Site Navigation

LAURA MARCU, PH.D.

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Marcu Lab Website

MAJOR RESEARCH INTEREST

In vivo optical spectroscopy and imaging for enhanced detection of disease in human tissue (cancer, cardiovascular); fluorescence-based minimally invasive medical diagnostics technology; high spatial – and time – resolution optical techniques for molecular imaging; optical bioMEMS; bionanophotonics: nanocrystals applications to molecular imaging

PERSONAL EDUCATION

Diploma of Engineer in Mechanical Engineering, 1984, Polytechnic Institute of Bucharest, Romania
Post-graduate specialization in Spectroscopy, Lasers, and Plasma Physics, 1989,University of Bucharest, Romania
M.S. in Biomedical Engineering, 1995, University of Southern California, Los Angeles
Ph.D. in Biomedical Engineering, 1998, University of Southern California, Los Angeles

AFFILIATION

Biomedical Engineering Graduate Group

RESEARCH INTEREST

Optical Spectroscopy and Imaging, Biophotonic Technology Development:

The mission of our research laboratory is to promote better diagnostic, treatment and prevention of human diseases through advancements in biophotonic technology - a field at the interface of physical sciences, engineering, biology and medicine. This is accomplished through a series of interdisciplinary research projects that enable early diagnosis and intraoperative demarcation of tumors, prevention of stroke and heart attack, and cancer therapy.

Professor Laura Marcu and her research group develop clinically compatible laser spectroscopy and imaging systems which facilitate in-vivo investigations of the relationship between tissue pathology and measured optical responses. Projects include development of fluorescence lifetime spectroscopy techniques for the recognition of major classes of fluorescent biomolecules in biological tissue, diagnosis of atherosclerotic cardiovascular disease, and intraoperative delineation of brain tumors. Recent work also targets optical microscopy techniques for imaging at the micro- and nano-scales, and non-invasive biological sensing.

Specific research areas:

* Development of fiber-optic time-resolved fluorescence spectroscopy and imaging devices for diagnosis of diseases in living tissues. This includes: (a) Research and engineering of clinical testing devices (b) Micro-scale optical spectroscopy and imaging systems (Optical MEMS) (c) Advanced analytical/mathematical methods and software tools for near-real time analysis/classification of optical data and display of diagnostic information.
* Applications of time-resolved fluorescence techniques to human diseases diagnosis. Specific projects include: (a) Catheter-based detection of vulnerable atherosclerotic plaques (b) Monitoring of the effects of therapeutic drugs on atherosclerotic plaque stabilization (c) Autofluorescence-guided brain tumor biopsy and surgery.
* Development of high spatial– and time–resolution optical microscopy techniques for studying molecular-targeted approaches to diagnosis and therapy of human diseases. Current studies target (a) Development of lifetime imaging microscopy (FLIM) instrumental platform (b) Applications of semiconductor quantum dots to early detection of pathologic transformations in tissues (c) Experimental research to study the application of ultrashort electric fields (nanoelectropulses) to cancer therapy.

RESEARCH PAPERS

B L. Marcu, J. A. Jo, Q. Fang, T. Papaioannou, A. Dorafshar, T. Reil, J. H. Qiao, D. Baker, M. C. Fishbein, and J. A. Freischlag. In-Vivo Detection of Macrophages in a Rabbit Atherosclerotic Model by Time-Resolved Laser-Induced Fluorescence Spectroscopy. Atherosclerosis. Vol. 181(2): 295-303, 2005.

O. V. Ivanova, L. Marcu, M. C. K. Khoo, “Nonparametric recognition of fluorescent system for tissue characterization: Simultaneous deconvolution in wavelength and time dimensions”. Annals of Biomedical Engineering. 33(4):529-542, 2005.

L. Marcu, J. A. Jo, P. V. Butte, W. H. Yong, B. K. Pikul, K. L. Black, and R. C. Thompson, Fluorescence lifetime spectroscopy of glioblastoma multiforme, Photochemistry and Photobiology, 80(1): 98-103, 2004.

P. T. Vernier, Y. Sun, L. Marcu, C. M. Craft, and M. A. Gundersen. Nanoelectropulse-Induced Phosphatidylserine Translocation, Biophysical Journal, 86(6): 4040-4048, 2004.

P. Ashjian, A. Elbarbary, P. Zuk, D. A. DeUgarte, P. Benhaim, M. H. Hedrick, L. Marcu. “ Non-invasive in-situ evaluation of osteogenic differentiation by time-resolved laser-induced fluorescence spectroscopy”, Tissue Engineering, 10(3/4):411-420, 2004.

Q. Fang, T. Papaioannou, J. Jo, R. Vaitha, K. Shastry, and L. Marcu, “Time-domain laser-induced fluorescence apparatus for clinical diagnostics,” Review of Scientific Instruments 75(1):151-162, 2004.

P. T. Vernier, Y. Sun, L. Marcu, C. M. Craft, and M. A. Gundersen, “Nanosecond pulsed electric fields perturb membrane phospholipids in T lymphoblasts”, FEBS Letters 572:103-108, 2004.

J. A. Jo, Q. Fang, T. Papaioannou, L. Marcu. “Fast model-free deconvolution of fluorescence decay for analysis of biological systems”. Journal of Biomedical Optics, 9 (4):743-752, 2004.