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Winter 1998

## Biomedical Program Moves Forward

UCI faculty recently submitted a proposal to the Whitaker Foundation to establish a biomedical engineering program.

The \$3 million proposal, if funded, will accelerate the development of a biomedical engineering center and, ultimately, a full department. The new, interdisciplinary center will span many existing departments and programs.

Research will focus on biophotonics,

biomedical nanoscale systems, and biomedical computational technologies. Much of this work currently occurs at BLI, the School of Engineering, the College of Medicine, the Department of Information and Computer Science, and at the Schools of Biological and Physical Sciences.

"The Whitaker proposal would consolidate and amplify these efforts," explains Institute Director Michael Berns, Ph.D. He and Assistant Engineering Professor Steve George, M.D., Ph.D., initially would head the program.

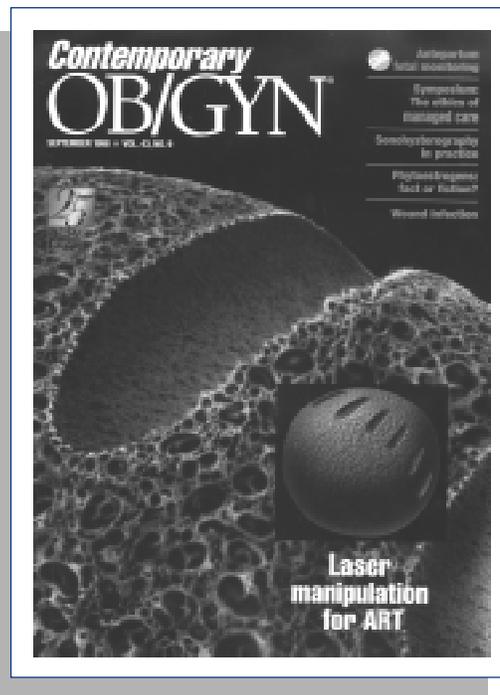
The department would include undergraduate and graduate degree programs and 12 new tenure track faculty positions. An undergraduate minor could be available by fall 1999.

Dr. Berns says the proposal builds on Whitaker-funded research taking place campuswide. In fact, BLI's own Drs. Nelson, Tromberg and Chen, along with Dr. George, are Whitaker recipients.

Whether the foundation funds it or not, Dr. Berns is upbeat about the biomedical program's prospects.

"We hope Whitaker will approve our proposal," he says, "but the campus will move forward regardless. Simply preparing the proposal has brought faculty members together and has helped to define the program," he notes.

Foundation representatives have scheduled a peer-reviewed site visit on campus for mid-December. ■



Dr. Yona Tadir's article recently was featured on the cover of Contemporary OB/GYN.

## Newsbriefs

### SCIENTIST MERITS COVER STORY

An article by BLI faculty member Yona Tadir, M.D., professor of gynecology at UCI, recently was featured on the cover of *Contemporary OB/GYN*.

In "Ten Years of Laser-assisted Gamete and Embryo Manipulation," Dr.

Tadir discussed the on-going impact of laser technology on assisted reproduction.

He noted how reproductive specialists employ lasers to trap and manipulate sperm. They even use lasers to drill holes in the zona pellucida of the em-

(Continued on pg. 8)

## Since the Beginning

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

Having recently assembled an account of the founding of the Beckman Laser Institute for the new UCI Chancellor, Ralph Cicerone, I thought our history would be of interest to others.

### The BLIMC's Inception

The idea of an interdisciplinary research and clinical program under one roof and focused around the use of light (photons generated from laser systems) germinated as a result of three things that occurred in 1980 and early 1981.

First, an award was received from the National Institutes of Health (NIH) to establish the Laser Microbeam Program (LAMP) as a national biotechnology resource center at UC Irvine.

Second, Arnold O. Beckman, then CEO and Chairman of Beckman Instruments, visited an open house at UCI to see the LAMP facility in operation.

Third, the LAMP program was expanded to include translational and clinical components in collaboration with the UCI Department of Surgery on the use of lasers and light-activated drugs for the treatment and diagnosis of cancer (photodynamic therapy: PDT). This new clinical-based program was funded by the NIH as a combined basic science and clinical study.

### A Proposal to Arnold Beckman

As a result of the above three occurrences, Brian Demsey, my friend and an original BLIMC board member, and I developed a business and programmatic plan to show to Arnold Beckman that proposed a "Laser Research Clinic."

The 19-page proposal was pre-

sented to him in February 1982.

This document was the first written plan that described an interdisciplinary laser research medical clinic that would provide: "(1) the best state-of-the-art laser and accessory instrumentation, (2) a team of laser technological and medical experts second to none, and (3) basic and applied clinical laser research to support and augment the delivery of laser therapy."

The proposal was purposely vague with respect to the general organization framework. At that time, it was not clear where the money would come from to fund the facility, and whether the facility would be a not-for-profit, a for-profit, or a combination of both. In fact, one prominent local businessman wrote to Chancellor Daniel Aldrich: "One option is to develop such a clinic in association with the University of California. I would like to know what incentives the University could provide if I were to raise the capital funds for such a clinic."

A formal letter and draft prospectus was sent to Arnold Beckman on June 30, 1981, requesting \$2.5 million for the establishment of a \$5 million laser research clinic at UCI as an extension of the LAMP program. His reply on July 7, 1981, was to postpone the decision while a variety of issues concerning the future of the medical school and hospital facilities were be-



*Arnold Beckman and Michael Berns in 1991.*

ing discussed between the community and the university.

### A Non-profit Formed

After numerous meetings and discussions with UCI officials, Arnold Beckman decided to fund the establishment of the Beckman Laser Institute and Medical Clinic (BLIMC). It was envisioned as a separate California 501(c)3 non-profit corporation with its own board of directors. The Board's primary, though not exclusive, purposes were: (1) to raise money, (2) to manage the money with respect to investment and programmatic allocation, and (3) to provide advice to the university on operation of the program. A "Statement of Principles," signed on August 29, 1984, by Arnold Beckman and Chancellor Aldrich, was the BLIMC's culminating, seminal document. Construction of the BLIMC started in 1984. Our doors opened in June 1986.

Since that time, almost 40,000 patients have been seen at the BLIMC, \$32 million has been raised in private donations, and over \$30 million of federal research funding has been awarded to the BLIMC faculty. ■

## Tattoo Removal Can Change Lives

Angela\* joined the Monrovia gang at 12. She was tattooed for the first time at 15. By 18, six amateur and professional tattoos marked her wrist, finger, chest, ankle and back. The largest is almost seven inches wide; the smallest, three black dots, means “my crazy life” to other gang members.

Angela tattooed the name of her boyfriend, a fellow gangbanger, on the inside edge of her finger. She said peer pressure kept her in the gang. After her boyfriend held a gun to her head and beat her repeatedly, Angela wanted out.

“I feared for my life everyday,” she says. “I was going nowhere.”

Almost two years ago, Angela became an informant for the Monrovia Police Department and turned in her boyfriend. The police have him in custody for three shootings.

“Turning in her boyfriend was her way of saying she was done with the gang,” says Officer William R. Couch, Monrovia Youth Services Officer.

The 18-year veteran remembers meeting 10-year-old Angela for the first time in a D.A.R.E. class.

“Maybe D.A.R.E. didn’t keep her out of the gang,” he says, “but when she wanted to change her life, she knew our program was there for her.”

While “mending lives” is his goal, the youth services officer is selective about whom he will help.

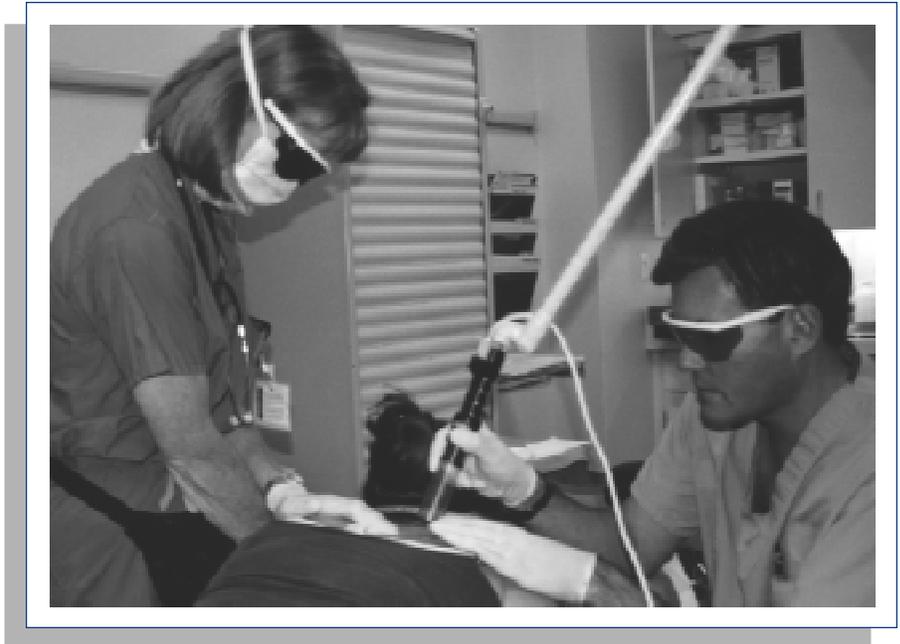
“First, they have to convince us they want out of the gang,” he explains. A personal essay and school records also are required.

Angela wrote to Officer Couch describing how she had changed her life. She was living in a domestic violence shelter and seeking counseling. She was working, planned to enroll in community college, and dreamed of becoming a police officer like him.

She asked for help removing the marks of her former life—her tattoos.

“I used to think they were cool,”

\* Not her real name



*Dr. Nelson treats Angela's tattoos with the YAG laser.*

Angela says. “Now, they’re embarrassing.”

But aesthetics, Officer Couch points out, aren’t why he is helping her. “Members of her former gang or a rival gang *will* attack her if they see those tattoos,” he says.

He contacted Institute Associate Director J. Stuart Nelson, M.D., Ph.D. Dr. Nelson, along with other BLI physicians, currently volunteers his time removing the tattoos of juveniles from the Orange County Probation Department.

To date, Dr. Nelson has treated Angela’s tattoos three times. The ones on her finger and wrist are almost invisible. Dr. Nelson says more sessions are needed, especially for the black tattoo on her back.

Under normal circumstances, Angela’s laser therapy would cost thousands. “Few physicians,” notes Institute Director Michael Berns, Ph.D., “are as giving of their time as Dr. Nelson. We truly need outside support in order to continue treating

and rehabilitating kids like Angela,” he explains.

Help, hopefully, will be forthcoming from the David and Lucile Packard Foundation. The Institute’s recent proposal to the Foundation would partially fund tattoo removal and counseling.

“We want to attend to the psychological and social needs of these youths, along with removing their tattoos,” says Dr. Berns.

“Many former gang members aren’t as fortunate as Angela,” he adds. “They may not have access to the rehabilitation necessary to help them get back on their feet.”

The program, as Dr. Berns describes it, would rely on a network of community activists like Officer Couch. Reformed gang members would be referred to the Institute’s Surgery Laser Clinic for treatment.

For Officer Couch, the thought of such a program elicits a mixture of relief and chagrin. “I too easily can fill the waiting room,” he says. ■

## Eggs Prove A Model Research Tool

Can eggs make more than a good omelette? At the Institute, eggs provide an ideal *in vivo* model for laser research.

### The CAM and PDT

Sol Kimel, Ph.D., a visiting chemist from the Technion Institute of Technology in Israel, introduced the egg—chick chorioallantoic membrane (CAM) to be precise—to BLI researchers a few years ago. Since then, he and BLI scientists have grown tumors on it to test photodynamic therapy (PDT).

PDT, a combination of photosensitizing drug and laser light, selectively destroys tumor tissue. It works, in part, by destroying the blood vessels that feed the tumor. Research by the 1998 Nobel Prize winners in medicine sheds light on the PDT process.

The Nobel recipients discovered that nitric oxide (NO) signals the endothelium inside vessels to dilate, thereby increasing blood flow. In PDT, the photo-

sensitizer creates free radicals that counteract the NO, thereby constricting the vessels.

Scientists hope the CAM will provide key information on the amount of light and photosensitizer needed to “kill” the vessels—and the tumor.

“In the future,” Kimel notes, “it may be possible to harvest a few tumor cells from a patient and grow those cells on the CAM.” Researchers then would use the CAM tumor to develop the best treatment protocol for the patient.

“Ultimately, this model could help determine PDT parameters for each patient,” Kimel explains.

### An Imaging Model

PDT aside, the CAM also is aiding imaging research.

For Wim Verkruijse, Ph.D., a postdoctoral fellow from the Netherlands, the CAM serves as an *in vivo* model to test pulsed-photothermal radiometry (PPTR).



A human tumor growing on the CAM.

An imaging method, PPTR uses laser light to induce a temperature increase in vessels. As soon as the laser is removed, heat diffuses out of the vessels and up to the CAM’s surface. By measuring the surface temperature as a function of time, researchers can determine the position of subsurface vessels.

“If the surface temperature rapidly increases, we know it’s a shallow vessel,” Verkruijse explains. “If it increases slowly, the vessel is deep.”

The CAM’s clear membrane also allows researchers to see the vessels, something human epidermis obscures.

“With PPTR, our goal is to improve the treatment of port wine stain birthmarks,” explains Associate Director and collaborator J. Stuart Nelson, M.D., Ph.D. “Knowing the temperature within the target vessel and its depth should help accomplish that goal.”

Included in the PPTR study are postdoctoral fellows Boris Majaron, Ph.D., and Sergey Telenkov, Ph.D.

### Model Originators

Institute Director Michael Berns, Ph.D., says a debt of gratitude is owed the developers of the CAM.

“We have to thank Sol, who brought the CAM to our attention, and BLI scientists Chung-Ho Sun, Lih-Huei Liaw, and Marie Wilson who refined it,” he notes. ■

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#### Beckman Laser Institute News

Nicole Knight

## Candela Offers BLI Technology to the Public

Among the Institute's many corporate partners, laser manufacturer Candela Corporation of Wayland, Massachusetts, stands out as the first to license a technology developed at BLI. Under a recent licensing agreement between UC Irvine, BLI and Candela, companies interested in using the novel dynamic cooling device™ (DCD) now negotiate with Candela for sublicensing rights.

Candela's President and CEO Gerard E. Puorro says the company is pleased to be licensing such an exciting invention. "It is rapidly becoming the industry standard," he says.

Institute Director Michael Berns, Ph.D., agrees. "The cooling device should have a significant impact on the safety and efficacy of a large number of laser procedures," he says.

The DCD™ relies on cryogen to selectively and dynamically cool the surface of the skin during laser treatment. The device minimizes the pain and thermal injury that the laser can sometimes cause without compromising treatment effectiveness. Patients have reported significant reductions in laser therapy discomfort.

Candela already has incorporated the DCD™ into its GentleLASE™ system for hair removal. It also is offered in conjunction with the ScleroPLUS™ and SPTL-1b™ lasers used to treat leg veins, red birthmarks, scars and warts.

The laser-cooling combination will be used primarily by dermatologists and plastic surgeons. Candela also will begin offering the cooling technology to other laser manufacturers for use with their laser systems.

The cooling device originally was invented to improve the treatment of vascular birthmarks in infants and children. Three BLI scientists, J. Stuart Nelson, M.D., Ph.D., Thomas E. Milner, Ph.D., and Lars O. Svaasand, Ph.D., invented the technology with funding from the National Institutes of Health, the Office of Naval Research MFEL program, the Department of Energy, the Whitaker Foundation and the David and Lucile Packard Foundation. It was patented this year.

Candela develops, manufactures and distributes laser and cryosurgical technologies. Since its 1970 beginning, Candela has established markets in the U.S., Europe and Asia, and currently sells its products in over 40 countries. For more information about the company, visit <http://www.clzr.com>. ■

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## Laser Cures Rajah's Limp

**I**nternational Champion Goldleaves Bu's Regal Rajah will have to rest on his laurels. His show days ended when a hamartoma—an abnormal mix of proliferative tissue—grew between the tendons of his left foreleg.

Now, happy that the growth is gone, owner Bea Goldblatt doesn't mind the three-year-old retriever's retirement. "I'm pleased that Dr. Peavy was able to save Rajah's leg," she says. "Some veterinarians had suggested amputation."

Goldblatt, an honorary life member of the Golden Retrievers Club of Los Angeles, first noticed Rajah's limp during field training. Doctors said the vascular growth was compressing the retriever's leg joints and leaking blood between his tendons.

Veterinarians surgically removed the

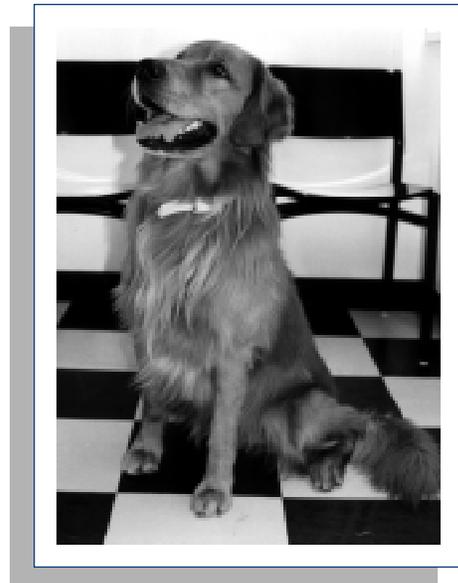
hamartoma twice: July and October 1997. It regrew both times.

That's when amputation was suggested, Goldblatt says. Then she heard about the Beckman Laser Institute and Veterinary Director George Peavy, D.V.M. Through the Veterinary Outreach Program, Dr. Peavy has helped cats, dogs, even iguanas.

Using the CO<sub>2</sub> laser, Dr. Peavy treated Rajah in September 1998. "I vaporized the abnormal tissue more completely and precisely than surgical instruments are able to do," he says.

So far he is pleased with the canine's progress.

As is Rajah's owner. "His limp is barely noticeable now," says Goldblatt. "He riles up the St. Bernards next door just like he used to," she laughs. ■



*Rajah two months after laser surgery.*

## Bruce Tromberg: Renaissance Researcher

**W**hether it's optics, chemistry, basketball, or the works of Primo Levi, the interests of Associate Professor Bruce Tromberg, Ph.D., are as multidisciplinary as the Institute's research.

Some call him a Renaissance man, but the Washington, D.C., native says he's just a product of the 1970s.

"It was a time when scientists began developing rapid, quantitative methods for understanding brain chemistry," he says.

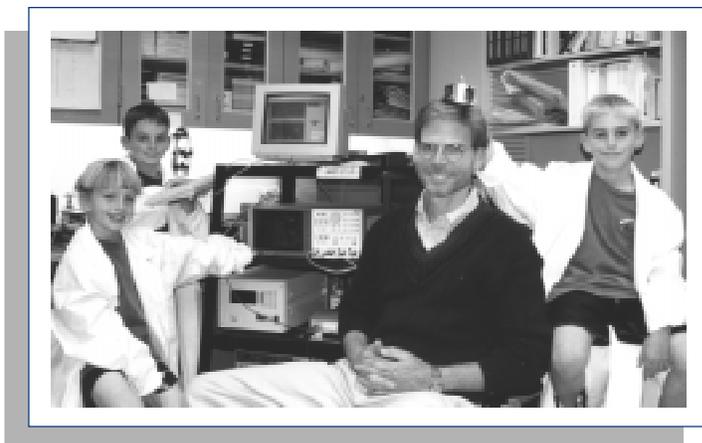
Advances in this emerging field inspired Tromberg to pursue chemistry and psychology degrees at Vanderbilt University. Upon graduation, he worked as a lab technician by day and a middle school counselor by night. After a year, he drifted away from counseling.

"I thought I could do more in quantitative science," Tromberg explains. "I

like to measure things. The key, I learned, is to measure chemistry in its native environment—the body. BLI offered that."

With a Ph.D. in chemistry from the University of Tennessee at Knoxville and experience as a Department of Energy Predoctoral Fellow at the Oak Ridge National Lab, Tromberg joined BLI as the Hewitt

Fellow in 1988. He was promoted to Assistant Professor in 1990 and Associate Professor in 1995. Institute Director Michael Berns, Ph.D., named Tromberg the Laser Microbeam and Medical Pro-



*(left to right) Daniel, Joshua and Matthew help their father, Associate Professor Bruce Tromberg, with photon migration.*

gram (LAMMP) director in 1996.

Tromberg notes that his diverse background comes in handy.

"Visiting researchers are pleasantly surprised that I can converse in German or Hebrew," he says. ■

## PUBLICATIONS

**Yona Tadir, M.D.**, published “Laser Manipulation for ART” on the cover of *Contemporary OB/GYN*.

**Hong Liang, Ph.D.**, published “Subcellular Phototoxicity of Photofrin-II and Lutetium Texaphyrin in Cells *in vitro*” in *Lasers in Medical Science*.

**Petra Wilder-Smith, Ph.D., D.D.S.**, published “Thermal, Microstructural and Physicochemical Effects of Nanosecond Pulsed Nd:YAG Laser Irradiation” in *Lasers in the Life Sciences*, and “Effects of 9.3mm CO<sub>2</sub> Laser on Human Dentin: A Morphological Study Using SEM and CLSM” in *Scanning Microscopy*.

**Matt Brenner, M.D.**, published “The Effect of Lung Volume Reduction Surgery in a Rabbit Model of Bullous Lung Disease” in *Journal of Investigative Surgery*. He also published “Rate of FEV<sub>1</sub> Change Following Lung Volume Reduction Surgery” in *Chest*.

**Zhongping Chen, Ph.D.**, published “Accuracy and Noise in Optical Doppler Tomography Studied by Monte Carlo Simulation” in *Physics in Medicine and Biology*.

**Brian Wong, M.D.**, published “Stress Relaxation of Porcine Septal Cartilage During Nd:YAG (l = 1.32 mm) Laser Irradiation: Mechanical, Optical, and Thermal Responses” in *Journal of Biomedical Optics*.

**John Chen, M.D.**, published “Effect of Lung Volume Reduction on Diffusing Capacity in an Animal Model of Emphysema” in *Journal of Surgical Research*.

**Ledford Powell, M.D.**, published “Changes in Pulmonary Physiology after Lung Volume Reduction Surgery in Rabbits with Moderate and Severe Emphysema” in *Surgical Forum*.

**Johannes de Boer, Ph.D.**, published “Imaging Thermally Damaged Tissue by Polarization Sensitive Optical Coherence Tomography” on the cover of *Op-*

*tics Express*. He published “Determination of the Depth Resolved Stokes Parameters of Light Backscattered from Turbid Media using Polarization Sensitive Optical Coherence Tomography” in *Optics Letters*.

**Marie J. Hammer-Wilson, M.S.**, published “*In vitro* and *in vivo* Comparison of Argon-pumped and Diode Lasers for Photodynamic Therapy using Second Generation Photosensitizers” in *Lasers in Surgery and Medicine*.

## PRESENTATIONS

**Matt Brenner, M.D.**, presented “Survival Following Bilateral Staple Lung Volume Reduction Surgery (LVRS) for Emphysema” at CHEST in Toronto.

**Zhongping Chen, Ph.D.**, presented “Monte Carlo Simulation of Optical Coherence Tomography and Optical Doppler Tomography” at the Third International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing in Claremont, Calif.

**Vickie LaMorte, Ph.D.**, presented “The PML-containing Nuclear Body A New Twist to Understanding Mechanisms of Disease” at the Symposium on Dynamic Organization of Nuclear Function in Cold Spring Harbor, N.Y.

**Vasan Venugopalan, Sc.D.**, co-chaired the session “Laser-Induced Transport in Diagnostic and Therapeutic Laser Applications” and presented “An Improved Diffusion Model for Radiative Transport in Turbid Media” at the International Mechanical Engineering Congress and Exhibition in Anaheim, Calif.

**Brian Wong, M.D.**, presented “Feedback Controlled Laser Mediated Cartilage Reshaping” at the Lasers and Electro-optics Society Meeting in Orlando, Fla. He also hosted the seminar “Laser Mediated Cartilage Reshaping” at the USC School of Engineering.

**Tatiana Krasieva, Ph.D.**, presented the poster “Modern Microscopy: New Tools for a Single Cell Assay” at the Cold

Spring Harbor Symposium.

**John Chen, M.D.**, presented “Survival Following Unilateral Versus Bilateral LVRS for Emphysema” at CHEST.

**Ledford Powell, M.D.**, presented research on LVRS to the American College of Surgeons meeting in Orlando, Fla., at the CHEST Conference, and at the National Nicotine Dependency Conference in Marina del Rey, Calif.

**Dan Serna, M.D.**, presented a poster on LVRS to the American Heart Association in Dallas, Tx.

**Shyam Srinivas, M.D./Ph.D. student**, presented “Determination of Burn Depth by Polarization Sensitive Optical Coherence Tomography” at the OSA Annual Meeting in Baltimore, Md.

**Xunbin Wei, Ph.D. candidate**, presented “Antigen Recognition by T-lymphocytes Studied with an Optical Trap and Calcium Imaging” at Wellman Labs, Harvard Medical School. He presented the poster “Mapping the Polarity and Stimulus Requirements for T-cell Activation” to the 52<sup>nd</sup> Annual Meeting of the Society of General Physiologists.

**Natasha Shah** presented “Multi-Wavelength *in vivo* Measurements of Human Breast Optical Properties Reveal Menopausal-dependent Absorption and Scattering Variations” at the Bios Europe '98 Conference in Stockholm.

## NOTABLES

**Vickie LaMorte, Ph.D.**, was awarded grants from the Chao Family Comprehensive Cancer Center and the American Cancer Society.

**Brian Wong, M.D.**, received the Sir Harold Delf Gillies Research Prize from the American Academy of Facial Plastic and Reconstructive Surgery.

**Shyam Srinivas, M.D./Ph.D. student**, was awarded a Medical Student Research Fellowship from the American Heart Association and an SPIE Educational Scholarship.

## NEWSBRIEFS

(continued from pg. 1)

bryo, assisting its implantation on the uterine wall.

In the article, he said that laser technology will remain an important tool in assisted reproduction.

Dr. Tadir currently leads an international study sponsored by Cell Robotics Inc. of Albuquerque, New Mexico. "One of our goals," he explains, "is defining the laser's role in improving the pregnancy rates of patients 39 and older following *in vitro* fertilization."

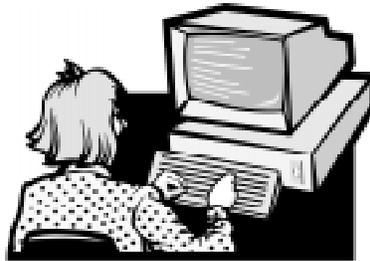
### NEW EMPLOYEES WELCOMED

Whether it's in the research, clinic or administrative areas, new faces abound at the Institute.

Scientist Zifu Wang, Ph.D., joins the Institute after postdoctoral study at the California Institute of Technology in Pasadena. Working with Institute Direc-

tor Michael Berns, Ph.D., Wang is developing new microscopy systems.

Other visiting scientists—Wim Verkruyse, Ph.D., from the University of Amsterdam, and Boris Majaron, Ph.D., from the Jozef Stefan Institute in



Slovenia—are investigating pulsed-photothermal radiometry.

New postdoctoral researcher Shao-Hua "Sean" Xiang, D.Sc., Ph.D., comes to BLI from the Hong Kong University of Science and Technology. Newcomer Qimin Shen, Ph.D., also a researcher, hails from Texas A&M University. Both are working with Assistant Professor

Zhongping Chen, Ph.D., on developing optical Doppler and optical coherence technology.

On the clinic side, operating room technician Sandra Johnson is the latest arrival.

And finally, the administrative department welcomes two employees. Diane Wilson takes on the duties of assistant accounting analyst; Ciria Ventura assumes the role of purchasing assistant.

### SUPPORT GROUP ADDS MEMBER

Marilyn Burton of Newport Beach recently joined the Institute's Support Group.

"Marilyn is a welcome addition to our Support Group," says Erin Miller, Director of Support Group Relations.

A philanthropic organization of over 50 members, the Support Group funds the treatment of indigent children's birthmarks, among others.

Call (949) 824-4111 for more information. ■



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