

LASER

BECKMAN LASER INSTITUTE

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SUMMER 2013

Laser Microbeam and Medical Program (LAMMP)

On May 1, 2013, Beckman Laser Institute and Medical Clinic (BLI) investigators received a \$5.9M, 5-year center grant from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) of the National



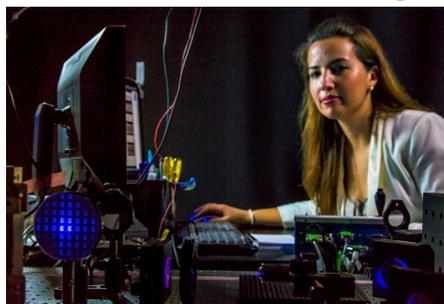
Chemical Engineering Professor Vasan Venugopalan (left) and BLI Professor Jerry Spanier lead the LAMMP Virtual Photonics technology core.

Institutes of Health (NIH). The grant supports the Laser Microbeam and Medical Program (LAMMP), one of only 30 NIBIB-funded Biomedical Technology Research Centers (BTRC) in the U.S. This is the seventh renewal of LAMMP spanning over a period of 33 years, making the UCI program one of the longest-running and most successful centers for Biophotonics and Biomedical Optics in the U.S.

LAMMP activities span from basic science and technology development to clinical translational research. Led by BLI Director and principal investigator (PI) Bruce J. Tromberg, Ph.D., Professor of Surgery and Biomedical Engineering, and BLI/LAMMP Medical Director J. Stuart Nelson, M.D., Ph.D., Professor of Surgery, LAMMP provides collaborators from UCI and around the world with state of the art biophotonics technologies and specialized resource facilities in cell

and tissue engineering, histopathology, pre-clinical models, and clinical care. With more than 40 IRB approved clinical protocols affiliated with the center, LAMMP has unique expertise to rapidly move new concepts and technologies from blackboard to benchtop to bedside.

LAMMP investigators are focused on 4 major areas of Technology Research and Development (TRD), known as "TRD cores." Overall, 11 new biophotonics platforms will be built based on cutting-edge designs and state-of-the-art computational methods. Nine new instruments will be directly available for clinical studies, and several devices will be duplicated and disseminated over the next five years to facilitate collaborative research with investigators around the country. These technologies will be applied to problems in cancer, vascular disease, metabolic syndrome, and neurologic disease. In addition, LAMMP technologies will be used to understand fundamental biological processes, such as mechano-transduction, wound repair,

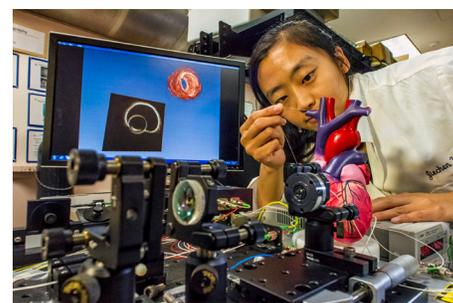


LAMMP Postdoctoral Fellow Martha Alvarez-Elizondo developing holographic optical tweezers.

angiogenesis, and cellular metabolism. The LAMMP "TRD cores" include:

TRD 1: Virtual Photonics Technologies (VPT) develops computa-

tional models and methods for simulating and visualizing light propagation in biological tissues. TRD 1 is co-lead by Vasan Venugopalan, Sc.D., Professor of Chemical and Biomedical Engineering, and Jerome Spanier, Ph.D., Research Professor, BLI. Professor Venugopalan is an expert in multi-scale modeling and



BME Graduate Student Jiawen Li working on an OCT microendoscope for imaging inside coronary arteries.

computation of light transport and photon interactions in biological tissues. Professor Spanier, a mathematician, is a pioneer and one of the world's leading experts in Monte Carlo techniques and transport problems.

TRD 2: Microscopy and Microbeam Technologies (MMT) focuses on the development of high-resolution non-linear optical microscopy (NLOM) techniques combined with laser microbeams. TRD 2 has 2 co-leaders: Eric Potma, Ph.D., Associate Professor of Chemistry, and Elliot Botvinick, Ph.D., Associate Professor of Biomedical Engineering. Dr. Potma is a pioneer and expert in non-linear Raman and multi-photon microscopies, and Dr. Botvinick is an expert in laser scissors and tweezers technology and specializes in mechano-

(LAMMP continued on p. 7)

The Ties that Bind

by Michael W. Berns, Ph.D.

Arnold and Mabel Beckman Professor
Co-Founder, Beckman Laser Institute

A year from now, the formal relationship between the Beckman Laser Institute Foundation Inc. (BLIF) and the Beckman Laser Institute (BLI) program at the University of California, Irvine (UCI) will end. Most people outside a small inner circle are probably not aware of this, and as the person who facilitated the negotiations between Arnold Beckman and UCI in 1984, I thought it would be timely to review the current situation.

Over the past thirty years, the relationship has primarily (but not exclusively) been financial: the BLIF has provided approximately 15 million dollars for on-going support, primarily for research activities, and roughly a million dollars for equipment. But some support has also been provided for conferences and to fund clinical activities related to the treatment of young children with

port wine stain birthmarks and severe hemangiomas. This has primarily been in the form of contributions to the Children's Treatment Fund and for a David Packard postdoctoral fellow.

But the relationship has also been intellectual, particularly in support of the technology transfer program through BLI interactions with board members from the business community (which has resulted in research grants from companies to the BLI) and support of the BLI business incubator which now houses three start-ups created by BLI faculty.

So what happens on August 31, 2014? Two key agreements expire: the lease of the building from the BLIF to UCI and a formal affiliation agreement signed in 1996, which replaced the initial Statement of Principles signed between UCI's founding chancellor Daniel Aldrich and Arnold O. Beckman. The immediate results of termination of both agreements are (1) the ownership of the BLI building transfers from the BLIF to UCI, and (2) the formal arrangement between the two entities, described in the affiliation agreement, ends. That

relationship includes such things as (a) how the building can be used, (b) distribution of BLI invention royalty money back to the BLI program, (c) the selection process for the BLI Director, and (d) issues relating to technology development and transfer to the private sector.

For the past two years, the BLIF and UCI have discussed the possibility of a new or a renewal of the affiliation agreement between the two entities, but it has not happened yet, and it may or may not happen. Whether or not we are successful at establishing a continued formal relationship between UCI and the BLIF, I am extremely proud of the BLI achievements over the twenty-seven years since the doors opened. The Beckman Laser Institute and Medical Clinic has achieved world recognition as a leading center for biophotonics research, and we have helped thousands of patients through laser treatment in the BLI clinic. I certainly expect this will continue in the future whether or not the BLIF and UCI continue with a formal relationship.

Newsbriefs

BLI Students are Part of a Winning Team

A team comprised of students from the Beckman Laser Institute (BLI) and The Paul Merage School of Business won First Place in the UCI Business Plan Competition for 2013. Sean White (Biomedical Engineering graduate student in Profs. Steve George's and Bernard Choi's labs), Bruce Yang (Biomedical Engineering graduate student in Prof. Bernard Choi's lab), Tyler Rice (recent Physics Ph.D. graduate in Prof. Bruce Tromberg's lab), and Charlene Ong (M.B.A. student at The Paul Merage School of Business) comprised "Team Laser Associated Sciences" (LAS) and were coached by Dale Sadlik, COO of Konan Medical. LAS was



Winning team: (from left to right) Bruce Yang, Tyler Rice, Sean White and Charlene Ong.

awarded \$15,000 for creating non-invasive medical devices that optically measure blood flow in peripheral tissue (i.e., fingers/toes). LAS represented The Edwards Lifesciences Center for Advanced Cardiovascular Technology whose mission is to create and foster an environment for innovative basic and

translational cardiovascular research and training. The Center is focused on a strategic partnership between the Department of Biomedical Engineering and the Division of Cardiology in the Department of Medicine. Its mission pursues additional strategic collaborative partnerships on campus with the Beckman Laser Institute, the California Institute for Telecommunications and Information Technology (Calit2), and the Sue and Bill Gross Stem Cell Research Center as well as in the thriving local biomedical device community of Orange County.

The 2013 Business Plan Competition at The Paul Merage School of Business is one of the nation's premier business plan competitions offering all UC Irvine students, staff and researchers the opportunity

(Newsbriefs continued on p. 6)

If you asked Sosé Thomassian-Yekikian where to eat in a certain city, she could give you several recommendations from personal experience. She and her husband, Allen Yekikian, loved discovering novel and interesting restaurants with character, charm and tasty food locally and in their travels. Her love for food also extended to cooking and baking with unconventional ingredients. Beyond food, you would find Sosé shopping for bargains and exchanging banter with her office mates.

Sosé and Allen shared a deep love and pride for Armenia and their Armenian heritage. So when she sent the following e-mail on January 31, 2013, it was a surprise but not unexpected: “I just wanted to let you know I am leaving UCI and my last day is February 11. My husband accepted

In Memoriam Sosé Thomassian-Yekikian



Allen and Sosé

a wonderful position as Director of Communications at the American University in Armenia! We are packing up and starting our adventure in a new country in 2 weeks. I am excited but sad to leave UCI.”

Meeting in 2007, getting engaged in September 2010, and marrying on August 11, 2012, Sosé and Allen’s life together was tragically cut short on May 10, 2013, in a fatal car accident on their way to Tbilisi for a weekend adventure.

Sosé worked at the Beckman Laser Institute (BLI) as Contracts and Grants Co-ordinator from March 2008 to December 2011 when she left BLI to transfer as a Senior Contracts and Grant Analyst at the TEC Business Center at UC Irvine. In her brief 30 years, she lived her life with enthusiasm, conviction and purpose, and we can only wonder what else she would have accomplished if there had been more time. She will be missed.

UROP and SURP Recipients

Each academic year, the Undergraduate Research Opportunities Program (UROP) awards fellowships to support noteworthy research during the academic year and SURP awards for the summer. The following undergraduate students working in the labs of BLI faculty were named as UROP Fellows for 2012-2013 and SURP Fellows for 2013.

Mentor: Dr. Albert Cerussi

Nana Colgate, “Improving the sensitivity of diffuse optical spectroscopic imaging for measuring brain and muscle hemodynamics” (SURP).

Truman Nguyen, “Measurement of the optical properties of diseased and healthy teeth for the early detection of dental caries” (SURP) (co-mentor: Dr. Petra Wilder-Smith).

Gerard Tran, “Improving therapeutic ultrasound treatments for lower back musculoskeletal injuries: a pilot study with non-invasive metabolic monitoring” (SURP).

Diana Wu, “Improving the sensitivity of diffuse optical spectroscopic imaging for measuring brain and muscle hemodynamics” (SURP).

Mentor: Dr. Bernard Choi

Ted Chang, “Design of a dental instrument that uses laser speckle imaging for assessment of pulpal vitality” (SURP).

Patrick Lo, “High-resolution, depth-resolved imaging of microglia and microvasculature in mouse brain using optical histology” (SURP).

Josh Yakel, “ALMA dye-VL light source: alternative to lasers as a phototherapeutic source” (SURP).

Mentor: Dr. Bruce Tromberg

Alex Matlock, “Construction of a multichannel, multiwavelength prototype for diffuse optical spectroscopic imaging (DOSI)” (SURP).

Mentor: Dr. Vasan Venugopalan

Tro Babikian, “Use of laser-generated cavitation bubbles to measure receptor-ligand binding” (UROP).

Mason Minot, “Use of laser-generated cavitation bubbles to measure receptor-ligand binding” (UROP).

Mentor: Dr. Petra Wilder-Smith

Janet Ajdaharian, “Imaging gingivitis response to a novel dentifrice” (UROP) and “Non-invasive imaging of human gingiva mesenchymal cells for the treatment of mucositis” (SURP).

Sarah Chung, “Imaging-based approach to evaluating dentifrice for treating gingivitis and periodontitis: a randomized clinical trial” (UROP).

Amin Sarraf, “Identification and validation of a non-invasive imaging approach to alimentary tract mucositis” (SURP).

Mentor: Dr. Brian Wong

Syed Hussain, “Electromechanical reshaping and viability of ex-vivo porcine trachea” (UROP).

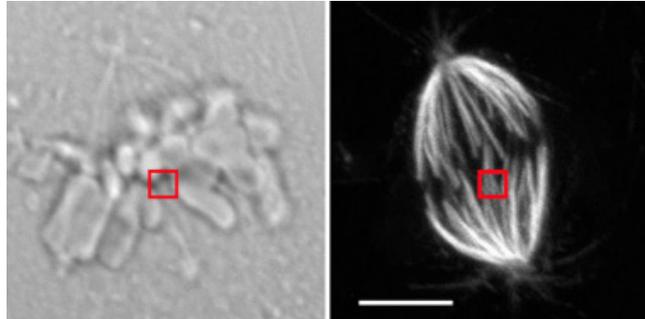
June Tong, “Optical computed tomography: a comparative analysis of pediatric upper airway reconstruction” (SURP).

Forces to Move Chromosomes

In “Measurements of forces produced by the mitotic spindle using optical tweezers” by J. Ferraro-Gideon, R. Sheykhani, Q. Zhu, M. Duquette, M. Berns and A. Forer published in *Molecular Biology of the Cell* 24: 1375-1386, 2013, the team, jointly led by Michael Berns of the Beckman Laser Institute (BLI) and Art Forer of York University, Toronto, Canada, used optical tweezers to measure the forces within a mitotic spindle which replaced the dogma which has been in the literature since 1983 when Bruce Nicklas of Duke University published results indicating that it takes 700 piconewtons to move a chromosome in a dividing cell—a number that, until now, has been generally accepted and used in all the textbooks.

Wanting to use a different method to verify the discrepancy between Nicklas’ 700 piconewtons measurement and optical theory that predicts a much lower number, Ferraro-Gideon et al. used optical trapping (laser tweezers) to grab (and stop) chromosomes from oscillating on the mitotic spindle. When released from the trap, the oscillation started up again. The amount of force pulling on the chromosomes could be quantified by

grabbing the chromosome and then gradually reducing the laser trap to find the minimal amount of laser power needed to stop the oscillation process. That was then converted to newtons with a simple equation. It turns out the amount of force needed was only a few



(Left) Differential interference contrast image of a PtK cell illustrating the position of the trap at the interface between the kinetochore and kinetochore microtubules. The trap is represented by the red square. (Right) The PtK cell stained with tubulin antibody. No damage to the microtubules is visible in the region in which the trap was applied (red square). Bar: 10 μm .

piconewtons, two orders of magnitude less than what has been thought based upon the 1983 experiments of Nicklas.

The Ferraro-Gideon article was cited in a commentary by Kerry Bloom entitled “A close look at wiggly chromosomes” published in *Developmental Cell* 25: 330-332, 2013, where she noted that the Nicklas measurements “have gone untested for over 30 years and have been the gold standard in the field. Very

recently, a group using calibrated optical traps found that the force required to stall movement was much closer to the theoretical values. While these are early days in force measurements and observing chromosome dynamics in live cells, the small cadre of biologists and physicists using optical methods and theory is growing, and they are showing us productive new ways to think about chromosomes.” In addition, images from the Ferraro-Gideon article were featured in HighMag, May 24, 2013. HighMag is a blog that posts images that are visually striking, biologically interesting and technically challenging.

This study is the culmination of a project first started at BLI in 1989: “Use of a laser-induced optical force trap to study chromosome movement on the mitotic spindle” by M. W. Berns, W. H. Wright, B. J. Tromberg, G. A. Profeta, J. J. Andrews and R. J. Walter in the *Proceedings of the National Academy of Sciences USA* 86: 4539-4543, 1989. It took twenty-four years to finally answer the question, “How much force is applied by the cell to move one chromosome?” ■

Honors and Awards

Petra Wilder-Smith, D.D.S.

BLI Dental Director Petra Wilder-Smith has been named as President-Elect of the Diagnostics Sciences Group of the International Association for Dental Research (IADR), the premier worldwide dental research organization. IADR is closely affiliated with the NIDCR, the dental branch of the National Institutes of Health.

Elliot Botvinick, Ph.D.

Associate Professor Elliot Botvinick has received two 3-year grants from the

JDRF (Juvenile Diabetes Research Foundation). He is co-PI with Associate Professor of Surgery Jonathan Lakey on “Identifying key parameters for encapsulated islet transplantation.” The second grant is entitled “Development of real-time, reversible insulin monitoring aptamer sensors” where as co-PI, he is working with co-PI Jonathan Lakey to find a way to successfully transplant encapsulated, stem cell-created pancreatic islets to treat and possibly cure Type 1 diabetes. The PI of the grant is Assistant Professor of Pharmaceutical Sciences Weian Zhao.

Lonnissa Nguyen, Ph.D.



Lonnissa Nguyen

Postdoctoral Research Fellow Lonniisa Nguyen has received a UCI Cancer Research Institute training grant fellowship for studying breast cancer metabolism in a 3D engineered tissue model. She will be working with Drs. Bruce Tromberg, Eric Potma, and Elliot Botvinick.

(Honors and Awards continued on p. 8)

Ph.D. Recipients

Cosimo Arnesano, Ph.D.



Cosimo Arnesano (right) with Prof. Enrico Gratton.

Cosimo Arnesano defended his thesis, “Living in a digital world: features and application of FPGA

(Fluorescence Lifetime Imaging Microscopy) in photon detection,” on May 20, 2013. Cosimo worked in the lab of Dr. Enrico Gratton and is looking for a job in

the biotechnology industry, hopefully related to fluorescence microscopy and



Viera Crosignani (right) with Prof. Enrico Gratton.

spectroscopy, biophotonics, or medical instrumentation development.

Viera Crosignani, Ph.D.

Viera Crosignani defended her thesis, “Deep imaging via enhanced-photon recovery,” on May 3, 2013. She worked in Dr. Enrico Gratton’s lab and will be working as a postdoctoral fellow with Drs. Anthony Durkin and Bruce Tromberg on multimodality skin imaging and modeling.

Austin Moy, Ph.D.

Austin Moy defended his thesis, “Optical histology: high-resolution visualization of tissue microvasculature,” on May 24, 2013. He has accepted a job at Edwards Lifesciences in Irvine, CA, to investigate new materials for heart valves.

Bruce Yang, Ph.D.

Bruce Yang defended his thesis, “Real-time laser speckle imaging as an intraoperative diagnostic tool during treatment of port wine stain birthmarks,” on May



From left to right: Austin Moy, Bruce Yang, Prof. Bernard Choi, Sean White and Owen Yang.

28, 2013. He worked in the lab of Dr. Bernard Choi and will continue working part-time for Dr. Choi while also working on the start-up company, LAS, he formed with a team of BLI students (see *Newsbriefs* on pg. 2).

Owen Yang, Ph.D.

Owen Yang defended his thesis, “Accelerated laser speckle imaging (LSI) and spatial frequency domain imaging (SFDI) with graphics processing units (GPU) and color cameras,” on May 7, 2013. He worked in Dr. Bernard Choi’s lab and is seeking employment in the biomedical imaging industry.

(Ph.D. Recipients continued on p. 7)

ICTS 2013 Clinical Translational Scientist of the Year Award

Dr. Brian Wong was awarded the 2013 Clinical Translational Scientist of the Year Award by The Institute for Clinical Translational Science (ICTS). In acknowledging Dr. Wong’s accomplishments, the ICTS noted that “in addition to working with local companies, Dr. Wong has collaborated with a number of different companies throughout the United States. In each case, the focus of this work has been on developing and defining technology that could be moved into direct patient use and development of product. There are very few physicians with the breadth of research interest and creativity that Dr. Wong has, and even fewer have the ability to work across a broad range of disciplines and topics. Rarely does one find an individual with the breadth of knowledge and expertise to understand both the fundamental sci-



Dr. William Armstrong (left), Chairman of the Department of Otolaryngology-Head and Neck Surgery, congratulates Dr. Brian Wong.

ence and technology in an emerging field while also understanding user needs in order to make something that is of practical value. He is uniquely positioned because of his expertise in engineering and medicine.”

Dr. Wong has been at UC Irvine

since 1990 and has progressed through the academic ranks from intern, resident, fellow, clinical instructor to his present position as Professor, Vice-Chairman, and Fellowship Director in Otolaryngology-Head and Neck Surgery. Since the time of joining the faculty in 1997, Dr. Wong has been continuously funded by the National Institutes of Health and the Department of Defense for work focused on treating disorders of the head, neck, and upper airway as well as facial plastic and reconstructive surgery. Technology developed in his lab has moved from basic concept to commercialization, and his work has already resulted in the founding of two companies.

Dr. Wong was honored at the 5th Annual ICTS Awards Dinner for “People Who Make a Difference in Human Health” on June 3, 2013. ■

Newsbriefs *(cont'd from p. 2)*

nity to form a team, create a business plan and potentially fund their business idea all within six months. The Final Presentations and Awards Ceremony for the Competition were held on May 10, 2013.

Ph.D. Received from the University of Oslo



Marlon Mathews

Marlon Mathews, M.D., received his Ph.D. from the University of Oslo, Norway. Dr. Mathews, a Neurosurgery Resident, collaborates with BLI Research Professor Henry Hirschberg.

ACRIN Trial Completes Enrollment

The ACRIN (American College of Radiology Imaging Network) trial was officially closed for patient enrollment on June 30, 2013. Initially begun two years ago, the target enrollment was 60 patients, and the maximum enrollment has been successfully accrued. The ACRIN trial is a multi-center study evaluating neo-adjuvant chemotherapy response in breast cancer patients using DOSI (diffuse optical spectroscopy imaging).

Visit to Camp Pendleton

A group of 12 physicians and scientists from the Beckman Laser Institute (BLI) and the Institute for Clinical and



Visit to Camp Pendleton: (from left to right) Dan Cooper, M.D., ICTS Director; Margaret Ryan, M.D., M.P.H., Clinical Research Director, U.S. Naval Hospital, Camp Pendleton; Albert Cerussi, Ph.D., BLI; Montana Compton, R.N., BLI; Gerard Tran, BLI; Warren Reuland, BLI; Commander Todd J. May, D.O., Naval Hospital, Camp Pendleton; Commander Kenneth Iverson, M.D., Commanding Officer, U.S. Naval Hospital, Camp Pendleton.

Translational Science (ICTS) traveled to Camp Pendleton to celebrate the first UCI-Naval Hospital Translational Research Awards on June 19, 2013. ICTS funded two pilot grants in which Naval Hospital physicians collaborated with UC Irvine physicians and scientists. One of the grants, "A pilot study to investigate non-invasive metabolic guidance for improving therapeutic ultrasound treatment of lower back muscle injuries," was awarded to Drs. Albert Cerussi and Joon You.

BLI Hosts Two Guests from the Naval Medical Center

The Beckman Laser Institute (BLI) hosted two special guests from the Naval Medical Center, San Diego, CA (NMCSD). Peter Shumaker, M.D., Head of Dermatology, and John D. Malone, M.D., M.P.H., F.A.C.P., F.I.D.S.A., F.A.C.P.E., Head of the Clinical Investigations Department, visited BLI on July 17, 2013, to tour the facility and meet with the various researchers to discuss the development of Biophotonics technologies in military medicine.

Congressional Visitor

Rep. Cathy McMorris Rodgers (R-WA) visited the Beckman Laser Institute (BLI) for a tour on July 1, 2013. Rep. Rodgers is the highest ranking woman in Congress, Chair of the House Republican



Two guests visit BLI: (from left to right) MFEL and Comparative Medicine Programs Director George Peavy, BLI; Dr. Peter Shumaker, Naval Medical Center; Dr. John D. Malone, Naval Medical Center; Dr. Albert Cerussi, BLI; Montana Compton, R.N., BLI.

Committee, and serves on the Health Subcommittee of the Energy & Commerce Committee, which has jurisdiction over the National Institutes of Health (NIH), Health and Human Services (HHS), the Food and Drug Administration (FDA), and has a focus on biomedical research and development. The main goal of her visit was to get a sense of the impact of the federal sequester on the NIH budget and what this might mean for the future of biomedical research. It was an opportunity for her to meet the students and faculty at BLI and see the important work being done at the institute.



Congressional visitor: (from left to right) BLI Director Bruce Tromberg, Professor of Pulmonary and Critical Care Medicine Matthew Brenner, Rep. Cathy McMorris Rodgers.

BLI Newsletter Staff

Editor: Bruce Tromberg

Writers: Elaine Kato, Erin Miller, Deborah Birnie

Layout & Design: Brian Hill

Arrivals and Departures

ARRIVALS

Jacob Boeckmann, M.D., is an M.D. Fellow in Facial Plastic Surgery who will be working with Dr. Brian Wong.

Frances Samolowicz Lazarow, M.D., is a Postdoctoral Fellow who will be working in Dr. Brian Wong's lab imaging subglottic stenosis in neonates.

Ylenia Santoro, Ph.D., has been hired as a Postdoctoral Researcher to work for Drs. Bruce Tromberg and Enrico Gratton.



Frances Lazarow (left) and Jacob Boeckmann

DEPARTURES

Mohammad Dadkhah, B.S., who worked in Dr. Petra Wilder-Smith's lab,

has been admitted to the College of Dental Medicine at Nova Southeastern University in Ft. Lauderdale, FL.

Dong Yel Kang, Ph.D., who was a postdoctoral scholar in Dr. Brian Wong's lab, has accepted an assistant professorship in the College of Engineering at Hanbar National University in South Korea.

Warren Reuland, B.S., a Jr. Specialist who worked in Dr. Bruce Tromberg's lab, has left to complete a one-year Master's program in pharmacology at Tulane University in New Orleans, LA.

LAMMP *(cont'd from p. 1)*

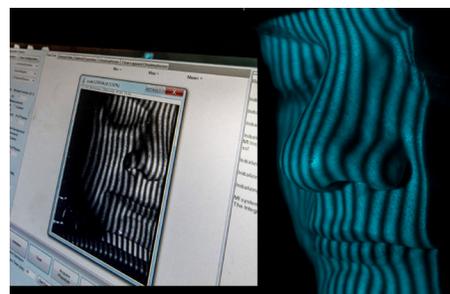
biology.

TRD 3: Multimodality Endoscopic Technologies (MET) develops systems that can perform real-time in vivo imaging of tissue structure and composition with high spatial resolution. TRD 3 is led by Professor of Biomedical Engineering Zhongping Chen, Ph.D. Professor Chen is a pioneer in optical coherence tomography (OCT), multi-modality imaging, and the extension of OCT and microscopy methods to micro-endoscopy technologies.

TRD 4: Diffuse Optical Technologies (DOT) develops model-based optical

technologies based on multiply scattered light that are capable of quantitative sub-surface metabolic spectroscopy and imaging. TRD 4 is co-led by Professors Bernard Choi, Ph.D., Tony Durkin, Ph.D., and Albert Cerussi, Ph.D. Dr. Choi is an Associate Professor of Biomedical Engineering and expert in laser speckle and vascular metabolic imaging. Dr. Durkin is an Associate Professor at the BLI and an expert in spectroscopy and imaging of skin and fluorescence. Dr. Cerussi is an Associate Research Professor at the BLI and an expert in photon migration and diffuse optical spectroscopy and imaging.

For more information on LAMMP



Spatial Frequency Domain Imaging is a diffuse optical technology in LAMMP.

technologies and the LAMMP virtual photonics initiative, see: <http://lammp.bli.uci.edu> and <http://www.virtualphotonics.org>. ■

Ph.D. Recipients *(cont'd from p. 5)*

Sean White, Ph.D.

Sean White defended his thesis, "Longitudinal use of in vivo imaging techniques to assess vascularization, hemodynamics, and oxygenation within implanted engineered tissues," on May 31, 2013. He worked in the labs of Drs. Steven George and Bernard Choi and will be a postdoctoral researcher in Dr. Choi's lab investigating a combined photothermal/photochemical treatment for port wine stain birthmarks.

Alexander Lin, Ph.D.

Alexander Lin defended his thesis, "Spatial frequency domain imaging:

applications in preclinical models of Alzheimer's disease," on May 10, 2013. He worked in Dr. Bruce Tromberg's lab and will continue to work part-time in Dr. Tromberg's lab while finishing medical school to complete his M.D./Ph.D. program.



From left to right: Jeffrey Suhlim, Alexander Lin and Tyler Rice with Prof. Bruce Tromberg

Jeffrey Suhlim, Ph.D.

Jeffrey Suhlim defended his thesis, "Development of label-free coherent Raman scattering microscopy for imaging lipids in biological tissue," on May 29, 2013. He worked in Dr. Eric Potma's lab and is seeking a job in the field of biomedical optics.

Tyler Rice, Ph.D.

Tyler Rice defended his thesis, "Quantitative, depth-resolved determination of particle motion using multi-exposure speckle imaging and spatial frequency domain analysis," on April 5, 2013. Tyler, who worked in Dr. Bruce Tromberg's lab, is working for BLI start-up Modulated Imaging Inc., as well as for LAS, Inc. (see Newsbriefs on pg. 2).



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Honors and Awards *(cont'd from p. 4)*

Haotian Cui, M.S.

Biomedical Engineering Graduate Student Haotian Cui, who was co-advised by Drs. Anthony Durkin and Bernard Choi, earned her Master's degree and is working as an engineer for Praxis BioSciences in Irvine, CA.

Vicki Hsiao, M.S.

Biomedical Engineering Graduate Student Vicki Hsiao, who worked in Dr. Bernard Choi's lab, earned her Master's degree and has accepted a job as a software engineer in the Bay area.

Shreyas Patel, M.S.,

Biomedical Engineering Graduate Student Shreyas Patel, who worked in Dr. Bernard Choi's lab, earned a Master's degree and is seeking employment in the biomedical devices field.

Ricky Suen, M.S.

Biomedical Engineering Graduate Student Ricky Suen, who worked in Dr.

Bernard Choi's lab, earned a Master's degree and is seeking employment in the biomedical devices field.

Steven Truong, M.S.

Biomedical Engineering Graduate Student Steven Truong, who worked in Dr. Bernard Choi's lab, earned his Master's degree and has accepted a job as an engineer with Applied Medical located in Rancho Santa Margarita, CA.

Wesley Moy, B.S.

Biomedical Engineering Graduate Student Wesley Moy received a 2013 Student Research Grant from the American Society of Laser Medicine and Surgery.



Wesley Moy

Bruce Yang, B.S.

Biomedical Engineering Graduate Student Bruce Yang was a 2013 Presidential Award recipient in the cate-

gory of Best Student/Resident for "Cutaneous Laser Surgery" at the 33rd annual meeting of the American Society for Laser Medicine and Surgery held on April 3-7, 2013, in Boston, MA.

Robert Warren, B.S.

Biomedical Engineering Graduate Student Robert Warren has received a CARE (Cardiovascular Applied Research and



Robert Warren

Entrepreneurship) training fellowship from The Edwards Lifesciences Center for Advanced Cardiovascular Technology. The fellowship is designed to enable students to conduct cardiovascular research with emphasis on a business plan. Robert will be developing diffuse optical imaging technologies to study cardiovascular disease in the lab of Drs. Albert Cerussi and Bruce Tromberg.