced surfaces and biomimetic layers with the inherent flexibility and robustness of natural systems. Understanding these nano- and microscale architectures is critical to the ability to self-assemble these unique barriers with embedded desired characteristics.

The ability to fabricate layers, membranes and vesicles with similar functions and characteristics of cells allows new architectures for compartments with controllable transport for bioprocessing and biomanufacturing, protective layers for biomolecules from harsh environments, green chemistry, new membranes for selectivity, biosensors that replicate living systems, and asymmetric arrangements of molecules for photonic delivery in energy applications.

Brief Description of Anticipated Work:

The government seeks to promote this type of research on asymmetric construction of vesicles to enable directional transport of payloads in and out of the interior. Specific objectives include:

1. To study the ability to self-assemble lipid bilayers and understand kinetics and resultant structures.
2. To predictably, selectively, and quantitatively incorporate desired molecules within either the inner or outer leaflet of the bilayer.
3. To study the ability to use bioorthogonal reactions to attach molecules selectively to either the inner or outer leaflet of the bilayer.
4. To develop new protocols to encapsulate biomolecules within the vesicle while maintaining functionality.
5. To perform imaging and analytical analysis on the resultant vesicle to illustrate and provide evidence of architecture.
6. To perform proof of principle experiments to prove the ability to control transport direction into or out of the vesicle.
7. To communicate results of study through publications and presentations at meetings.

Substantial Government involvement is anticipated for this project. The Government's participation efforts include:

1. Development of study methodology
2. Joint data gathering and communication
3. Approval of project activities
4. Collaborative research articles and presentations

Materials Requested for Statement of Interest/Qualifications:

Please provide the following via e-mail attachment (Maximum length: 2 pages, single-spaced 12 pt. font).

1. Name, Organization and Contact Information
2. Brief Statement of Qualifications (including):
 - a. Biographical Sketch,
 - b. Relevant past projects, publications, and clients with brief descriptions of these projects,
 - c. Staff, faculty or students available to work on this project and their areas of expertise,
 - d. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.).

Note: A proposed budget is NOT requested at this time.

Review of Statements Received: Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements will be evaluated based on the investigator's specific experience and capabilities in areas related to the study requirements.

Please send responses or direct questions to:

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Timeline for Review of Statements of Interest: Review of Statements of Interest will begin **ten working days** after posting of SOI.