

**REPORT OF INVENTIONS AND SUBCONTRACTS**  
(Pursuant to "Patent Rights" Contract Clause) (See Instructions on back)

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Executive Services Directorate (9000-0095). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION. RETURN COMPLETED FORM TO THE CONTRACTING OFFICER.**

1. a. NAME OF CONTRACTOR/SUBCONTRACTOR Devaraj, Neal		c. CONTRACT NUMBER W9132T-14-2-0002	
b. ADDRESS (include ZIP Code) 9500 Gilman Drive #0359 La Jolla, CA 92093-0359		d. AWARD DATE (YYYYMMDD) 20140314	
2. a. NAME OF GOVERNMENT PRIME CONTRACTOR DEPARTMENT OF THE ARMY U.S. AR		c. CONTRACT NUMBER W9132T-14-2-0002	
b. ADDRESS (include ZIP Code) 2902 NEWMARK DRIVE, P. O. BOX 9005 CHAMPAIGN, ILLINOIS 61826-9005		d. AWARD DATE (YYYYMMDD) 20140314	
		e. FROM 20140314	
		b. TD 20150313	

**SECTION I - SUBJECT INVENTIONS**


5. "SUBJECT INVENTIONS" REQUIRED TO BE REPORTED BY CONTRACTOR/SUBCONTRACTOR (If "None," so state)		ELECTION TO FILE PATENT APPLICATIONS (X)		CONFIRMATORY INSTRUMENT OR ASSIGNMENT FORWARDED TO CONTRACTING OFFICER (X)	
a.	b.	d.		e.	
		(1) UNITED STATES	(2) FOREIGN	(a) YES	(b) NO
None		(a) YES	(b) NO	(c) YES	(d) NO

f. EMPLOYER OF INVENTOR(S) NOT EMPLOYED BY CONTRACTOR/SUBCONTRACTOR		g. ELECTED FOREIGN COUNTRIES IN WHICH A PATENT APPLICATION WILL BE FILED	
(1) (a) NAME OF INVENTOR (Last, First, Middle Initial) N/A	(2) (a) NAME OF INVENTOR (Last, First, Middle Initial) N/A	(1) TITLE OF INVENTION N/A	(2) FOREIGN COUNTRIES OF PATENT APPLICATION
(b) NAME OF EMPLOYER	(b) NAME OF EMPLOYER		
(c) ADDRESS OF EMPLOYER (include ZIP Code)	(c) ADDRESS OF EMPLOYER (include ZIP Code)		

**SECTION II - SUBCONTRACTS (Containing a "Patent Rights" clause)**

6. SUBCONTRACTS AWARDED BY CONTRACTOR/SUBCONTRACTOR (If "None," so state)		FAR "PATENT RIGHTS"		DESCRIPTION OF WORK TO BE PERFORMED UNDER SUBCONTRACT(S)		SUBCONTRACT DATES (YYYYMMDD)	
a.	b.	c.	d.	e.		(1) AWARD	(2) ESTIMATED COMPLETION
				(1) CLAUSE NUMBER	(2) DATE (YYYYMM)		
N/A							

**SECTION III - CERTIFICATION**

7. CERTIFICATION OF REPORT BY CONTRACTOR/SUBCONTRACTOR (Not required if: (X as appropriate))		SMALL BUSINESS or		NONPROFIT ORGANIZATION	
I certify that the reporting party has procedures for prompt identification and timely disclosure of "Subject Inventions," that such procedures have been followed and that all "Subject Inventions" have been reported.				<input checked="" type="checkbox"/>	
a. NAME OF AUTHORIZED CONTRACTOR/SUBCONTRACTOR OFFICIAL (Last, First, Middle Initial) Mayoral, Shelby, C.	b. TITLE Principal Contract & Grant Officer	c. SIGNATURE 		d. DATE SIGNED	

DD FORM 882 INSTRUCTIONS

GENERAL

This form is for use in submitting INTERIM and FINAL invention reports to the Contracting Officer and for use in reporting the award of subcontracts containing a "Patent Rights" clause. If the form does not afford sufficient space, multiple forms may be used or plain sheets of paper with proper identification of information by item number may be attached.

An INTERIM report is due at least every 12 months from the date of contract award and shall include (a) a listing of "Subject Inventions" during the reporting period, (b) a certification of compliance with required invention identification and disclosure procedures together with a certification of reporting of all "Subject Inventions," and (c) any required information not previously reported on subcontracts containing a "Patent Rights" clause.

A FINAL report is due within 6 months if contractor is a small business firm or domestic nonprofit organization and within 3 months for all others after completion of the contract work and shall include (a) a listing of all "Subject Inventions" required by the contract to be reported, and (b) any required information not previously reported on subcontracts awarded during the course of or under the contract and containing a "Patent Rights" clause.

While the form may be used for simultaneously reporting inventions and subcontracts, it may also be used for reporting, promptly after award, subcontracts containing a "Patent Rights" clause.

Dates shall be entered where indicated in certain items on this form and shall be entered in six or eight digit numbers in the order of year and month (YYMM) or year, month and day (YYMMDD). Example: April 2005 should be entered as 200504 and April 15, 2005 should be entered as 20050415.

- 1.a. Self-explanatory.
- 1.b. Self-explanatory.
- 1.c. If "same" as Item 2.c., so state.
- 1.d. Self-explanatory.
- 2.a. If "same" as Item 1.a., so state.
- 2.b. Self-explanatory.
- 2.c. Procurement Instrument Identification (PII) number of contract (DFARS 204.7003).
- 2.d. through 5.e. Self-explanatory.

5.f. The name and address of the employer of each inventor not employed by the contractor or subcontractor is needed because the Government's rights in a reported invention may not be determined solely by the terms of the "Patent Rights" clause in the contract.

Example 1: If an invention is made by a Government employee assigned to work with a contractor, the Government rights in such an invention will be determined under Executive Order 10096.

Example 2: If an invention is made under a contract by joint inventors and one of the inventors is a Government employee, the Government's rights in such an inventor's interest in the invention will also be determined under Executive Order 10096, except where the contractor is a small business or nonprofit organization, in which case the provisions of 35 U.S.C. 202(e) will apply.

5.g.(1) Self-explanatory.

5.g.(2) Self-explanatory with the exception that the contractor or subcontractor shall indicate, if known at the time of this report, whether applications will be filed under either the Patent Cooperation Treaty (PCT) or the European Patent Convention (EPC). If such is known, the letters PCT or EPC shall be entered after each listed country.

6.a. Self-explanatory.

6.b. Self-explanatory.

6.c. Self-explanatory.

6.d. Patent Rights Clauses are located in FAR 52.227.

6.e. Self-explanatory.

6.f. Self-explanatory.

7. Certification not required by small business firms and domestic nonprofit organizations.

7.a. through 7.d. Self-explanatory.

**REPORT DOCUMENTATION PAGE**

*Form Approved  
OMB No. 0704-0188*

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<b>1. REPORT DATE (DD-MM-YYYY)</b> 07-02/2015		<b>2. REPORT TYPE</b> Final Technical Report		<b>3. DATES COVERED (From - To)</b> 3/14/2014 - 3/13/2015	
<b>4. TITLE AND SUBTITLE</b> Controlling Functional Group Architecture in Artificial Cells				<b>5a. CONTRACT NUMBER</b> W9132T-14-2-0002	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b> Principal Investigator: Dr. Neal K. Devaraj Email: ndevaraj@ucsd.edu Phone: (858) 534-9539				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> The Regents of the University of California, San Diego Campus 9500 Gilman Dr. Dept. 621 La Jolla, CA 92093-0621				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> Tax ID No: 956006144 DUNS No: 804355790	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> ERDC-CERL ATTN: CEERD-CN-E (Neil Wesslund) 2902 Newmark Dr Champaign, IL 61822 Phone: 217-373-4464, Email: Neil.A.Wesslund@usace.army.mil				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> ERDC-CERL	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> No limitations/restrictions on distribution.					
<b>13. SUPPLEMENTARY NOTES</b> N/A					
<b>14. ABSTRACT</b> The goals and objectives of the period were to explore whether or not our triazole membrane synthesis system would allow for functional groups to be more predictably incorporated into phospholipid membranes spontaneously and also if the efficiency of incorporation can be improved compared to conventional methods. We also sought to utilize copper catalyzed cycloadditions to modify reactive groups within the phospholipid membrane structure and how the nature of the reactive elements, the copper catalyst, the azide, and the alkyne, affect the location and yield of the resulting product. The initial exploration of both these goals were performed and accomplished. We also developed a new methodology for synthesizing and controlling membrane architecture using light based approaches.					
<b>15. SUBJECT TERMS</b> phospholipid, membranes, redox, cycloaddition, light					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b> UU	<b>18. NUMBER OF PAGES</b> 4	<b>19a. NAME OF RESPONSIBLE PERSON</b> Shelby Mayoral
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			<b>19b. TELEPHONE NUMBER (Include area code)</b> (858) 534-3331

20150710089

## INSTRUCTIONS FOR COMPLETING SF 298

**1. REPORT DATE.** Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

**2. REPORT TYPE.** State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

**3. DATES COVERED.** Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

**4. TITLE.** Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

**5a. CONTRACT NUMBER.** Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

**5b. GRANT NUMBER.** Enter all grant numbers as they appear in the report, e.g. AFOSR-82-1234.

**5c. PROGRAM ELEMENT NUMBER.** Enter all program element numbers as they appear in the report, e.g. 61101A.

**5d. PROJECT NUMBER.** Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

**5e. TASK NUMBER.** Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

**5f. WORK UNIT NUMBER.** Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

**6. AUTHOR(S).** Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, J, Jr.

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES).** Self-explanatory.

**8. PERFORMING ORGANIZATION REPORT NUMBER.**

Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES).** Enter the name and address of the organization(s) financially responsible for and monitoring the work.

**10. SPONSOR/MONITOR'S ACRONYM(S).** Enter, if available, e.g. BRL, ARDEC, NADC.

**11. SPONSOR/MONITOR'S REPORT NUMBER(S).** Enter report number as assigned by the sponsoring/monitoring agency, if available, e.g. BRL-TR-829; -215.

**12. DISTRIBUTION/AVAILABILITY STATEMENT.** Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/ restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

**13. SUPPLEMENTARY NOTES.** Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

**14. ABSTRACT.** A brief (approximately 200 words) factual summary of the most significant information.

**15. SUBJECT TERMS.** Key words or phrases identifying major concepts in the report.

**16. SECURITY CLASSIFICATION.** Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

**17. LIMITATION OF ABSTRACT.** This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.

## Technical Report

1. A comparison of actual accomplishments with the goals and objectives established for the period, the findings of the investigator, or both:

The goals and objectives of the period were to explore whether or not our triazole membrane synthesis system would allow for functional groups to be more predictably incorporated into phospholipid membranes spontaneously and also if the efficiency of incorporation can be improved compared to conventional methods. We also sought to utilize copper catalyzed cycloadditions to modify reactive groups within the phospholipid membrane structure and how the nature of the reactive elements, the copper catalyst, the azide, and the alkyne, affect the location and yield of the resulting product. The initial exploration of both these goals were performed and accomplished. We developed a light based approach to membrane synthesis and modification, using soluble ruthenium photoreduction agents, which can trigger cycloadditions on the membrane in response to light. Using this new methodology, we were able to provide evidence for spatially restricting the modification of lipid membranes with coumarin dyes. We provided evidence for restricting modification to the inner and outer leaflet of the lipid membranes. Data was generated by high-performance liquid chromatography and fluorescence microscopy. Using the coumarin probe, we were able to show how the nature of the reactive elements, the copper catalyst, the azide, and the alkyne, affect the location and yield of the resulting product in the phospholipid membrane.

2. Reasons why established goals were not met, if appropriate:

-established goals of conducting proof of concept studies for controlling the architecture of lipid membranes for the first period were met.

3. Other pertinent information including, when appropriate, analysis and explanation of cost overruns or high unit costs:

-nothing to report

4. Identification of work planned during the coming reporting period:

- We propose to continue to explore whether or not our triazole membrane synthesis system would allow for functional groups to be more predictably incorporated into phospholipid membranes spontaneously and also if the efficiency of incorporation can be improved compared to conventional methods. We believe that the minimal nature of our approach lends itself to further elaboration and application, particularly with respect toward creating robust and scalable approaches towards artificial, self-sustaining cells that would be able to mimic key aspects of natural cells. Of particular interest would be to achieve de novo synthesis and self-assembly of artificial cells capable of undergoing photo-driven electron transfer reactions. We will also work with Dr. Cropek's lab to further enable enzyme encapsulation to improve the efficiency of light-driven hydrogen fuel production.

5. Changes in key personnel, if applicable:

-None