LASER

BECKMAN LASER INSTITUTE

WINTER 2017/2018

UCI Beckman Laser Institute & Medical Clinic

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BLIMC Mission

Discover new optics and photonics technologies for biomedical research; ***Create*** innovative, accessible methods and devices that transform healthcare; and ***Educate*** the next generation of Scientists, Engineers, and Physicians.

On the Cover

Front: Professor Bernard Choi with LASER technology for imaging blood flow.
Back: Dr. Elliot Botvinick with his research team.

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IN THIS ISSUE

ARNOLD AND MABEL BECKMAN FOUNDATION AND UCI GIFT CHALLENGE

COLLABORATIVE GIVING SUPPORTS THE FUTURE OF MEDICINE

Without the vision of Dr. Arnold Beckman, the Beckman Laser Institute and Medical Clinic (BLIMC) would not be the interdisciplinary center that it is today. Dr. Beckman, through the Arnold and Mabel Beckman Foundation, provided the original financial gift to establish the BLIMC. As a successful scientist and businessman, Dr. Beckman preferred to donate in the form of matching grants, challenging others to invest.

In honor of Dr. Beckman's spirit of giving to advance science through philanthropic partnerships, Arnold and Mabel Beckman Foundation and UCI have teamed up to offer a $3.5 million matching fund. In order to meet the challenge and continue to move life-changing technologies from "bench to bedside," we need your help. Your gift, no matter the size, will help support the mission of the BLIMC. The technologies that we create today will shape the future of medicine.

To make a gift, please visit: **connect.uci.edu/BLI** or contact Gabrielle Comfort, director of development, at 949.824.8859 or gcomfort@uci.edu.

IN THE FORESEEABLE FUTURE

One of the few certainties in science is that it's impossible to predict the future. When the Beckman Laser Institute and Medical Clinic (BLIMC) was established in 1982, LASERs were revolutionary new tools with seemingly infinite potential. Despite their appeal, LASERs circa 1982 were impractical, high-maintenance machines. The futuristic vision for LASERs in Medicine was at odds with the everyday reality of how the technology worked. Over the years, dramatic advances have transformed LASERs into compact, reliable instruments. It is now possible to meet those early expectations – and much more. This has propelled LASERs and related optics and photonics technologies to the forefront of biology and medicine.

Hindsight is 20-20. On February 9, 2017, with more than 200 supporters in attendance, we reflected on the early days and celebrated the 30th Anniversary of the 1986 dedication of the BLIMC building (See page 2). We recounted the story of how BLIMC co-founders Drs. Arnold O. Beckman and Michael W. Berns met in 1979. A few years later, the Arnold and Mabel Beckman Foundation made a $2.5 million investment in a young professor, a new university, and an emerging technology. More than 30 years later, the results of this ongoing experiment are in: UCI is ranked in the top 10 of public universities in the country and the BLIMC has experienced extraordinary growth and impact.

Looking Forward. When our building opened in 1986, it housed one professor (Dr. Berns) and a group of about 10 students and staff. Today, the BLIMC has 21 faculty and approximately 200 people from more than 10 departments in the schools of Medicine, Engineering, Physical Sciences and Biological Sciences. Although biophotonics medical devices barely existed when we were established, they now constitute an ~$80 billion annual market. With this enormous worldwide growth, the BLIMC must continue to develop cutting-edge optics and photonics technologies in order to remain vibrant and productive over the next 30 years.

Converging Technologies. Recognizing this challenge, UCI Provost and Executive Vice Chancellor Dr. Enrique Lavernia has made an $8 million investment in optics and photonics via the BLIMC-led Convergence Optical Sciences Initiative (COSI) (See page 2). Over the next five years, COSI will hire at least five new faculty and create a dedicated space for academic-industry collaboration and engagement that will help drive continued innovation and discovery for the next 30 years. In July, we welcomed our first COSI hire, Dr. Chris Barty, a pioneer in advanced laser technologies and UCI professor of Physics and Astronomy (See page 4 to learn more about Barty).

Engineering Space and Time. COSI has been launched at just the right moment. However, the BLIMC building, a state-of-the art facility 30 years ago, is now in urgent need of renovation and expansion. New COSI activities will put significant pressure on a structure carefully designed to balance basic science and technology development with clinical translation and commercialization; all under one roof. The Arnold and Mabel Beckman Foundation has recognized this need and I am excited to announce that the Foundation recently committed $1.75 million to UCI in support of the BLIMC renovation and expansion. UCI has agreed to match this amount, giving us a total of $3.5 million to launch a new captial campaign. We are making significant progress, but we need your help to continue to move life-changing technologies from "bench to bedside."

Full Circle. In 1982, a $2.5 million matching gift from the Arnold and Mabel Beckman Foundation launched the BLIMC and helped drive forward a new scientific discipline. Seeded once again by the Foundation, we now need additional support from our community of friends to provide the right tools and talent to fulfill our mission. The BLIMC was established as, and remains, a powerful public-private partnership. With your help, we can leverage the generosity of the Arnold and Mabel Beckman Foundation and UCI to put the right people in the right place – a remodeled and expanded BLIMC – at the right moment in time to shape the next 30 years of innovation and discovery. ***With your investment, we may not be able to predict the future – but we can be prepared to shape it.***

Bruce J. Tromberg, Ph.D.
Director, Beckman Laser Institute & Medical Clinic

BLIMC CELEBRATES 30 YEARS

The Beckman Laser Institute and Medical Clinic (BLIMC) held its 30th anniversary, "Multiple Reflections," on February 9, 2017. The event celebrated the Institute's past achievements, present accomplishments and future discoveries.

In 1982, Dr. Arnold O. Beckman, through the Arnold and Mabel Beckman Foundation, provided the original financial gift to create the BLIMC as an interdisciplinary center at UCI for the development and application of optical technologies in biology and medicine. He liked to donate money in the form of matching grants, challenging recipients to be as invested as he was in the venture. At the celebration, BLIMC co-founder Dr. Michael Berns recounted his experiences with Dr. Beckman and their shared vision to create one of the first interdisciplinary medical laser institutes in the world. Together, Drs. Berns and Beckman raised funds to build the original building, which opened in 1986.

Over the past 30 years, the BLIMC has played a key role in helping drive the growth of optics and photonics in biology and medicine. Director Dr. Bruce Tromberg summarized the history of this expansion that has helped fuel the development of "Biophotonics and Biomedical Optics," a new discipline that is now well-represented in academic and industry programs around the world. However, according to Tromberg, we are only scratching the surface. Innovations in optics and photonics technologies combined with health care economic pressures are creating important new opportunities that will allow us to "embark on a path forward over the next 30 years that is as bold and visionary as the founding of the Institute."

Introducing COSI

UCI Provost and Executive Vice Chancellor Dr. Enrique Lavernia announced the "Convergence Optical Sciences Initiative (COSI)," an $8 million UCI investment in optics and photonics. "Our goal is to create exciting new opportunities with a broader impact on scientific discovery and human health," said Lavernia. COSI will partner BLIMC with the schools of Engineering, Physical Sciences, Biological Sciences, and Medicine, in collaboration with UCI Applied Innovation. Over the next five years, COSI will hire at least five new faculty and create a dedicated space for academic/industry collaboration and engagement. The first COSI hire is Dr. Chris Barty, professor of Physics and Astronomy, who is a pioneer in advanced laser light source technologies. Barty, who joined UCI and the BLIMC on July 1, 2017 has already launched Lumitron Technology Inc., a new venture that will commercialize his discoveries.

According to Provost Lavernia, "COSI-generated photonics expertise will benefit UCI programs, such as the Chao Family Comprehensive Cancer Center, the Institute for Clinical and Translational Science, the Edwards Lifesciences Center for Advanced Cardiovascular Technology, as well as further innovation and commercialization in cardiology, neurology, cancer, and sports medicine. It will draw people who are developing revolutionary new light sources and imaging technologies, innovators who are creating new methods and technologies to find and cure disease, and entrepreneurs who will accelerate the translation and impact of our work via commercialization. We believe this is a powerful strategic approach for UCI to build new human and intellectual capital that will substantially strengthen our region."

Could biophotonics prevent disease?

"The ability to fashion ways to better diagnose and treat diseases that have gone on without adequate interventional options is an area where I think the intersection between photonics and medicine is going to have an impact," said vice chancellor for health affairs and CEO of the UCI Health System, Dr. Howard J. Federoff. "This is increasingly clear as we understand more about the etiology or underlying basis of disease." According to Federoff, the potential is to develop non-invasive, low-cost screening technologies to detect diseases pre-clinically, before a doctor sees them. Federoff cited screening for microscopic melanoma before it comes to clinical attention and using near-infrared light for non-invasive brain imaging. "I think this is just the proverbial tip of the iceberg," said Federoff.

According to Dr. Pramod P. Khargonekar, UCI vice chancellor for research, convergence can lead to breakthroughs when engineers, chemists, and physicists collaborate with biologists and practicing physicians. Optics, photonics and imaging technologies could have tremendous impact on cancer, neurological diseases such as Alzheimer's disease, and cardiovascular disease. "We still think of therapies and diagnostics, but I can imagine a future using these non-invasive techniques of photonics and optics," said Khargonekar. "You could detect initiation of disease and use that to take steps to prevent full-blown occurrence. That would be an amazing breakthrough."

Reshaping noses, preserving brain function and building artificial pancreases

Attendees toured 17 interactive technology demonstrations featuring unique inventions by BLIMC faculty. For example, researchers in the lab of Dr. Brian Wong, professor of Otolaryngology, Biomedical Engineering (BME), and Surgery, showed how bioelectric technologies combined with biophotonic imaging could lead to new minimally-invasive surgical approaches for repairing and remodeling cartilage, tendon, ligament, skin, and fat.

The lab of Dr. Elliot Botvinick, associate professor of BME and Surgery, is developing an artificial pancreas for type 1 diabetics. Their innovative approach will provide patients with implantable scaffolds that house pancreatic islet cells combined with oxygen-sensing microparticles. Optical sensing of microparticle activity is used to monitor oxygen levels and blood vessel growth. "It is like building the house first, and then moving in," said researcher Dr. John Weidling. Rachel Gurlin, a graduate student, has just published her first paper on the new approach. Her sister has type 1 diabetes. "I cannot imagine studying anything else," said Gurlin.

The multiplier effect of COSI

"If you think about the fundamental technology that BLIMC has embraced and leverages every day, it not only has benefit for patient outcomes, but it also has implications in other fields," said Bob Phillippy, former CEO of Newport-Spectra Physics Corporation. "The technologies that are used to create consumer devices can also create medical devices. Behind it all is photonic technology and it is the fundamental nature of light being behind the scenes, in many cases, ubiquitously deployed, to be able to do the work faster. You hear the speed of light. Literally. Harnessing that technology and leveraging its capabilities is something that is really significant...and (potentially) world changing."

"We already have seen the incredible trajectories and impressive impact of BLIMC-generated technologies on the local healthcare economy," said chief innovation officer and executive director of UCI Applied Innovation, Dr. Richard Sudek. "Orange County has over 300 medical device companies that depend on innovation as their lifeblood. It is our mission to get these technologies from the lab to commercialization. We bridge that last step—implementation—by supporting BLIMC researchers and fostering the networks of entrepreneurship: partnerships, licensing, and industry-sponsored research with companies and researchers. As COSI accelerates the rate of innovation generation, we are partnering with the BLIMC to ensure that more of these promising technologies get to market."

Excerpts from Cove TechCurrents, by Wendy Wolfson. For video of the event, visit www.bli.uci.edu/30th

Renaissance in Light

Dr. Chris Barty joins UCI as the first professor in the BLIMC-led Convergence Optical Sciences Initiative

"We are in a renaissance in light source technology," stated Dr. Chris Barty, who joined UCI and the BLIMC as professor of Physics and Astronomy in July. And "Renaissance Man," is one way to describe Barty.

With Ph.D. and M.S. degrees in applied physics from Stanford University and B.S. degrees, each with honors, in chemistry, physics, and chemical engineering from North Carolina State University, Barty joined UCI after serving as the chief technology officer for the National Ignition Facility (NIF) and Photon Science Directorate. Prior to that he was the founder and director of the mission-based Photon Science and Applications program at Lawrence Livermore National Laboratory (LLNL).

At LLNL, Barty helped manage and guide the technical evolution of the world's highest-energy and largest laser within the NIF – a laser the size of a football stadium. He also played key roles in the development of ultrahigh intensity laser science, laser inertial fusion energy and laser defense activities at LLNL. For more than a decade, Barty has also pioneered laser-Compton technology, an extremely bright, x-ray and gamma-ray light source that can be created with short-pulse lasers and energetic electron beams. In the gamma-ray spectral region, the peak brightness of a laser-Compton light source pulse can be 15 orders of magnitude beyond any other man-made light, making it possible to access and manipulate the nucleus of an atom with photons, an emerging field known as "nuclear photonics." These highly mono-energetic gamma-ray sources produce narrow, laser-like beams of incoherent gamma rays that can penetrate through lead and other thick containers and can be tuned to a specific energy so they predominately interact with only one kind of material.

"In the early days of lasers, the controlled manipulation of the outermost electron structure of the atom became possible, leading to a wide variety of new applications and science that now impacts many, many aspects of our daily lives," stated Barty. "Similarly, laser-Compton gamma-ray sources are now enabling 'nuclear photonics,' or the photon-based manipulation of proton motion within the nucleus, and thus are leading to new applications and science including the isotope-specific detection of materials for security and advanced medical imaging, and enable novel forms of discovery-class, nuclear spectroscopy." Since Barty first coined the term "nuclear photonics" in 2008, the related international community has grown rapidly and now includes more than $500 million of activities and a major biennial conference by the same name.

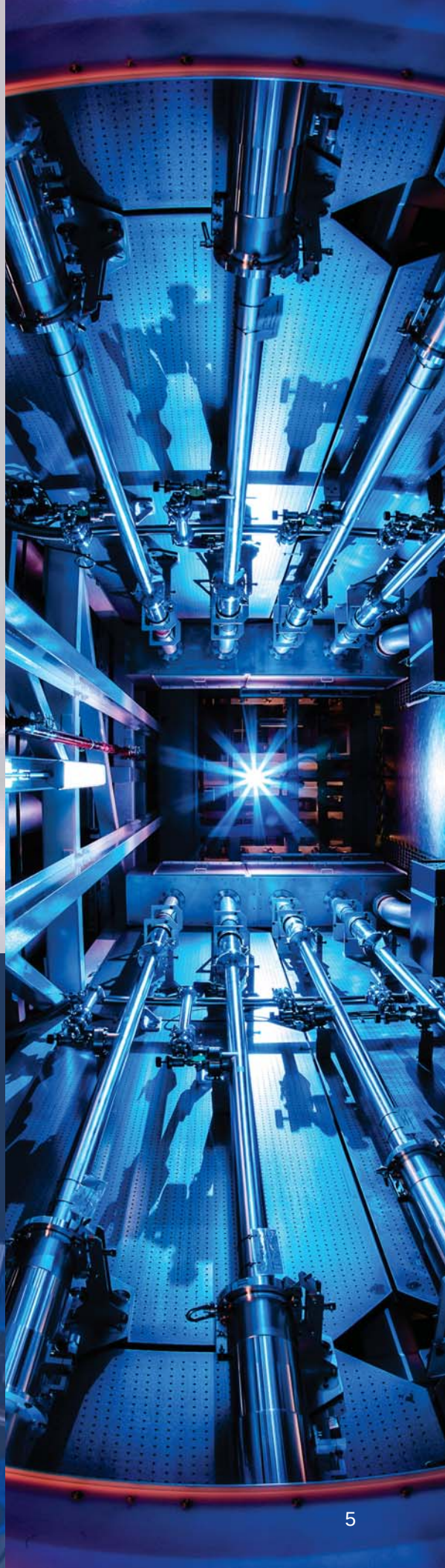
"[At LLNL] We constructed a proof-of-principle laser-Compton machine and used its photons to detect the presence of lithium concealed behind

aluminum and lead," shared Barty. "The machine created a record peak brilliance. It used an existing linear accelerator and custom laser systems designed specifically for laser-based Compton scattering x-ray and gamma-ray sources."

Barty's patented laser-Compton technology is now being transferred to industry, and is the foundation behind a new company, Lumitron Technology, Inc., which he helped launch and which will be headquartered in the University Research Park adjacent to campus. As the lead hire in the Convergence Optical Sciences Initiative (COSI), he will concentrate his efforts on building the world's highest output, tunable, mono-energetic, compact, x-ray light source based on laser-Compton scattering. "My focus will not only be to establish laser-Compton systems as the 'gold standard' for imaging and therapy, but also to target a broad ecosystem of new science and technology across a range of industrial, commercial and healthcare applications."

"When I look here [at UCI], I see the grand vision. BLIMC completely gets the story where academic and industrial activities are encouraged which doesn't happen everywhere," stated Barty.

"We are pushing the frontier of basic science and engineering. Laser-Compton technology will enable the location, study and treatment of disease in ways not previously possible. We have a tremendous opportunity to change healthcare and make a real impact on medicine. The unique x-ray capabilities of compact, laser-Compton sources will also play a pivotal role in materials science, micro-fabrication, and the rapid emergence of additive manufacturing."



More about Dr. Chris Barty

For his many contributions to advanced lasers, novel x-ray and gamma-ray sources and the applications of both, Dr. Chris Barty has been elected a fellow of numerous professional societies including most recently the American Association for the Advancement of Science (AAAS) and before that the American Physical Society (APS), the Optical Society of America (OSA), the International Society for Optical Engineering (SPIE) and the Institute for Electrical and Electronics Engineers (IEEE). He is the recipient of the 2016 SPIE Harold E. Edgerton Award for his work on ultrafast lasers and laser-based x-ray and gamma-ray science and is currently the chairman of the International Committee on Ultrahigh Intensity Lasers (www.ICUIL.org). He has published more than 200 manuscripts and presented more than 200 invited talks, spanning topics in lasers, optics, materials science, nuclear science, medicine, chemistry, engineering and physics.

IN MEMORIAM
LARS OTHAR SVAASAND

Lise Randeberg, Professor, Norwegian University of Science and Technology and Bruce Tromberg, Professor, University of California, Irvine

On February 23, 2017, the Beckman Laser Institute and Medical Clinic (BLIMC) lost a dear colleague, mentor and friend, Dr. Lars Othar Svaasand, in Trondheim, Norway at the age of 79.

Svaasand was a pioneer in Biomedical Optics who made seminal contributions to photodynamic and photothermal therapy, optical diagnostics, and computational modeling of light transport in tissues. Trained as an electrical engineer, he began his career in 1962 working in the rapidly emerging field of lasers and fiber optics at the Norwegian Defense Research Institute. In 1974, he joined the faculty of the Norwegian University of Science and Technology (NTNU) where he remained until he retired in 2008. Between 1988 and 2008, Svaasand frequented the BLIMC as a visiting professor, serving as an influential teacher and collaborator.

Professor Svaasand was a gifted instructor known by generations of electrical engineers in Norway for his thought-provoking and inspiring lectures on electromagnetics. Over the years he held several leadership roles at NTNU, including serving as dean of the College of Engineering, head of the Department of Physical Electronics and a member of the University Board of Governors.

Lars had a global network of friends and coworkers. On his first extended visit to the United States in the mid-1980s, he worked at the University of California, Santa Barbara on photosensitizer fluorescence as an approach for cancer screening in cigarette-smoking uranium mine workers. He returned to the United States in 1988 as a guest of the BLIMC. This visit spearheaded a longstanding relationship with the Institute for more than 20 years.

Professor Svaasand's activities spanned from developing original mathematical models for characterizing light propagation in tissues to investigating new concepts for the creation of new medical laser therapies. He collaborated with BLIMC colleagues to integrate these activities, developing innovative technologies for frequency domain photon migration (FDPM) and tissue spectroscopy. In addition, he explored using medical laser therapies for cutaneous (skin) diseases, such as "port wine stains" (PWS) or birthmarks that can have a negative physical and psychological impact on children and adults.

In the late 1980s and early 1990s skin overheating and scarring limited the effectiveness of laser PWS therapy. BLIMC medical director Dr. Stuart Nelson, who specializes in treating PWS in infants and children, worked with Svaasand and colleagues Tom Milner and Sol Kimel to find a solution. They discovered that they could preserve the skin and reduce scarring by cooling it with liquid cryogen "dynamically" with each therapeutic laser pulse. Svaasand's calculations led to the first prototype "dynamic cooling device (DCD)," using a cryogen and fuel injection valve purchased from a local automobile parts store. Svaasand's lifelong passion for collecting and rebuilding WWII-era military vehicles proved instrumental in turning their idea into a practical device.

Svaasand's theoretical insight, creativity, and real-world knowledge had a significant impact. DCD technology is now available on over 25,000 medical lasers, and has generated more than $55 million in patent royalty revenue for the University of California. Svaasand's engineering and physics contributions improved the versatility and effectiveness of laser therapies, benefitting tens of millions of patients around the world.

In addition to his inventive problem solving abilities, Professor Svaasand was an extraordinary advisor who used simple words and drawings to convey complicated theories, often using the back of an envelope or napkin. He taught his colleagues to tolerate chaos before finding meaningful patterns in data, and to "keep track of the gradient," advising that often the most exciting breakthroughs occur where change is most prominent. In addition to these somewhat esoteric concepts, Lars shared a practical and human lesson: never give up and be prepared for the unexpected. He often quoted Henrik Ibsen, the famous Norwegian playwright, reminding investigators (in his own translation) "if the starting point is wrong, the outcome might be quite original."

Professor Svaasand was a considerate and respectful listener who was always open to hearing different perspectives and sharing new ideas. Lars was a warm-hearted friend and valued colleague, dedicated father and husband, and enthusiast of various pursuits, spanning from restoring WWII-era vehicles to watching Hollywood westerns. He will be deeply missed.

Lars with his granddaughter Soveig

TREATING THOSE IN NEED

REVOLUTIONARY PORTABLE SCREENING DEVICE HELPS DETECT ORAL CANCER

Worldwide, oral cancer is the sixth-most common cancer-related cause of death, killing almost a quarter-million people each year. In low-income nations such as India, which has the world's highest rate of oral cancer, the situation is more imperative, primarily due to limited awareness and limited access to specialized care for the underserved. In some parts of India, the disease kills more people than any other ailment. However, survival rates greatly rise if oral cancer is quickly diagnosed.

To increase early detection, BLIMC professor Dr. Petra Wilder-Smith has partnered with the Mazumdar Shaw Cancer Center in Bangalore, India, to conduct a National Institutes of Health (NIH)-funded study to develop and test a low-cost, portable screening device that field-workers can use to screen for oral cancer. The technology is enabling those who are rarely treated by a dentist to receive timely diagnoses and care, significantly improving their health.

Wilder-Smith developed the technology after she witnessed that at-risk patients who lived in remote villages did not have the funds or resources to travel great distances to the Cancer Center for monitoring. Also, she realized that

patients avoided care because they found the biopsies – the standard practice at the time – to be too painful. These patients would often times go undiagnosed or seek treatment after it was too late. Taking these factors into consideration, Wilder-Smith designed a new pain-free, portable technology for use in remote areas. This device creates detailed laser images of oral lesions that can easily be sent by cell phone to the Cancer Center for evaluation.

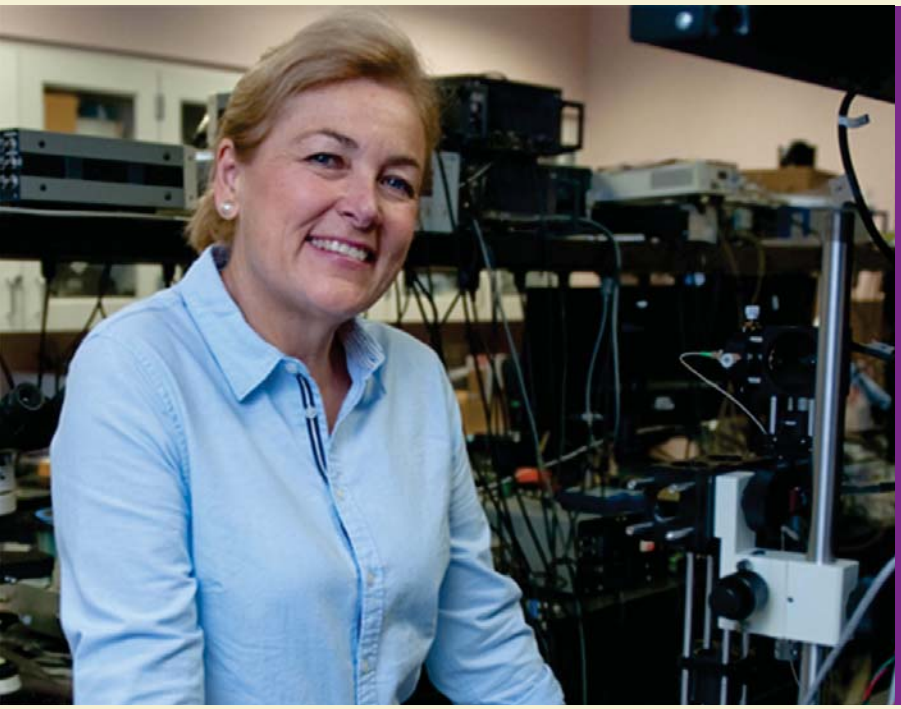
“Petra is widely recognized for her visionary leadership in the pioneering use of optics and photonics technologies for improving oral health,” noted Dr. Bruce Tromberg, BLIMC director. “She has a special combination of abilities as a compassionate clinician with a unique understanding of patient needs, particularly in medically underserved communities.”

Over the past year, UCI teams have traveled to India with a prototype device to test on patients. They screened more than 12,000 people, identifying 1,200 with or at high risk of imminently developing oral cancer.

Wilder-Smith says these efforts are promising, and her team is gearing up for a larger campaign to help those across the nation. “We’re in conversations with several foundations and government groups to explore ways of expanding this program quickly – with the goal of saving thousands of lives,” she says.

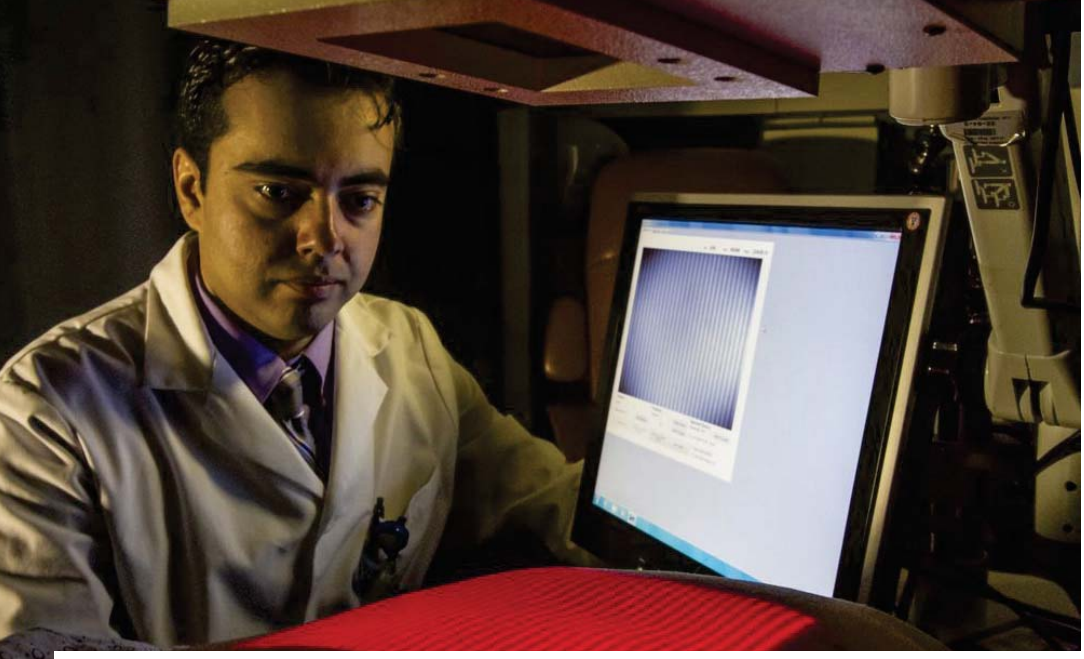
Article adapted from, “Better screening of oral cancer in India,” featured in UCI Magazine and “Better than biopsies,” featured on UCI News. Both articles written by Tom Vasich.

Dr. Petra Wilder-Smith screens a patient for oral cancer



Dr. Petra Wilder-Smith

In 1992, Dr. Petra Wilder-Smith joined the faculty of the Beckman Laser Institute and Medical Clinic (BLIMC), where she currently serves as dental director. Over the past two decades, she and BLIMC professor Dr. Zhongping Chen have created innovative methods based on optical coherence tomography (OCT) technology to detect and monitor oral cancer. OCT is unique because it allows high resolution imaging of tissue structure and blood flow beneath the surface where cancer starts. This can all be done non-invasively without having to perform a tissue biopsy.



IMAGING INNOVATOR

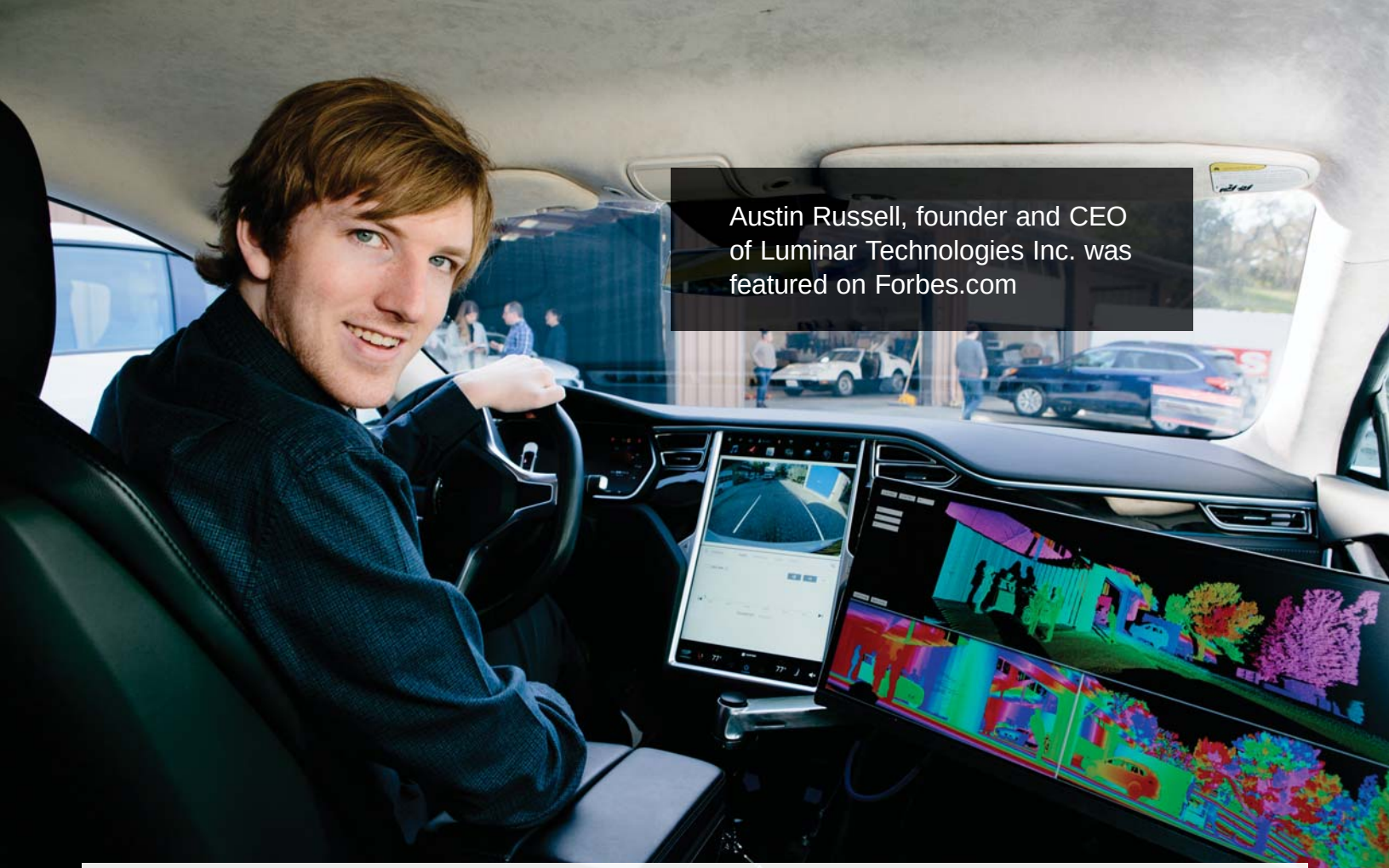
First company launched in the BLIMC Photonic Incubator to receive FDA clearance

Modulated Imaging, Inc. (MI, Inc.) received clearance from the Federal Drug Association (FDA) for its Ox-Imager CS system. This is the first technology developed by a company founded in the Photonic Incubator of the Beckman Laser Institute and Medical Clinic (BLIMC) to be cleared by the FDA. According to UCI alum Dr. David Cuccia, MI, Inc. CEO/CTO, this device is expected to assist clinicians with the identification of lower limb vascular issues, leading to patients receiving more appropriate and timely treatment. With FDA clearance MI, Inc. is now in the process of launching the system at clinics throughout the country.

“This FDA clearance is a major milestone for our company and for the patients and physicians within the vascular treatment communities,” said Cuccia. “Ox-Imager can lead to significant preventive care actions, as well as an estimated potential $6.2 billion in savings per year. We’re proud to be able to provide meaningful information that advances patients’ health and wellness.”

HONORED FELLOW OF SPIE

Dr. Anthony Durkin, associate professor of Biomedical Engineering and BLIMC associate director, was honored as a 2017 International Society for Optics and Photonics (SPIE) fellow for his achievements in spatial frequency domain imaging and tissue optics. Since the society’s inception in 1955, more than 1,200 SPIE members have been distinguished as fellows for their technical achievements and service to the optics community and SPIE. The emphasis of Durkin’s research is on the development of quantitative optical technologies to address clinically compelling problems, including burn severity assessment, wound healing, reconstructive surgery, and skin cancer.



Austin Russell, founder and CEO of Luminar Technologies Inc. was featured on Forbes.com

CEO AT AGE TWENTY-TWO

Former BLIMC high school researcher becomes pioneer of self-driving car technology

At age 22, Austin Russell, a former BLIMC high-school independent researcher, launched Luminar Technologies, Inc. The company recently announced that it is partnering with the Toyota Research Institute to advance self-driving car technology. Russell, CEO of Luminar Technologies Inc., developed an advanced laser lidar sensor system that detects a car's surroundings in high-definition 3D, paving the way for self-driving cars to "actually work and be safe."

For Russell, being a pioneer meant having the patience to build a better lidar system that would not only advance the industry, but do it in a field that could save people's lives. "We're able to see seven seconds out instead of one second," Russell shared with *Business Insider*, "That's a really big breakthrough."

Russell, a gifted student, memorized the periodic table by age four and transformed a Nintendo gaming headset into a cell phone by the sixth grade. He first conceptualized and designed augmented reality and wireless power transmission projects during his last two years of high school, working as an independent researcher in the Tromberg lab at the BLIMC.

"Our plan is to power every autonomous vehicle that's produced and make them so they can truly be safe and autonomous," Russell said of his future vision. As he stated on Bloomberg.com, "You would push yourself to the limit at least ultimately. That's what you have to do if you want to make an impact on the world."

Article adapted from, "Toyota is trusting a startup for a crucial part of its newest self-driving cars" by Johana Bhuiyan on Recode.com; "Meet the 22-year-old college dropout who wants to power every future self-driving car," by Biz Carson in Business Insider and, "The 22-year-old at the center of the self-driving car craze," by Alex Webb, Lizette Chapman and Alex Barinka on Bloomberg.com.

First-grader Jackson Samz

FAMILY TREATMENT

VASCULAR BIRTHMARKS FOUNDATION CONFERENCE OFFERS HOPE

Visiting sunny southern California was a treat for first-grader and Utah resident, Jackson Samz. Not because of the typical Disneyland vacation, but rather seeing his friends and Beckman Laser Institute and Medical Clinic (BLIMC) "family" at the annual Vascular Birthmarks Foundation Conference.

Since infancy, Jackson has been treated by Dr. Stuart Nelson, medical director of the BLIMC, for the red patches on his face known as "port-wine stains." Every October, Jackson and over 300 children and their families attend the Conference. Families travel from as far away as India to hear from international experts on vascular birthmarks and malformations, including Dr. Nelson – pioneer of the innovative Dynamic Cooling Device, used to treat infants and children who are born with port-wine stains.

Jackson prior to treatment

With this year's conference hosted at the BLIMC, there was a sense of familiarity for many families who routinely visit the Institute for treatment. "These kids have been on a plane more times in their lifetime than most adults," said Julia, Jackson's mother, "The doctors, nurses and staff have seen Jackson grow up."

The two-day conference, co-sponsored by the Vascular Birthmarks Foundation, featured over 144 clinic appointments and 27 dental and orthodontic exams, which were conducted by seven medical teams specializing in various malformations. More than 60 participants attended sessions for social support, insurance assistance and make-up consultations for teens who are often teased by peers for their appearance.

"It's very isolating for families," explains Erin Miller, conference organizer and director of external relations of the BLIMC, "They feel like they are alone and here they are able to come together as a community of support."

Jackson and his family look forward to attending next year's conference in New York City. They not only anticipate hearing the latest advancements in research, diagnosis and treatment of vascular birthmarks, but more importantly they have hope – hope for what is to come.

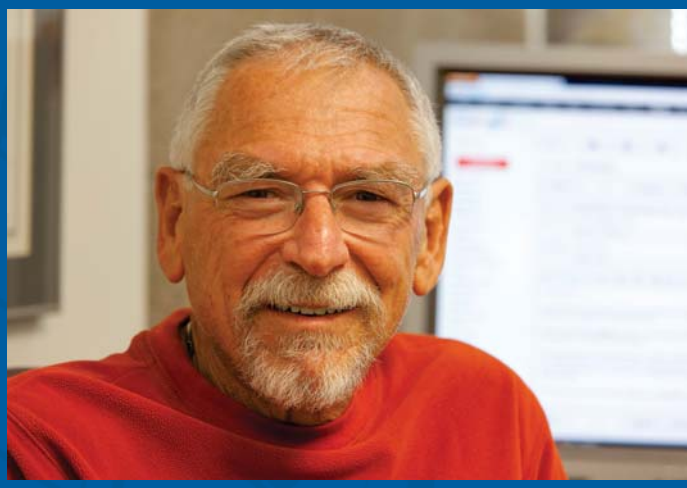
"Jackson does normal kid stuff – he likes rock climbing, building Legos and playing with his dog," shared Julia, "He'll be on maintenance [for his port-wine stain] at some point. I have a feeling that something big will happen within our lifetime."

The BLIMC would like to thank the following 2017 Vascular Birthmarks Foundation Conference donors for their generosity:

Anonymous
Beckman Laser Institute, Inc.
Cutera
Cynosure
Pierre Fabre
Lauri Firstenberg
Dr. Anton Hasso
Dr. Paula and Mr. Bay Miltenberger
Dr. J. Stuart Nelson
Syneron/Candela
Terumo Interventional Systems
Trader Joe's
UCI Health
The Williamson Family

"AND THE BEAT GOES ON STILL MOVING STRONG ON AND ON"

Lyrics from "And the Beat Goes On"
The Whispers, 1979



I met Dr. Arnold Beckman at the end of 1979, the same year The Whispers first sang the song "And the Beat Goes On." In a way, it is now a touchstone for me because of an idea I had over 40 years ago.

One of the first grants I received in 1986 (the year the doors of the BLIMC opened) has been continuous since then, and was recently renewed for another three years for a total of $5.4 million. This award, "Advanced Optical Technologies for Defense Trauma and Critical Care," was granted under the United States Department of Defense (DOD) Military Medical Photonics Program. If not the longest, this grant is one of the longest continuous government grants to UCI and represents close to $30 million of funding over 30 years.

The grant includes research projects by five BLIMC faculty members that pursue studies on the development of unique optical technologies for the assessment of patient trauma with a sixth project focused on understanding the mechanisms of damaged nerve repair. At a recent visit by the DOD program managers, the faculty and students put on a set of superb presentations that left me very proud of the team members. It is clear that the seeds that were sewn over 30 years ago have grown into a mature and vibrant program.

These projects include: assessment for the detection of critical injury in soldiers in the field with potential unrecognized hemorrhage; imaging and treatment of burns and wounds, including response to therapy; evaluation of airway injuries; assessment of dehydration in soldiers working in extreme conditions, and creating diagnostics to assess brain and spinal cord injuries. All of these technologies are not only important to the military, but on a much larger scale to many areas of human medicine, such as cancer, heart disease, diseases of the nervous system, and repair of nerve damage.

It is interesting to reflect on the 30 years of a grant that has served as a key core support of the BLIMC. At the beginning, in 1986, the purpose of the award was to study basic mechanisms of how short-pulsed lasers affect biological tissue. Then, as years passed while government administrations changed and university priorities re-ordered, the current award has evolved into an applied science program. This reflects the evolution of BLIMC and its more recent emphasis on developing technologies that directly improve the human condition. And that is good, and "the beat goes on, still moving strong on and on."

Michael W. Berns, Ph.D.
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