AFRL-AFOSR-VA-TR-2021-0020

Multi-modal Microscope for biophysical assessment of optical perturbation in the neural system

Mahadevan-Jansen, Anita
VANDERBILT UNIVERSITY
230 W 41ST STREET FL 7
NEW YORK, NY, 37203-2416
US

03/23/2021
Final Technical Report

DISTRIBUTION A: Distribution approved for public release.

Air Force Research Laboratory
Air Force Office of Scientific Research
Arlington, Virginia 22203
Air Force Materiel Command

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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 Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. 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 FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
23-03-2021	Final	15 Aug 2015 - 14 Aug 2017

4. TITLE AND SUBTITLE
Multi-modal Microscope for biophysical assessment of optical perturbation in the neural system

5a. CONTRACT NUMBER

5b. GRANT NUMBER
FA9550-15-1-0328

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Anita Mahadevan-Jansen

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
VANDERBILT UNIVERSITY
230 W 41ST STREET FL 7
NEW YORK, NY 37203-2416
US

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AF Office of Scientific Research
875 N. Randolph St. Room 3112
Arlington, VA 22203

10. SPONSOR/MONITOR'S ACRONYM(S)
AFRL/AFOSR RTB2

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
AFRL-AFOSR-VA-TR-2021-0020

12. DISTRIBUTION/AVAILABILITY STATEMENT
A Distribution Unlimited: PB Public Release

13. SUPPLEMENTARY NOTES

14. ABSTRACT
In this DURIP, we proposed to build a multi-modal non-linear optical microscope that can acquire cellular and molecular, biochemical and thermal information from the same location during optical stimulation from neural cells and tissue in vivo in a single combined framework. We have successfully built this instrument - Multimodal Advanced Nonlinear and Thermal Imaging System, or MANTIS, a microscope that is modular and integrated into a single platform. This instrument combines multi-photon fluorescence imaging, second harmonic generation (SHG) imaging, high resolution biochemical imaging with coherent anti-stokes Raman scattering (CARS), targeted vibrational mode imaging with stimulated scattering (SRS) and thermal imaging in such a way that we can reproducibly overlay the various images with < 1 micron precision. This instrument has enhanced our ability to perform the funded AFOSR research, and has become a unique resource within Vanderbilt as well as to the biophysics community at large to perform such integrated imaging. This combination of various non-linear microscopy modalities with thermal imaging has provided our engineering students with a unique opportunity to correlate information acquired with each domain and recognize the limitations and benefits of each technique.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			SOFI BIN-SALAMON
U	U	U	UU	3	**19b. TELEPHONE NUMBER** *(Include area code)* 426-8411

AFOSR Deliverables Submission Survey

Response ID:13881 Data

1. Report Upload

Report Type

Equipment Report

Primary Contact Email

Contact email if there is a problem with the report.

anita.mahadevan-jansen@vanderbilt.edu

Primary Contact Phone Number

Contact phone number if there is a problem with the report

615-343-4787

Organization / Institution name

Vanderbilt University

Grant/Contract Title

The full title of the funded effort.

Multi-Modal Microscope for Biophysical Assessment of Optical Perturbation in the Neural System

Grant/Contract Number

AFOSR assigned control number. It must begin with "FA9550" or "F49620" or "FA2386".

FA9550-15-1-0328

Principal Investigator Name

The full name of the principal investigator on the grant or contract.

Anita Mahadevan-Jansen

Program Officer

The AFOSR Program Officer currently assigned to the award

Sofi Bin-Salamon, Ph.D.

Reporting Period Start Date

08/15/2015

Reporting Period End Date

08/14/2017

Abstract

In this DURIP, we proposed to build a multi-modal non-linear optical microscope that can acquire cellular and molecular, biochemical and thermal information from the same location during optical stimulation from neural cells and tissue in vivo in a single combined framework. We have successfully built this instrument - Multimodal Advanced Nonlinear and Thermal Imaging System, or MANTIS, a microscope that is modular and integrated into a single platform. This instrument combines multi-photon fluorescence imaging, second harmonic generation (SHG) imaging, high resolution biochemical imaging with coherent anti-stokes Raman scattering (CARS), targeted vibrational mode imaging with stimulated scattering (SRS) and thermal imaging in such a way that we can reproducibly overlay the various images with < 1 micron precision. This instrument has enhanced our ability to perform the funded AFOSR research, and has become a unique resource within Vanderbilt as

well as to the biophysics community at large to perform such integrated imaging. This combination of various non-linear microscopy modalities with thermal imaging has provided our engineering students with a unique opportunity to correlate information acquired with each domain and recognize the limitations and benefits of each technique.

Distribution Statement

This is block 12 on the SF298 form.

Explanation for Distribution Statement

If this is not approved for public release, please provide a short explanation. E.g., contains proprietary information.

SF298 Form

Please attach your SF298 form. A blank SF298 can be found here. Please do not password protect or secure the PDF The maximum file size for an SF298 is 50MB.

Upload the Report Document. File must be a PDF. Please do not password protect or secure the PDF . The maximum file size for the Report Document is 50MB.

Upload a Report Document, if any. The maximum file size for the Report Document is 50MB.

Archival Publications (published) during reporting period:

New discoveries, inventions, or patent disclosures:

Do you have any discoveries, inventions, or patent disclosures to report for this period?

Please describe and include any notable dates

Do you plan to pursue a claim for personal or organizational intellectual property?

Changes in research objectives (if any):

Please list personnel associated with the period of performance for this grant (to include any past and present collaborators, students and AFOSR program officers):

Dr Anita Mahadevan-Jansen (PI)
Mr Wilson Adams (graduate student)

Extensions granted or milestones slipped, if any:

One year no-cost extension granted which allowed for the testing of the instrument.

AFOSR LRIR Number

LRIR Title

Reporting Period

Laboratory Task Manager

Program Officer

Research Objectives

Technical Summary

Funding Summary by Cost Category (by FY, $K)

	Starting FY	FY+1	FY+2
Salary			
Equipment/Facilities			
Supplies			
Total			

Report Document

Report Document - Text Analysis

Report Document - Text Analysis

Appendix Documents

2. Thank You

E-mail user

Sep 21, 2020 00:12:35 Success: Email Sent to: anita.mahadevan-jansen@vanderbilt.edu