LASER
BECKMAN LASER INSTITUTE

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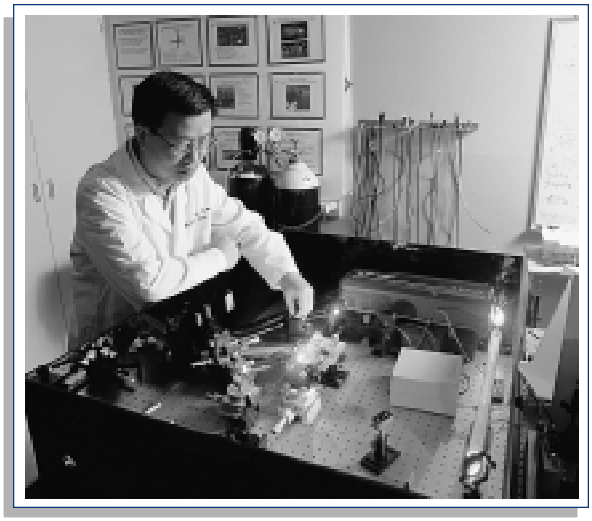
Spring 1999

Whitaker Grants $3 Million Award



Institute Assistant Professor Zhongping Chen has engineered a biomedical device to gauge subsurface blood flow.

The Whitaker Foundation recently granted UCI a $3 million Development Award to launch a nationally-recognized program in biomedical engineering.

"We were impressed," said Peter Katona, Whitaker Foundation president of biomedical engineering programs, "by the scope of UCI's goals and the plans for achieving them. The prospect for building an influential biomedical engineering program is excellent."

BLI Director Michael Berns, Ph.D., who also co-directs the UCI Biomedical Engineering Center, says UCI is honored to be chosen for a Development Award.

"This is an exciting opportunity," Berns says, "for UCI and the Beckman Laser Institute to play a major role in shaping biomedical engineering in the 21st century."

UCI's Development Award is only the 11th such award granted by Whitaker in the past 10 years.

The four-year award will support biomedical engineering research already taking place at the College of Medicine, the Schools of Engineering, Biological Sciences and Physical Sciences, and at the Beckman Laser Institute.

Research will build on UCI's strengths in biophotonics, biomedical nanoscale systems, and biomedical computation. Biophotonics use light to make diagnostic instruments and therapeutic devices for cancer, heart disease and other diseases; nanoscale systems use computer chips and tiny mechanical robots to monitor and manipulate body functions; computation employs computers to identify genes, improve medical imaging, and model light transport through tissue.

Whitaker funding also will help to equip core technology development labs, to fund undergraduates, graduate students and postdoctoral researchers, and to recruit as many as 12 new faculty.

The impact of the award will be felt by students on many levels. New biomedical engineering coursework leading to an undergraduate minor will be offered in the 1999-2000 school year.

"Our intent is to offer full undergraduate and graduate programs by 2001," says Steve George, M.D., Ph.D., assistant professor and biomedical engineering program co-director.

Talks also are underway at the School of Engineering about the prospect of forming an academic Department of Biomedical Engineering in the future.

The Whitaker Foundation, based in Rosslyn, Va., was established after the death of Uncas A. Whitaker, founder of AMP, the world's largest manufacturer of electrical connection devices. The 24-year-old foundation plans to give away its $430 million endowment by the end of 2006. ■

Institute Scientists Win Kudos

Professor To Chair Conference

Associate Director J. Stuart Nelson, M.D., Ph.D., was elected chairman of the Gordon Research Conference on "Lasers in Medicine and Biology" to be held June 11-16, 2000.

The Gordon Research Conferences promote discussions of leading-edge research in the biological, chemical and physical sciences.

Editor Appointed

Bruce Tromberg, Ph.D., associate professor at the Beckman Laser Institute and director of the Laser Microbeam and Medical Program, was named editor-in-chief of the *Journal of Biomedical Optics*.

Published quarterly by the International Society for Optical Engineering, the journal features peer-reviewed papers on the use of optical technologies in medicine and biology.

Scientist Wins NIH Grant

Assistant Professor Brian Wong, M.D., recently was honored with a Mentored Clinical Scientist Development Award from the National Institutes of Health (NIH).

The $550,000 grant will fund Wong's ongoing study of laser reshaping of cartilage. Although cartilage is widely used in reconstructive surgery, it is not always available in the right size. The five-year award will help Wong develop a method to reshape cartilage rapidly and safely.

Heart Grant Awarded

The American Heart Association has awarded Assistant Professor Vickie J. LaMorte, Ph.D., a four-year research grant. LaMorte will use the $260,000 award to study sterol regulatory binding proteins, the transcription factor proteins important in cholesterol regulation and, ultimately, coronary heart disease.

NIH Renews Grant

The NIH awarded Principal Investigator (PI) Michael Berns, Ph.D., and co-PI Yona Tadir, M.D., $1.3 million to continue research on photodynamic therapy. The four-year renewal will support ongoing basic and clinical research that may one day yield effective treatments for cervical disease and ovarian cancer.

Fulbright Selects BLI Scientist

Tuan Pham, a medical and doctoral student working in Associate Professor Tromberg's research group, was chosen for a J. William Fulbright Foreign Scholarship. The scholarship will fund 10 months of research at Lund University Laser Medical Centre in Sweden beginning in August.

While in Sweden, Pham will study quantitative tissue optical spectroscopy using ultra-fast, white light pulses. He plans to measure tissue absorption and scattering over a wide range of wavelengths. By using many wavelengths, Pham hopes that it will be easier to differentiate normal tissue from tumor tissue. ■

Arnold Beckman: A Scientific Life and Legacy

As Dr. Arnold Beckman turns 99, it seems appropriate to take a few moments to reflect on the life of this great man.

Throughout the course of his life, honors and awards have been heaped on Dr. Beckman (they keep coming—and rightly so). In fact, he recently was awarded the 1999 Public Welfare Medal by the National Academy of Sciences in Washington, D.C. I consider him one of the greatest philanthropists of our time, as do many others.

The Beckman Foundation

Dr. Beckman, through the Arnold and Mabel Beckman Foundation, has given away approximately $300 million to various scientific programs.

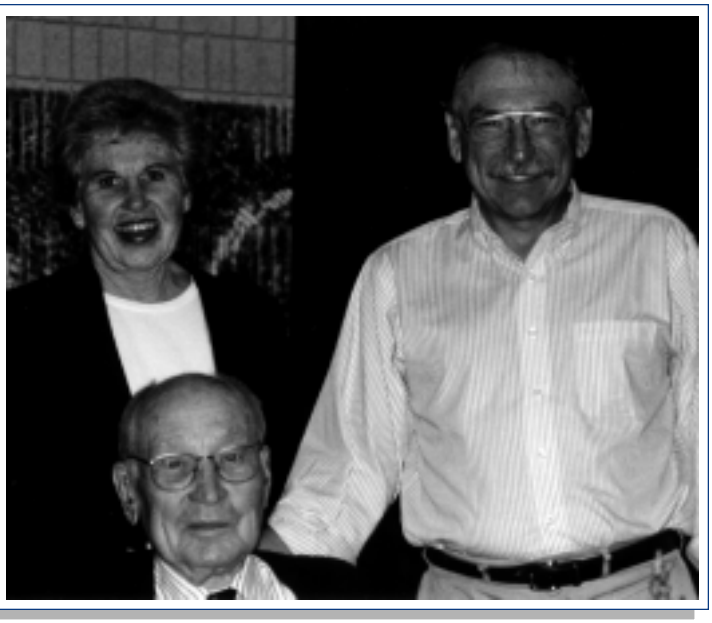
This Foundation, in addition to providing research support to the Beckman Laser Institute, also funds the Beckman centers at the California Institute of Technology, the University of Illinois, Urbana-Champaign, City of Hope Hospital and Medical Center, and Stanford University.

The Foundation also supports the country's brightest young scientists through the Beckman Young Investigator (BYI) awards. Since 1991, 128 young faculty have received BYI funding, including our own Dr. Nancy Allbritton, whose research is featured on page 5.

In 1997, the Foundation also initiated the Beckman Scholars Program to recognize outstanding undergraduate students in chemistry and biological sciences. So far, students at 36 universities have received this award.

The scientists funded through the Beckman Scholars Program and BYI awards, and the research underway at the five Beckman institutes and centers, bode well for the future of science in the U.S.

The wisdom of Dr. Beckman is not only manifest in his generous support of science and scientists but also (and perhaps more importantly) in his decision to continue the Beckman Foundation into perpetuity.



Dr. Beckman and his daughter Pat celebrated his 99th birthday with Dr. Berns, scientists and staff at the Beckman Laser Institute.

Science Is Its Mission

Ten years ago, Dr. Beckman revised the Foundation's mission to include "preserving and enhancing the capital assets and distributing revenue to support leading-edge research in the fields of chemistry and the life sciences, broadly interpreted, and particularly to foster the invention of methods, instruments and materials that open up new avenues of research and applications in these disciplines and related sciences."

The disciplines that the Foundation targets are those around which Dr. Beckman's company, Beckman Instruments (now Beckman Coulter), flourished. Chemistry and life sciences tantalized (and still do) his curiosity. It is thrilling to still see the twinkle in his eyes when he listens to young scientists describe their newest research.

A Lasting Scientific Legacy

Because of his vision and through the legacy of his Foundation (comprised of family and trusted friends), Dr. Beckman will continue to be a driving force in science in the U.S. and, indeed, the world.

Thank you Dr. Beckman for what you have done for science in this century and for the impact you will have on science in the next.

Michael Berns

Editor's Note: This tribute to Dr. Beckman was written on April 10, 1999, the occasion of his 99th birthday.

Clinical Advance Speeds Healing

New research by two Beckman Laser Institute clinicians may reduce the healing time after full-face laser skin resurfacing and set a new standard for treatment.

A two-year clinical study of 91 patients who underwent full-face laser skin resurfacing showed that those prescribed fluconazole, an antifungal medication, healed three days faster than patients treated with the standard drug regime.

On average, the top layer of skin, or epithelium, of patients on fluconazole healed seven or eight days after laser treatment.

Howard Conn, M.D., UCI Chief of Ocular Plastic Surgery, and Vandana Nanda, M.D., UCI Associate Clinical Professor, recently presented these findings at the annual meeting of the American Society for Laser Medicine and Surgery.

Laser Skin Resurfacing

Laser skin resurfacing, a popular treatment for softening the appearance of wrinkles and scars, works by removing the epithelial layer. In a response similar to that following a second-degree burn, the skin heals, regrowing a new epithelial layer. As an added benefit, the heat produced by the laser is thought to shrink collagen, effectively tightening the new epithelium.

Laser skin resurfacing is less destructive and offers more favorable results than chemical peels or dermabrasion.

Improving Treatment

Although the treatment is safe and effective, Dr. Conn noticed that patients who underwent intensive full-face resurfacing with the CO_2 laser did not heal as quickly as expected.

Laser skin resurfacing, before and after treatment.

"Patients often developed areas of redness and crusting starting three days after surgery and lasting for several days," he explains. "Their skin exhibited symptoms of infection even though the patients were prescribed the appropriate regime of antibiotics."

Healing after skin resurfacing depends on such factors as the type of laser used, post-operative skin care, and the kinds of antibiotics prescribed.

Standard medications currently prescribed include daily dosages of Cephalexin and Ciprofloxacin, both antibacterial agents, for a week after surgery. Three days before surgery patients also begin daily dosages of Acylclovir, an antiviral drug, that continue for 8 days after laser treatment.

Although it wasn't part of the standard treatment regimen, Dr. Nanda noticed that fluconazole, an antifungal medication, seemed surprisingly effective against bacterial infection.

Research published in the *Journal of Trauma* noted that fluconazole actually enhanced the ability of neutrophils, the natural bacteria-fighters in all of us, to battle infection.

Starting in October 1996, Drs. Nanda and Conn prescribed the standard regime plus fluconazole to selected full-face resurfacing patients.

"We prescribed fluconazole only to patients who underwent at least two passes of laser treatment at a 300 mJ intensity," Dr. Nanda says. "We found that the delayed re-epithelialization had occurred primarily at this treatment intensity."

Patients treated with only one "pass" of the laser, or at an intensity less than 300 mJ, were excluded from the study group.

Drug Yields Results

The results so far have been promising. Ninety-five percent of patients treated with fluconazole healed within nine days. Only 53 percent of patients on the standard regime healed that quickly.

Not surprisingly, this research generated quite a bit of interest at the recent laser medicine conference. Both clinicians hope that the information will benefit patients nationwide.

If you would like more information about laser skin resurfacing, call (949) 824-7980. ■

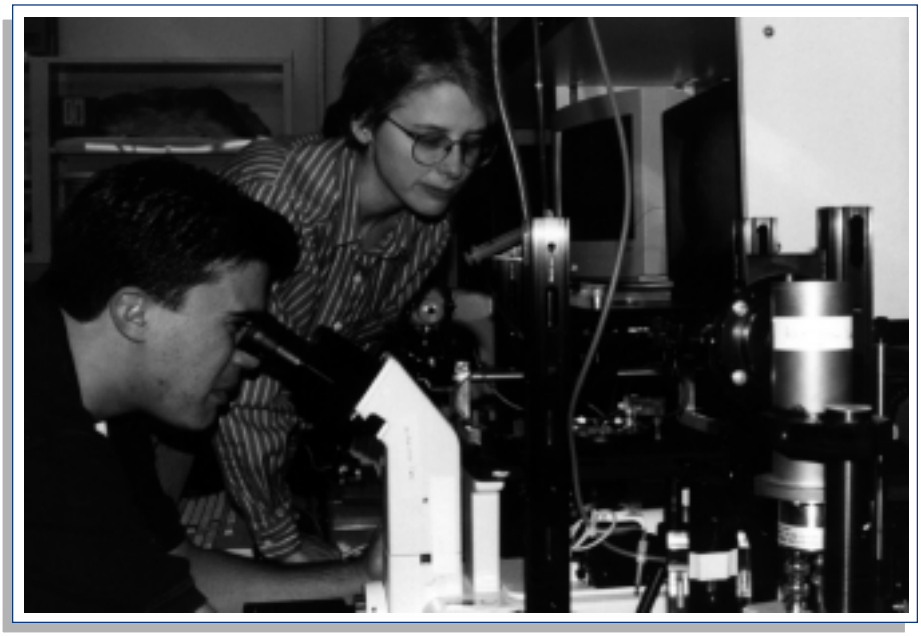
LMS Lights the Way

When your car won't start, you pop the hood to find out what's wrong.

Wouldn't it be nice to do the same with cells?

Fortunately, a new device now makes "popping the hood" of a cell possible. The laser micropipette system (LMS), developed through a collaboration between scientists at the Beckman Laser Institute and the College of Medicine, allows them to stop a cell's activities in less than a millisecond and analyze what's inside.

"It's a whole new way to look at what is happening in the cell," says LMS-developer Nancy Allbritton, M.D., Ph.D., assistant professor of physiology and biophysics.



Assistant Professor Allbritton and graduate student Joe Soughayer test the LMS.

Cell Signaling

What happens inside a cell has been a longtime interest of Allbritton's. While pursuing a doctoral degree at the Massachusetts Institute of Technology, she started investigating the way cells "signal" important functions like growth and death

"We know so little about cell signaling," Allbritton says, "yet it controls everything that happens to us."

Allbritton's early research focused on capillary electrophoresis-based methods for cellular analysis. After a postdoctoral fellowship at Stanford, she was recruited to UCI in 1994. An award the next year from the Beckman Young Investigator program helped to support her continuing investigation of the mechanisms of cell signaling.

The advent of LMS happened a few years later during a chance conversation between Allbritton and Institute Associate Professor Bruce Tromberg, Ph.D.

"Back then," Allbritton explains, "I had an idea about how to analyze cell signaling, but no idea about how to stop cellular activity quickly enough."

Then Tromberg told her about laser tweezers and scissors.

Laser tweezers and scissors are tools available at only a few research centers, including the Institute. The "tweezer" is actually a laser beam with enough internal force to grasp a cell, or a structure inside a cell, without damaging it. The "scissor"—also a laser—cuts or ablates the cell.

Thanks to early research by Director Michael Berns, Ph.D., Institute researchers have used lasers to hold, cut and ablate cells for over a decade.

"With laser scissors and tweezers," Tromberg says, "we had a way of freezing cell activity. Nancy had a way of evaluating the cell's contents. It was a natural collaboration."

Allbritton agrees, adding, "One of the reasons I came to UCI was to collaborate with the folks at the Beckman Laser Institute."

Collaboration Leads To LMS

Allbritton and her colleagues, including Assistant Professor Chris Sims, M.D., and Postdoctoral Fellow Gavin Meredith, Ph.D., began developing LMS in March, 1997. It is now operational, although the scientists continue to make improvements.

Allbritton calls its prospects bright. "LMS may eventually help us analyze cancer cells and perhaps understand the intracellular activities that trigger cancer," she says. ■

Variety Is the Spice of…Work?

In this fast-paced, frenetic world, few can claim to have worked for the same employer for 27 years. But then most employees aren't Elaine Kato. It's not that she's opposed to change. It's just that when she finds something she likes—the Beckman Laser Institute, for example—she sticks with it.

Her "stick-to-itiveness" also extends to her personal life. Consider that she has been married to Howard Kato for 28 years. She's had the same best friend since 1973 and has lived in the same house since 1979.

` But staying power, Elaine says, doesn't explain why she's still at BLI.

"This job has been so different from my training in the humanities," she says. "I took very few science classes in college, so it's been interesting to learn about medicine and science."

Elaine has worn many hats during her time at BLI—from editing Dr. Berns' first book to coordinating laser courses. After the birth of her son Dylan, now 18, she worked at home typing grants. She's now back in the office three days a week computerizing patient records, among other things.

"I know a little of everything, but not a lot of anything," she says with a laugh.

In the end, maybe the variety of her assignments has been the key to her tenure at BLI. ■

Elaine Kato

Institute Contributors and Partners

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PUBLICATIONS

Michael Berns, Ph.D., published "Human Corneal Ablation Threshold Using the 193-nm ArF Excimer Laser" in *Invest. Ophthalmol. Vis. Sci.*

Yona Tadir, M.D., published "Intrauterine Light Probe for Photodynamic Therapy" in *Obstetrics Gynecol*.

Bruce Achauer, M.D., published "Intralesional Photocoagulation of Periorbital Hemangiomas" in *Plastic Reconstructive Surgery*.

Johannes de Boer, Ph.D., published "Determination of the Depth Resolved Stokes Parameters of Light Backscattered from Turbid Media by use of Polarization-sensitive Optical Coherence Tomography" in *Optics Letters.*

Boris Majaron, Ph.D., published "Calculation of Crater Shape in Pulsed Laser Ablation of Hard Tissues" in *Lasers Surg. Med.*

Rene Hornung, M.D., published "Systemic Application of Photosensitizers in the Chick Chorioallantoic Membrane (CAM) Model: Photodynamic Response of CAM Vessels and ALA Uptake Kinetics by Transplantable Tumors" in the *J. Photochem. Photobio. B: Biology.*

Marie J. Hammer-Wilson, M.S., published "Photodynamic Activity of Lutetium-Texaphyrin in a Mouse Tumor System" in *Lasers Surg. Med.*

Xunbin Wei, Ph.D. candidate, published "Minimum Number of Receptors and Spatial Requirements for T cell Activation Studied with an Optical Trap and Calcium Imaging" in *Proc. Int. Soc. Photo-opt. Eng.*, and "Cell Viability and DNA Denaturation Measurements by Two-Photon Fluorescence Excitation in CW Al:GaAs Diode Laser Optical Traps" in the *J. Biomed. Optics.*

PRESENTATIONS

Howard Conn, M.D., and **Vandana Nanda, M.D.**, presented "Prophylactic Fluconazole Promotes Re-epithelialization in Full-face Carbon Dioxide Laser Skin Resurfacing" at the meeting of the American Society for Laser Medicine and Surgery (ASLMS).

Petra Wilder-Smith, Ph.D., D.D.S., presented "Laser-induced Fluorescence for Detection and Diagnosis of Oral Malignancy" to the International Association for Dental Research.

Hong Liang, Ph.D., presented "Cell Surgery and Manipulation by Laser Scissors and Laser Tweezers" at the University of Hong Kong.

George Peavy, D.V.M., presented "Influence of Wavelength and Pulse Duration on Bone Ablation Using an FEL Between 2.9 and 9.3 μm" to the International Society for Optical Engineering (SPIE).

Boris Majaron, Ph.D., presented "Thermo-mechanical Laser Ablation of Hard Dental Tissues" to SPIE.

Xunbin Wei, Ph.D. candidate, presented "Minimum Number of Receptors and Spatial Requirements for T cell Activation Studied with an Optical Trap and Calcium Imaging" to SPIE.

Joon Y. Choi presented "Thermal, Mechanical, Optical and Morphological Changes in Bovine Nucleus Pulposus Induced by Nd:YAG Laser-Mediated Heating" at the ASLMS meeting.

NOTABLES

Petra Wilder-Smith, Ph.D., D.D.S., was awarded an NIH/NCI Phase 2 SBIR for oral cancer detection.

Vickie LaMorte, Ph.D., won a UCI Faculty Career Development Award.

Vasan Venugopalan, Sc.D., was named Assistant Professor in the Department of Chemical and Biochemical Engineering and Materials Science. He also was awarded a faculty research grant from the College of Medicine Committee on Research.

Johannes de Boer, Ph.D., was promoted to Assistant Professor and also was awarded a grant from the College of Medicine Committee on Research.

Tuan Pham and **Shyam Srinivas** both passed their Ph.D. qualifying exams.

Loretta Sparks joined the Institute as Personnel/Payroll Manager.

Ciria Ventura is the Institute's new Purchasing Manager.

Albert Cerussi, Ph.D., joined the Institute as a Postdoctoral Researcher.

Joon Y. Choi was awarded a 1999 Joel Noe Travel grant.

Amir M. Karamzadeh was awarded an Alpha Omega Alpha Fellowship.

Natalie Boghosian and **Nicolle Miller** were awarded UCI undergraduate research fellowships. **Linh Nguy** was awarded a student travel grant.

NEWSBRIEFS

(continued from pg. 2)

Incubator Expansion Complete

The Photonic Incubator expansion will be ready for occupancy this summer.

"This new space will allow us to work even more closely with our corporate partners," says Institute Director Michael Berns. "It will also create an environment where we can translate much of our basic research into applications that directly benefit human health."

The expansion adds approximately 10,000 square feet. The new space includes four applications labs for developing and prototyping new medical devices, a future operating room, and office and conference space that will be shared by scientists and corporate partners.

The project was started with a $1 million grant from the Economic Development Administration.

Generous donors, including the Beckman Family Trust, the Hester Family Foundation, as well as many members of the BLI Support Group, also funded the expansion. ■

The Photonic Incubator will facilitate the transfer of technology from the public sector to the private sector.

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