



BECKMAN LASER INSTITUTE

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SPRING 2012

FDA AND BIOCOM AT BLI

UC Irvine (UCI) and BIOCOM were hosts for a morning tour of the Beckman Laser Institute (BLI) and a Roundtable Luncheon at the BLI Library on January 16, 2012. The attendees included representatives from the United States Food and Drug Administration (FDA) and medical device companies, including companies housed in the BLI Photonics Incubator. The FDA was represented by Dr. Jeffrey E. Shuren, Director of the CDRH (Center for Devices and Radiological Health), which is a branch responsible for the premarket approval of all medical devices, and Dr. Steven Pollack, Director of OSEL (Office of Science and Engineering Laboratories).

The event was organized by UCI Assistant Vice Chancellor of Research

Development Jacob E. Levin and BIOCOM President and CEO Joe Panetta. BIOCOM is the largest regional life science association in the world and represents more than 560 member companies in Southern California. The association focuses on initiatives that positively influence the region's life science community in the development and delivery of innovative products that improve health and quality of life. Some of BIOCOM's Orange County members in attendance included: Marvin Garrett, VP, Regulatory Affairs, Quality and Compliance, ISTA

(FDA continued on p. 4)



BLI Director Bruce Tromberg conducts a tour of BLI. From left to right: Maddie Baudoin, Assoc. Director of Public Policy, BIOCOM; Dr. Tromberg; Dr. Steven Pollack, Director of OSEL/FDA; Dr. Jeffrey Shuren, Director of CDRH/FDA; Dr. Randy Berg, UCI Asst. Director of Research Development; Dr. Goran Matijasevic, Executive Director, CEO Roundtable, UCI.

Newsbriefs

Popular with the Blogs

An article about the Beckman Laser Institute on C&ENonline (<http://cen.acs.org/articles/90/i1/Lights-Lasers-Invade-Clinic.html>) was picked up by several blogs including engadget.

Laser Tattoo Removal Program Highlighted

In "Judge Sparks Laser Tattoo Removal" in the January 2012 issue of *SPIE* (The International Society for Optics and Photonics) *Professional Magazine* (<http://spie.org/x7424.xml>), BLI Medical Director J. Stuart Nelson was mentioned for his contribution to the laser tattoo removal program conceived by U.S. District Court Judge David O. Carter.

An award ceremony in March 2011 which honored Dr. Nelson for his service to the program was covered in the Spring 2011 issue of the BLI newsletter.

Research Photo on Cover of Nature Photonics



A photo illustrating research published in the January 2012 issue of *Nature Photonics* was used for that issue's cover. The article by T. Wu,

T. A. Nieminen, S. Mohanty, J. Miotke, R. L. Meyer, H. Rubinsztein-Dunlop and M. W. Berns, entitled "A photo-driven micromotor can direct nerve fibre

growth," shows that laser-driven spinning vaterite particles can create microfluidic flows for controlling the growth direction of nerve fibers (<http://www.nature.com/nphoton/journal/v6/n1/covers/index.html>).

Dental Article Tapped Twice for Publication

An article originally published in *LASER* (Jahr: 2011 Ausgabe: 03, pp. 24-29) entitled "Optical imaging in the oral cavity: innovative and emergent imaging techniques" by D. Le, A. Le, J. Holtzman, J. Epstein and P. Wilder-Smith was selected for reprint in *LASER, North American edition, international C.E. Magazine of Laser Dentistry* on February 10, 2012, the first edition of the new year.

(Newsbriefs continued on p. 2)

Interdisciplinary Collaboration

by Michael W. Berns, Ph.D.

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

When I went to Arnold Beckman in 1982 with the idea of building an institute that emphasizes interdisciplinary collaboration to solve problems, I didn't quite expect it to turn out this way. My vision was not broad enough; my perspective was too narrow. Maybe if the Internet was around back then it would have been a "no brainer." But the Internet has given that original vision a much greater horizon than I ever could have imagined. We can literally collaborate with colleagues on the other side of the world with the aid of the Internet, in real time.

The study described in the Research

Update of this newsletter, "Neuron Damage Elicits Response from Axonal Growth Cone," and another article published in *Nature Photonics* (see Newsbriefs, "Research Photo on Cover of *Nature Photonics*") are perfect examples. The collaborators are not only physicists (Halina Rubinsztein-Dunlop and Timo Nieminen from Australia) but also neurobiologists (Ron Meyer and Jill Miotke from the Department of Developmental and Cell Biology here at UCI), an engineer (Tao Wu, a postdoctoral student at BLI), a 32-year UCI employee and electron microscopist (Leacky Liaw) and a fast-becoming obsolete cell biologist (myself). This team epitomizes the type of work done at the BLI, as do many other projects in the labs of BLI scientists who also have similar mixes of disci-

plines focusing mental energies on problems of importance in basic and applied science.

The BLI is a conglomeration of scientists and students who would not normally share space under the same roof. The interdisciplinary uniqueness of the BLI is what makes the organization so successful in achieving solutions and results that might either never have come to fruition or would have taken longer to get there by traditional means. As we approach the 30 year birthday of the BLI in 2014, it is time to pause and reflect on the accomplishments since the doors opened in 1986 and to decide what that future will be for the first-conceived institute of Arnold Beckman's ultimately five Beckman Institutes/Centers. ■

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

BLI Students Present Talks at Photonics West



Tyler Rice

Three graduate students who work in Dr. Bernard Choi's lab gave presentations at the SPIE (The International Society for Optics and Photonics) Photonics West meeting held in San

Francisco, CA, on January 21-26, 2012. Wes Moy gave an invited presentation entitled "Preclinical *in-vivo* evaluation of NPe6-mediated photodynamic therapy on normal vasculature." Tyler Rice also gave an invited presentation entitled "Development of coherent Spatial Frequency Domain Imaging (c-SFDI) for simultaneous determination of optical and dynamical properties of tissue." Austin Moy gave a presentation entitled "Optical histology of microvasculature in thick tissue sections."

BLI Director in Taiwan

BLI Director Bruce Tromberg was a plenary speaker at the International Photonics Conference 2011 held in Tainan, Taiwan, on December 8-10, 2011.



BLI Director Bruce Tromberg (fourth from left) with a group of attendees at the International Photonics Conference 2011.

PNAS Research Paper Highlighted in *Optics and Photonics Focus*

An article by Joana Braga Pereira, "Traffic Lights for Chemotherapy," which focuses on a paper published in the *Proceedings of the National Academy of Sciences (PNAS)* by Drs. Darren Roblyer and Bruce Tromberg and colleagues can be found online in *Optics and Photonics Focus* (<http://www.opfocus.org/index.php?topic=story&v=16&s=4>). The

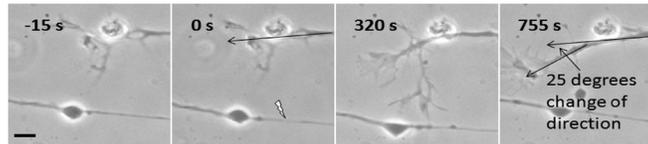
research paper, "Optical imaging of breast cancer oxyhemoglobin flare correlates with neoadjuvant chemotherapy response one day after starting treatment," by D. Roblyer, S. Ueda, A. Cerussi, W. Tanamai, A. Durkin, R. Mehta, D. Hsiang, J. A. Butler, C. McLaren, W.-P. Chen and B. Tromberg appeared in *PNAS* 108: 14626-14631, 2011. The article by Ms. Pereira notes that many cancer patients do not respond to chemotherapy and have to

(Newsbriefs continued on p. 8)

Neuron Damage Elicits Response from Axonal Growth Cone

Researchers in the laboratory of Dr. Michael W. Berns have uncovered a novel process of growth cone response to damage produced at a localized site on a single axon using laser subcellular surgery, fluorescence and transmission electron microscopy, and a goldfish retinal ganglion cell culture model.

It is likely that this response is mediated by specific molecules released from the damaged area. An axon is a long and single nerve-cell process that usually conducts impulses away from the cell body. Growing axons have a highly motile, slightly bulbous structure at the growing tip called the growth cone which “sniffs out” the extracellular environment for signals that instruct the axon which direction to grow. Filaments



Directed filopodial extension in response to laser injury on a parallel-growing axon. Irradiation site is indicated by the white arrow. Irradiation at 0 s leads to thinning of the axon shaft. The non-irradiated growth cone extends a filopodium toward the injury site, makes apparent contact, and subsequently withdraws. In addition, the entire growth cone turned toward the injured axon by 25 degrees.

called “filopodia” sprout around the edges of the growth cone (like fingers from a hand) and are key elements in this nerve sensory system.

Although it is well known that damage to neurons results in release of substances that inhibit axonal growth, release of chemical signals from damaged axons that attract axon growth cones has not been observed. In the study done by the Beckman Laser

Institute researchers, a 532 nm laser was focused to a diffraction-limited spot to produce partial damage on specific sites to single goldfish axons *in vitro*. The axons underwent a localized decrease in thickness (“thinning”) within seconds. Analysis by fluorescence and transmission electron microscopy indicated

that there was no gross rupture of the cell membrane. Mitochondrial transport along the axonal cytoskeleton immediately stopped at the damage site but recovered over several minutes. Within seconds of damage, nearby growth cones extended filopodia towards the injury and were often observed to contact the damaged site. Turning of the growth cone towards the

(Axons continued on p. 7)

Honors and Awards

Elliot Botvinick, Ph.D.

Assistant Professor Elliot Botvinick has received the Biomedical Engineering Faculty of the Year award for 2011-2012. Nominations were made by engineering students, faculty, and staff, and the winners were selected by the Engineering Presidents' Council of the ESC, which consists of the presidents of engineering student organizations on campus. Dr. Botvinick also received a National Institutes of Health (NIH) Physical Oncology Center pilot grant for the study of breast cancer.

Zhongping Chen, Ph.D.

Professor Zhongping Chen has received a 4-year National Institutes of Health (NIH) R01 grant from the National Eye Institute (NEI) for “Elastographic imaging of the retina/choroid in age-related macular degeneration.” This is a collaborative grant involving Dr. Chen, Dr. Ronald Silverman, Department of Ophthalmology, Columbia University,

and Dr. Qifa Zhou, Department of Biomedical Engineering, USC.

David Cuccia, Ph.D.

David Cuccia, Ph.D., CEO of Modulated Imaging Inc. which is located in the Beckman Laser Institute (BLI) Photonics Incubator, has been informed that he has been selected to receive the Dr. Horace Furumoto Innovations Professional Development Award from the American Society for Laser Medicine and Surgery for 2012. The award is given to a scientist whose qualifications reflect the leadership and commitment of Dr. Furumoto in the development of laser technology applications. This is the third time the award has been given to a researcher at BLI. Associate Professor of Dermatology Kristen Kelly, M.D., was the recipient in 2009, and in 2010, BLI Assistant Research Professor Wangcun Jia, Ph.D., who works in Dr. J. Stuart Nelson's lab, received the award.

Kristen Kelly, M.D.

Associate Professor Kristen Kelly has

once again been recognized by the Orange County Medical Association (OCMA) as a “Physician of Excellence” in the field of Dermatology. Every year, the OCMA conducts a comprehensive survey of local physicians and rates them on leadership, teaching, mentoring, medical research, scientific advances, and humanitarian service. The list of Orange County's “Top Doctors of 2012” appeared in the January 2012 issue of *Orange Coast* magazine.

Brian Wong, M.D., Ph.D.

Professor Brian Wong has been selected for the 6th straight year as a “Physician of Excellence” by the Orange County Medical Association (OCMA) in Otolaryngology-Head and Neck Surgery. Based on a comprehensive survey that rates physicians on leadership, teaching and mentoring, medical research and scientific advances, and humanitarian service, the list of Orange County's “Top Doctors of 2012” appeared in the January 2012 issue of *Orange Coast* magazine.

(Honors and Awards continued on p. 6)

Working Together for a Common Goal

Research labs in the pursuit of transforming pure science into practical solutions abound at the Beckman Laser Institute (BLI), and the lab of Biomedical Engineering Associate Professor Bernard Choi is no different. Dr. Choi's current research interests stem from his core desire to develop pragmatic, enabling technologies and methodologies to assist clinicians, scientists, and engineers. He currently has a strong interest in developing point-of-care imaging devices that are robust, simple to use, and deployable. Researchers in his lab have put considerable effort to refine imaging systems and techniques in order to position the lab as a collaborative hub. Most of the research projects in the lab involve development of solutions to problems posed by scientists and engineers both within and outside of BLI.

Recent publications with Dr. Choi's contribution reflects the collaborative nature of doing research at BLI. Working with the labs of Drs. Bruce Tromberg and Anthony Durkin produced "Laser speckle imaging in the spatial frequency domain" in *Biomedical Optics Express* 2: 1553-1563, 2011. Collaborating with BLI Dental Director

Petra Wilder-Smith produced "Assessment of pulpal vitality using laser speckle imaging" in *Lasers in Surgery and Medicine* 43: 833-837, 2011. "Intensity-based modified Doppler variance algorithm: application to phase instable and phase stable optical coherence tomography systems" in *Optics Express* 19: 11429-11440, 2011, involved collaboration with Dr. Zhongping Chen's lab.

Bernard Choi, Ph.D., received a B.S. degree in Biomedical Engineering at Northwestern University where he was fortunate to do research with Professor Jay Walsh, a pioneer in the use of lasers for making precise cuts into biological tissues. He then obtained his Master's and Ph.D. degrees at The University of Texas at Austin (UT-Austin) where he studied with Professor A. J. Welch, also a pioneer in the field of tissue optics. When he came to BLI in 2001, he worked with Medical Director J. Stuart Nelson as the Arnold and Mabel Beckman Fellow. He worked on a National Institutes of Health (NIH) funded project involving pulsed photothermal radiometric characterization of port-wine stain birthmarks. He was also able to

develop research projects involving optical clearing and the dorsal window chamber model (both methods learned as a graduate student at UT-Austin) and laser speckle imaging (inspired by a 2001 paper by Andrew Dunn, a former BLI postdoctoral fellow and presently Associate Professor of Biomedical Engineering at UT-Austin).

In Dr. Choi's Microvascular Therapeutics and Imaging laboratory, there are currently four Ph.D. students, five Master's-level students, two Junior Specialists, and 19 undergraduate students. The key feature of the lab, Dr. Choi notes, "is the overall chemistry of the team. The graduate students all get along very well with each other, and several of the students hang out with each other on a regular basis. The friendship bonds are quite strong." He also modestly points out that "I benefit from the fact that the students in the lab make me look good. I think I do a good job of putting students in my lab in a position to succeed, but the students themselves are the ones that put in the blood, sweat, and tears to generate results and outcomes." ■

FDA (cont'd from p. 1)

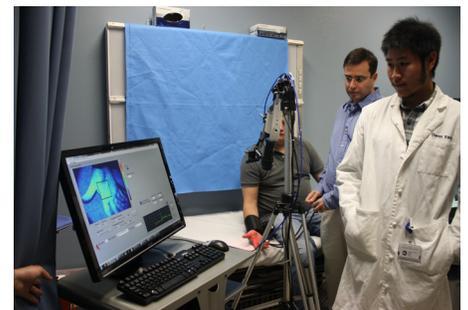
Pharmaceuticals; Kevin Cousins, EFVP Finance & CFO, Neomend, Inc.; Kevin Larkin, President & CEO, TherOx; David D'Cruz, VP, U.S. Clinical & Regulatory Affairs, ResMed; and Stanton Rowe, Chief Science Officer, Edwards Life Sciences. BLI Photonics Incubator companies included Modulated Imaging Inc., OCT Medical Imaging, Inc., and Praxis Biosciences, LLC.

BLI was selected as the campus meeting site because it is a National Institutes of Health (NIH) National Biophotonics Facility and is responsible for many of UCI's top commercialized inventions. It has research labs and clinical space as

well as the incubator. A tour of the BLI demonstrated how BLI is an example of the type of research and training taking place within a University and how BLI is being received and used by the private biomedical sector in Orange County.

The purpose of the Roundtable Luncheon following the tour was to focus discussion on issues affecting the medical device industry including: (1) technology transfer issues within and between academia and industry, (2) general impediments to innovation and the medical device eco-system, (3) opportunities to change the dynamics of the medical device eco-system, and (4) how Industry can work with the FDA and help foster regulatory

research in the device development space. The exchange of ideas and advice proved to be extremely helpful and illuminating. ■



Demonstration of Laser Speckle Imaging to image blood-flow changes in real time. This technology, developed by the Microvascular Therapeutics and Imaging (MTI) laboratory at Beckman Laser Institute, is based on the use of video cards equipped with Graphical Processing Units (GPUs).

A Lab Full of Brothers

In Dr. Bernard Choi's lab, there are about 30 graduate and undergraduate students. Of these, two are Yangs and three are Moys. While Owen and Bruce Yang are not related, Austin, Wes and Justin Moy are brothers, and they excel in the arts, athletics and academics.

All three credit their mother, a Research Assistant in the Department of East Asian Studies at UC Santa Barbara, and father, a physicist at NSTec STL in Santa Barbara, with instilling the values that have made them well rounded. All of them were encouraged to explore music, academics and sports, and their parents ingrained in them the importance of education, hard work, determination, and trying new and different things. Their parents, as Justin notes, told them "if it's worth doing, it's worth doing well." Following their parents' advice, all three brothers play musical instruments and enjoy participating in all kinds of sports, including basketball, soccer, baseball and water polo. Because their father grew up in Chicago, they are also avid fans of the Chicago Bears and White Sox.

While having a common work and play ethic, their paths to the Beckman Laser Institute were dissimilar. All graduated from high school in the Santa Barbara area, but Austin, the oldest, decided to attend Cornell University (his father's alma mater) and graduated with a B.S. in Engineering Physics in 2005 and earned an M.Eng. degree in

Biomedical Engineering in 2006. Meanwhile, Wes attended UC Berkeley and graduated with a B.S. in Mechanical Engineering in 2007. Justin, the youngest, is an undergraduate student at UC Irvine with a double major in jazz trumpet performance and civil engineering with a transportation emphasis. He completed his Civil Engineering degree in Summer 2011 and will finish his music major in the near future. Austin decided to

markers in thick tissue sections. Wes leads a project designed to develop a new optical therapy for treatment of port-wine stain birthmarks. His current research is focused on evaluating the efficacy of various photodynamic therapy protocols to induce persistent shutdown of the microcirculation in a mouse dorsal window chamber model. Justin works with Wes on the treatment development project.

Both Austin and Wes have recently

published papers on their research: "Wide-field functional imaging of blood flow and hemoglobin oxygen saturation in the rodent dorsal window chamber" by A. Moy, S. White, E. Indrawan, J. Lotfi, M. Nudelman, S. Constantini, N. Agarwal, W. C. Jia, K. M. Kelly, B. Sorg and B. Choi in *Microvascular Research* 82: 199-209, 2011; and "Preclinical *in-vivo* evaluation of NPe6-mediated



From left to right: Dr. Bernard Choi, Wes Moy, Austin Moy and Justin Moy.

follow Justin and attend UC Irvine as a graduate student. He joined Dr. Choi's lab as a Ph.D. student in 2008. Wes came down to Irvine to join his brothers and initially worked in the lab of BLI Medical Director J. Stuart Nelson before enrolling in the Master's program in Biomedical Engineering and joining Dr. Choi's lab in 2010. Hoping to follow in his brothers' footsteps and pursue graduate school, Justin officially joined Dr. Choi's lab in Winter quarter 2012.

In Dr. Choi's lab, Austin works on a project called optical histology. He is currently developing and refining a chemical-based method to image the microcirculation and other molecular

photodynamic therapy on normal vasculature" by W. J. Moy, S. J. Patel, B. S. Lertsakdadet, R. P. Arora, K. M. Nielsen, K. M. Kelly and B. Choi in *Lasers in Surgery and Medicine* 44: 144-151, 2012.

The brothers agree there is no sibling rivalry among them, and they are grateful for the opportunity to work together in a "family" atmosphere. Austin is quick to acknowledge that Dr. Choi "has made it a priority to have people in the lab who are both smart people and good people, and as a result, our labmates are not just colleagues but our friends as well." ■

A Better Way to Diagnose Sinusitis

In the U.S., chronic sinusitis is associated with over 40 million visits to physicians and health care providers each year. Sinusitis is typically diagnosed based on clinical history which is difficult to correctly ascertain, and often, misdiagnosis leads to both over-treatment (i.e., antibiotics) and under-treatment (i.e., misdiagnosis as allergies or migraine).

Praxis Biosciences, LLC, a start-up company founded by Beckman Laser Institute (BLI) faculty member, Brian J. F. Wong, M.D., has licensed a technology related to a low-cost sinus disease-screening device. Recently, Praxis received a fast-track SBIR (Small Business Innovation Research) grant from the National Institutes of Health (NIH) for “Development and validation of NIRS (near-infrared spectroscopy)-based sinusitis screening.” The Principal

Investigators are Praxis Chief Technology Officer Joon You, Ph.D., a former graduate student at BLI, and BLI Associate Researcher Albert Cerussi, Ph.D.

The aims of the grant are to develop and deliver a very low-cost optical imaging tool for quick and simple assessment of sinusitis by primary care doctors and physician extenders. The grant will enable development of clinical device and testing. The device is based upon the principle of near-infrared (NIR) light being transmitted through thick biological tissues.

The company’s sinus-screening tool utilizes a specially designed light-wand placed inside the patient’s mouth. The near-infrared light scatters and lights up the whole face. “But if you have blocked sinus cavities, the shape of the light pattern differs from a healthy sinus,” notes



(a) Preoperative and (b) postoperative transillumination patterns taken from a 73-year-old Caucasian male who underwent surgery for chronic bilateral maxillary sinusitis. Note increased postoperative light penetration through maxillary sinuses with signal abutting infraorbital rim.

Dr. You.

In the second phase of the fast-track grant, the researchers will validate the efficacy of the device via a clinical study with Ear, Nose & Throat (ENT) specialists and primary care physicians. The final product will be able to provide means to better identify patients with acute sinusitis and then monitor progress of any therapies. Ultimately, the device will help reduce health-care costs by optimizing and streamlining patient care in sinusitis.

Honors and Awards *(cont'd from p. 3)*

Max Kotlarchyk, Ph.D.

Max Kotlarchyk defended his thesis, “Optical measurement of micromechanics and structure in a 3D fibrin extracellular matrix,” on October 21, 2011. He worked in Dr. Elliot Botvinick’s lab. He is currently working as a Senior Biomedical Engineer at Syprosoft Engineering, a small consulting firm in Irvine that specializes in medical devices.

Samir Shreim, Ph.D.

Samir Shreim, who was a part of Dr. Elliot Botvinick’s lab, defended his thesis, “Manipulation and optical interrogation of the cell micromechanical environment,” on November 2, 2011. He is currently working as a consulting scientist for a medical device start-up company.

Lucy Hallajian

UCI Biological Sciences undergraduate

student Lucy Hallajian was appointed a UROP Fellow by the Undergraduate Research Opportunities Program (UROP) for the 2011-2012 academic year and received funding for her research project entitled “The use of optical coherence tomography in detection of the progression of tooth decay” under the supervision of BLI Dental Director Petra Wilder-Smith and BLI Assistant Researcher Dr. Jennifer Holtzman.

Leina Rizzo

UCI Biological Sciences undergraduate student Leina Rizzo was appointed a UROP Fellow by the Undergraduate Research Opportunities Program (UROP) for the 2011-2012 academic year and received funding for her research project entitled “The use of optical coherence tomography in detection of the progression of tooth decay.” She worked under the supervision of BLI Dental Director Petra Wilder-Smith and BLI Assistant Researcher Jennifer Holtzman.

Stephanie Mansour

UCI Biological Sciences undergraduate student Stephanie Mansour, who does research in BLI Dental Director Petra Wilder-Smith’s lab, was appointed a UROP Fellow by the Undergraduate Research Opportunities Program (UROP) for the 2011-2012 academic year and received funding for her research project entitled “Clinical research study to assess the effects of dry mouth dentifrice in the oral tissues.”

Tasneem Nabelsi

UCI Biological Sciences undergraduate student Tasneem Nabelsi, working in BLI Dental Director Petra Wilder-Smith’s lab, was appointed a UROP Fellow by the Undergraduate Research Opportunities Program (UROP) for the 2011-2012 academic year and received funding for her research project entitled “Clinical research study to assess the effects of dry mouth dentifrice in the oral tissues.”

Arrivals and Departures

ARRIVALS

Linda Chandler

has been hired as Purchasing Manager. Linda previously worked in Purchasing at the UCI Department of Dermatology for five years.



Linda Chandler

Adrien Ponticorvo, Ph.D.,

has joined Dr. Anthony Durkin's lab as a postdoctoral scholar. He completed his Ph.D. in Biomedical Engineering at the University of Texas at Austin and will be working on research related to characterizing the sensitivity of spatial frequency domain imaging for detecting early failure in reconstructive skin flaps.



Adrien Ponticorvo

Krista Scrivner

has been hired as Contracts and Grants Coordinator. Krista is a UC Davis graduate (Sociology) and has research experience at UC Davis, UC Berkeley and UC Irvine.



Krista Scrivner

DEPARTURES

Sose Thomassian, Contracts and Grants Analyst, has taken a new position as Sr. Contract and Grant Analyst at the TEC Business Center which provides contracts and grants/financial management services to faculty in the School of Engineering, ICS and Calit2.

Dmitry Yudovsky, who worked in Dr. Anthony Durkin's lab has taken a job with Dex One and will be developing algorithms for quantitative marketing.

Selected Recent Publications

"Mechanical analysis of the effects of cephalic trim on lower lateral cartilage stability" by S. Oliaei, C. Manuel, D. Protsenko, A. Hamamoto, D. Chark and B. Wong in *Archives of Facial Plastic Surgery* 14: 27-30, 2012.

"Extending vaterite microviscometry to ex vivo blood vessels by serial calibration" by S. G. Shreim, E. Steward and E. L. Botvinick in *Biomedical Optics Express* 3: 37-47, 2012.

"Imaging scattering orientation with spatial frequency domain imaging" by S. D. Konecky, T. B. Rice, A. J. Durkin and B. J. Tromberg in *Journal of Biomedical Optics* 16: 126001, 2011.

"Vocal fold wound healing after injection of human adipose-derived stem cells in a rabbit model" by S. J. Hong, S. H. Lee, S. M. Jin, S. Y. Kwon, K. Y. Jung, M. K. Kim, H.

Park and K. W. Lee in *Acta Oto-Laryngologica* 131: 1198-1204, 2011.

"Laser surgery" by G. M. Peavy and P. Wilder-Smith in *Oral and Maxillofacial Surgery in Dogs and Cats*, F. J. M. Werstraete and M. J. Lommer (eds.). Oxford: Elsevier Ltd., pp. 79-88, 2012.

"Effects of motion on optical properties in the spatial frequency domain" by J. Nguyen, R. B. Saager, D. J. Cuccia, D. Hsiang, K. M. Kelly and A. J. Durkin in *Journal of Biomedical Optics* 16: 126009, 2011.

"Quantitative fluorescence imaging of protoporphyrin IX through determination of tissue optical properties in the spatial frequency domain" by R. B. Saager, D. J. Cuccia, S. Saggese, K. M. Kelly and A. J. Durkin in *Journal of Biomedical Optics* 16: 126013, 2011.

Biology at UCI. The electron microscopy was done by Lih-Huei Liaw (recently retired in March 2010; see BLI Newsletter, Spring 2010) who has been recalled to work part-time. Other collaborators who contributed to this study were UCI graduate student Veronica Gomez-Godinez, past BLI postdoctoral fellow Samar Mohanty, now Assistant Professor of Physics at University of Texas at Arlington, and Linda Shi, Project Scientist in the Institute for Engineering in Medicine, UC San Diego.

Axons (cont'd from p. 3)

The results of this study, "Neuronal growth cones respond to laser-induced axonal damage," by T. Wu, S. Mohanty, V. Gomez-Godinez, L. Z. Shi, L.-H. Liaw, J. Miotke, R. L. Meyer and M. W. Berns, was published in *Journal of the Royal Society Interface* 9: 535-547, 2012. ■

injured axon also was observed. Repair of the laser-induced damage was evidenced by recovery of the axon thickness as well as restoration of mitochondrial movement. These responses suggest that the injured axons release a substance or substances (chemoattractants) that elicit a response from nearby growth cones. Further studies to determine the nature of the chemical signals and the physiological pathways involved in the growth cone response are necessary. Understanding, and perhaps controlling, these mechanisms might facilitate the growth of axons into damaged neural circuits thus promoting their restoration and repair. The laser irradiation studies were done by BLI postdoctoral fellow Tao Wu in collaboration with Professors Ron Meyer and Jill Miotke of the Department of Developmental and Cell

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

endure harmful side effects even when the treatment itself does not prove effective. The new technique published in the PNAS journal could indicate on the very first day whether or not the planned treatment would be effective and should be continued.

Graduate Student Presents Talk in Colorado



Hosain Haghany

Hosain Haghany, a Physics graduate student working with Professors Bruce Tromberg and Albert Cerussi, gave an invited talk on "Multi-channel broadband diffuse optical spectroscopic

imaging for breast cancer applications" at the University of Colorado, Boulder, in January 2012.

Hot Topic

BLI Researcher Brian Wong, M.D., Ph.D., Professor, Director of the Division of Facial Plastic Surgery in the Department of Otolaryngology-Head and Neck Surgery, Vice Chair of the Department of Otolaryngology, presented a talk entitled "Emerging Applications for Optical Tomography in the Head, Neck and Upper Airways" at the BiOS Hot Topics plenary session at the SPIE (The International Society for Optics and Photonics) Photonics West meeting held in San Francisco, CA, on January 21-26, 2012. The talk can be viewed on YouTube at <http://www.youtube.com/watch?v=kqGoNEofl9A&list=UU0GnZ40gZON2-sluGR0Px>.

Research Photo Used for Cover of *Integrative Biology*

A photo from "VEGF internalization is not required for VEGFR-2 phosphorylation in bioengineered surfaces with covalently linked VEGF" by S. M.



Anderson, B. Shergill, Z. T. Barry, E. Manousiouthakis, T. T. Chen, E. Botvinick, M. O. Platt, M. L. Iruela-Arispe and T.

Segura was used for the cover of the September 2011 issue of *Integrative Biology*. Vascular endothelial growth factor (VEGF) is known to activate proliferation, migration, and survival pathways in endothelial cells through phosphorylation of VEGF receptor-2 (VEGFR-2). By covalently binding VEGF to a heparin substrate, the stability (half-life) of VEGF is extended over three-fold. In this paper, mathematical models support the biological conclusions, further suggesting that VEGF internalization is significantly increased when covalently bound and indicating that VEGF is available for repeated phosphorylation events.