Nelson
Elected to
ASLMS
Presidency

Members of the American Society for Laser Medicine and Surgery (ASLMS) have elected J. Stuart Nelson, M.D., Ph.D., to serve as the next president of their organization. Dr. Nelson will serve as President-Elect for the remainder of 2000 and will assume the President’s mantle when the organization convenes for its annual meeting in New Orleans next spring.

With more than 4,000 members, ASLMS is the world’s largest professional organization for research, education, and clinical care in the field of laser medicine. The society crosses disciplinary borders, drawing its members from a variety of medical and surgical fields as well as nursing, dentistry, veterinary medicine, industry, research, and government.

As President, Dr. Nelson will preside at all meetings of the ASLMS membership. “I’m honored to serve ASLMS and its members in this capacity,” says Nelson, who will also be called upon to organize the annual meeting of the ASLMS in spring 2002.

Institute Director Michael Berns, Ph.D., a past President of ASLMS himself, understands the rigors and the responsibilities of the office. “Dr. Nelson will be busy, but I’m sure he is the right person for the job. It’s gratifying to see a former student receive accolades for his work, and I think his election confirms the excellent reputation which BLI enjoys with professionals in the field.”

Institute co-founder Arnold O. Beckman, Ph.D. (seated, center) celebrates his 100th birthday with staff and faculty at the Beckman Laser Institute, April 18, 2000 (see newsbrief below).

Newsbriefs

A CENTURY OF EXCELLENCE

Faculty and staff gathered at the Beckman Laser Institute on April 18, 2000, to celebrate the 100th birthday of BLI co-founder Dr. Arnold O. Beckman. Cake and champagne were served in honor of Dr. Beckman’s “century of excellence,” and Institute Director Michael Berns, Ph.D., was on hand to make the toast.

“Dr. Beckman has single-handedly changed the course of science and technology in this country,” notes Dr. Berns. “His record of inventions and his record of philanthropy are both unsurpassed. Everything we do here [at BLI] bears his imprint in some way, and I feel lucky to have Dr. Beckman as a friend and mentor.”

(newsbriefs continued on p. 7)
A Voice From the Past Says, ‘Time for a Change!’

by Michael Berns, Ph.D.
Arnold and Mabel Beckman Professor
President and Director

Moving to a new home affords us the opportunity to come across valuable things we forgot we had. While packing boxes with my wife, Robbie, to prepare for our recent move, I came across an audiocassette that my close friend Doug Nash (thanks, Doug!) made at the BLI opening ceremonies fifteen years ago.

The tape still sounds great, and so I am enclosing along with this newsletter a transcription of the comments made by Institute co-founder, Dr. Arnold O. Beckman (now 100 years young). I think you will find Dr. Beckman’s comments both enjoyable and illuminating.

With his characteristic wit, Dr. Beckman explains why he established BLI as a separate, non-profit corporation with a unique business relationship to the University of California. The nervous laughter of university officials and friends of UCI can be heard in the background.

Dr. Beckman points out that BLI was conceived as an experiment and, as such, was born with the capacity to either succeed or fail. Fifteen years later, I think it’s time we evaluate the results.

The success of the Institute is reflected in the numerous research achievements made here, as well as the publications, awards, and honors which our faculty and students have written and earned over the years.

With respect to technology transfer, we can be proud of our patent record and of the numerous technologies that have moved from our labs to the real world of patients and business. And with regard to our clinical record, what figure better illustrates our success than the 20,000 patients who have been treated at BLIMC for various ailments and conditions with our state-of-the-art laser technology?

If any, the failure of the Institute has been its unwillingness to capitulate in the face of an ever-changing health care environment where both patients and physicians are held captive by providers and business strategies that are inconsistent with the high standards of academic research, patient care, and instruction.

So then, fifteen years into our “experiment,” the time seems right for a course adjustment. We are returning to the most basic precept of the BLI mission: that is, basic and clinical research “under a single roof.” Having added the new Photonics Incubator, we at BLI now have the capability to: (1) pursue the basic research that leads to new diagnostic and treatment modalities; (2) test these new technologies and concepts on patients in our “research clinic” and; (3) develop the potential of these technologies with our corporate partners in the Photonics Incubator.

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Beckman Laser Institute News
Alexander Karn
According to the National Cancer Institute, one in eight women in the U.S. will be diagnosed with breast cancer. Despite education programs and improvements in diagnostic technologies, breast cancer remains the most common form of cancer among women. In fact, the incidence of the disease has been rising over the past two decades. As a result, the “fight for a cure” has become a top priority at cancer research facilities across the nation and around the world.

Scientists at the University of California, Irvine have taken a leadership role in this effort. Led by Bruce J. Tromberg, Ph.D., Director of the Laser Microbeam and Medical Program (LAMMP) at the Beckman Laser Institute, and John A. Butler, M.D., UCI’s Chief of Surgical Oncology, a group of UCI researchers is working to develop a new technique that uses laser light to find and characterize tumors in breast tissue.

The Stories Lasers Tell

Photon Migration Spectroscopy (PMS) uses near-infrared light to assess physiology and structure in dense tissues such as the human breast. As light waves propagate through these tissues, bundles of light known as photons are absorbed and scattered by the biological materials they encounter. PMS “translates” absorption and scattering data to provide functional images of vital physiological parameters.

“It sounds difficult, but the basic idea is easy to understand,” Tromberg explains. “We shine a near-infrared laser on the skin surface; light waves penetrate and move painlessly through the tissue; and when these waves exit, they have a story to tell about what they encountered on their journey.”

In the field of cancer research, this “story” could provide clinicians with information they can only collect at present with a combination of mammography and surgical biopsy.

“First of all, mammography does not work as well in younger women since they tend to have denser breast tissue than postmenopausal women,” Butler says. “This leads to greater uncertainty in determining whether tumors are cancerous or benign.”

Since PMS provides unique functional information, the technique could be used in conjunction with other methods to improve diagnostic accuracy. For example, PMS scans could be performed at the patient’s bedside to help minimize the large number of surgical biopsies performed in the United States.

Improving Risk Assessment

Tromberg and his research team are currently conducting clinical studies in an effort to assemble an “optical properties” database which they will use later to correlate raw data collected via PMS to meaningful diagnostic criteria.

“We have to train ourselves to recognize significant data patterns as new samples are collected. We are literally writing the book on the optical properties of breast tissue as we work toward assembling reliable diagnostic criteria,” Tromberg explains.

Tromberg hopes that PMS can eventually improve risk assessment for women with a history of breast cancer in the family. Because it monitors biological processes taking place within the breast, PMS could significantly improve current understanding of physiological changes associated with disease development and the impact of new therapies.

“Because light is so sensitive to tissue function, we are literally taking a new ‘look’ into all aspects of breast disease: prevention, diagnosis, and treatment,” Tromberg says.

A portable laser scanner is used to locate and characterize tumors and other abnormalities in breast tissue.
Every medical imaging technique has its drawbacks, and each fills a particular niche. For example, radio-frequency and ultrasound imaging provide safe, low-cost visualization of basic anatomy, but resolution for these techniques is relatively poor. By contrast, short wavelength techniques, such as x-ray and ionizing radiation, yield greatly improved resolution, but these can damage living tissues and degrade biological samples.

Optical imaging technology, the use of light packets (photons) to “see” inside the human body, offers researchers and clinicians a middle road: high-resolution capabilities without the risks associated with shorter wavelength techniques.

Until recently, however, optical imaging techniques, e.g., optical coherence tomography (OCT), were not suitable for functional imaging of tissue anatomy and physiology. Scientists could use light-reflectivity to generate structural images, but no information about physiological events and processes inside these tissues was available. Researchers at the Beckman Laser Institute have made it their mission to change this.

Without Making an Incision
Optical Doppler Tomography (ODT) is a new imaging modality which combines the principles of OCT with Doppler velocimetry to image tissue structure and measure blood flow and microcirculation at the same time. Zhongping Chen, Ph.D., Assistant Professor of Surgery at BLI, heads a team of researchers working to make ODT a viable tool for the diagnosis and management of disease.

“Science moves ahead when we bring new questions to existing knowledge,” Chen explains. ODT can quickly collect high-resolution images of tissue micro-structures (e.g., the orientation and size of tiny arteries and veins) as well as data for blood flow velocity (hemodynamics).

The technique itself is quite simple. Harmless light is delivered into the skin via a hand-held applicator. A second beam of light is emitted by the applicator to survey the progress of the first. The interaction of these two beams provides raw information about tissue structure and physiology. Complex algorithms are then used to transform this data into working, real-time images.

“To the best of our knowledge, this is a first,” says Chen. “Never before has it been possible to provide blood flow images and velocity profiles on a real-time scale in vivo. We can now monitor tissue microvasculature without making an incision, without exposing patients to dangerous radiation, really, without any special preparation at all.”

Getting Under Our Skin
Although ODT has not yet been tested in a clinical setting, the technique promises to have broad applications for medical diagnostics and physiological monitoring. Because it offers resolution levels at or near the level of standard histopathology, ODT might be able to eliminate the need for certain surgical biopsies.

As with OCT, ODT can be used to identify normal versus neoplastic...
Richard Diaz: Making Chaos Compute

Shall we call it Diaz’s Law? A fixed principle in the BLI universe? A rule with no exceptions? At precisely the moment he sits down at his desk or stops to pop an Altoid into his mouth—just when he wonders at the silence—there comes a distress call across the BLI intercom: “Richard Diaz, please dial 9-0.”

These S.O.S. signals are a regular feature of Richard’s work day. As BLI’s computer resource specialist, Richard puts out digital fires large and small. Lost files, fried disks, crashed systems, and cranky printers: these are Richard’s strong suit.

“Computers have always been part of my life,” he says, “although I only decided to start a career in the field recently.” Since then, the long-time Orange County resident hasn’t had much time to spare. “I love interacting with people,” Richard explains. “And I don’t mind being in demand because the environment at BLI is great. We’re very lucky here.”

“Single and loving it,” Richard currently lives in Fullerton with his six year-old cocker spaniel, Lucky, although the two are planning a move to Long Beach.

An avid baseball fan, Richard estimates that he will have seen fifty-five Angels’ games by the time the pennant race wraps up in September. “I’m a life-long Angel,” Richard says proudly. “Whether it’s work or playing beach volleyball or organizing a group excursion to Edison Field, I like to stay busy.”
A successful collaborative effort between the Beckman Laser Institute and the laboratory of Dr. Nancy Allbritton (Department of Physiology and Biophysics at the University of California, Irvine) has resulted in a new patent for the Laser Micropipette System (LMS).

The LMS offers a unique method and apparatus for lysing (dissolving) and analyzing the molecular contents of a single, living cell or its subcellular components. By employing its microanalytical capabilities, researchers can use the LMS to extract a single cell’s molecular contents, which include DNA, RNA, enzymes, structural proteins, metabolites, drugs, toxins, and physiological reporter molecules. These compounds can then be isolated for subsequent analysis.

Marketing plans for the Laser Micropipette System are proceeding rapidly. The developers of the LMS have recently met with representatives at Beckman-Coulter (Fullerton, CA), Eli Lilly (Indianapolis, IN), and also SmithKline Beecham (Philadelphia, PA) to discuss further development of the technology.

Discussions with these firms will continue. In addition, the possibility of spinning-off this technology into a new company is also being discussed.

Conference attendees heard a range of talks covering the most recent advances in the field of laser medicine. Sessions included: “High Resolution Functional Imaging in Cells and Tissues: New Methods and Contrast Mechanisms” (Bruce J. Tromberg, Ph.D., Chair); “Biomedical Optics and Laser Treatment of Human Skin” (R. Rox Anderson, M.D., Chair); “Recent Developments in Photodynamic Therapy” (Willem M. Star, M.D., Chair); and “Inverse Problems and Statistical Methods in Optical Biology” (Thomas Milner, Ph.D., Chair).

“It’s an honor to serve as chair for a meeting of this magnitude,” says Nelson. “The Gordon Research Conference has long been considered the most important scientific meeting in the field.” Nelson secured $55,000 in funding from the Whitaker Foundation, The National Science Foundation, and the U.S. Air Force. “We were able to fully fund the attendance of forty-eight graduate students and postdocs, nearly double the number funded two years ago.”

Since 1931, Gordon Research Conferences have provided an international forum for the presentation and discussion of frontier research in the sciences. GRC sponsored more than 100 different conferences during summer 2000.
‘ODT: GLIMPISING THE SKIN’

Petra Wilder-Smith, D.D.S., Ph.D., Associate Adjunct Professor of Surgery, has received major funding from the California Cancer Research Program (California Department of Health Services) for her work on non-invasive diagnosis of oral cancer. The three-year award, which totals $879,000, will support Wilder-Smith’s research on the use of photosensitizers (light-sensitive compounds which can be applied topically or administered orally) to detect pre-malignant and malignant lesions of the mouth via fluorescence.

At present, there is no reliable method, with the exception of surgical biopsy, to discriminate between benign, harmless sores which occur regularly in the mouth and those lesions which will turn cancerous if left untreated.

Reviewers’ comments were enthusiastic. One reviewer notes, “[This] research has important cancer control potential. Development of reliable oral cancer screening technologies could greatly improve the current reliance on unassisted visual inspection.”

Institute Director Michael Berns, Ph.D., also has high hopes for the project. “This research has exceptional potential, not just for dentistry, but for cancer detection and diagnostic medicine in general.”

DENTAL PROGRAM EARNS NEW FUNDING
Oral Cancer Detection Project Snares $879K

Petra Wilder-Smith, D.D.S., Ph.D., Associate Adjunct Professor of Surgery, has been awarded a $35,000 grant by the Cancer Research Foundation of America (CRFA) to support continuing research on in vivo fluorescence cancer detection as an alternative to surgical biopsy.

Dr. Wilder-Smith’s project was one of seventeen research programs (newsbriefs continued on p. 8)

PRESIDENTIAL ACCOLADES

BLI collaborator Steve George, M.D., Ph.D., Assistant Professor of Chemical and Biochemical Engineering and Materials Science and an active faculty member in UCI’s Biomedical Engineering Program, has been selected to receive a Presidential Early Career Award for Scientists and Engineers (CAREER).

At the behest of the Clinton Administration, the National Science Foundation (NSF) established the CAREER program in 1995 to help scientists and engineers in the early stages of their academic careers to develop their research and educational programs.

“CAREER awards support exceptionally promising college and university junior faculty who are committed to the integration of research and education,” says NSF Director Rita Colwell. "We recognize these faculty members, new in their careers, as most likely to become the academic leaders of the 21st Century."

The CAREER Award is the highest honor bestowed by the U.S. government to outstanding scientists and engineers in the early stages of their independent research careers. Awards range from $200,000 to $500,000 for a period of four to five years.

CANCER RESEARCH GRANT

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Dr. Wilder-Smith’s project was one of seventeen research programs (newsbriefs continued on p. 8)
(cont’d from page 7)

funded by the CRFA (Alexandria, VA) as part of its Innovative Research Program for 2000 (see “Dental Program Earns New Funding” on page 7 for more on cancer detection via laser excitation and fluorescence).

The CRFA is a non-profit health foundation whose mission is the prevention of cancer through research and education. Since its inception in 1985, the CRFA has provided more than $42.1 million to over 200 scientists working in the field of cancer prevention and treatment.

MAJOR FUNDING FOR ODT

Zhongping Chen, Ph.D., Assistant Professor of Surgery, has received new funding from the National Institutes of Health (NIH) for his work on novel techniques for optical imaging.

The four-year award, worth more than $1 million, will support Dr. Chen’s research on Optical Doppler Tomography (ODT), a light-based imaging modality which gives clinicians a high-resolution glimpse of sub-dermal tissue physiology and can simultaneously provide functional information such as tumor vasculature (for more on ODT and its applications for medicine, see research update on page 4).