

BSAC News

AN NSF / INDUSTRY / UNIVERSITY COOPERATIVE RESEARCH CENTER
FOUNDED IN 1986



BSAC celebrates its 15th Anniversary 1986–2001

BSAC has graduated 73 Ph.D.s and 31 M.S. since its founding

BSAC currently has 134 Graduate Student Researchers under ten Directors.

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CITRIS Research Initiative Funded

An ambitious multi-campus research initiative called the Center for Information Technology in the Interest of Society (CITRIS) has been funded by the State of California over the next four years. CITRIS is the fourth project to be funded through the Centers for Information Science and Innovation (CISI) program launched by Governor Gray Davis. The project is expected to raise \$200 million in private funding, with \$100 million in state matching funds. To date, over \$170 million in private funds are committed, largely through the efforts

of Dean of Engineering Richard Newton. UC Berkeley is the lead campus in CITRIS, with computer science professors Randy Katz serving as Director and James Demmel serving as

Chief Scientist and Associate Director. UC Davis, UC Santa Cruz, and the new UC Merced campus in the Central Valley are also partners in CITRIS. More than 100 faculty members in engineering, science, social science, and other disciplines at



Artist's conception of the CITRIS II building, with Cory Hall in the background and Northgate Hall in the foreground.

four UC campuses will collaborate with researchers at more than 20 supporting companies on CITRIS-related research. The CITRIS project aims to create and harness information tech-

nology to tackle society's most critical needs, such as energy efficiency, transportation, earthquake preparedness, health care, and education. Solutions to many of these problems share a common feature: at their core they depend on highly-distributed, reliable, and secure

information systems that can evolve and adapt to radical changes in their environment, delivering information services that adapt to the people and organizations that need them. CITRIS

intends to develop such "Societal-scale Information Systems" (SISs). The Internet and the telephone network are limited, albeit highly successful, SISs. An SIS must easily

(Continued on page 2)

QB3 Center for BioNanotechnology Funded

Bioengineering, Biotechnology and Quantitative Biomedical Research Institute (QB3) by UC San Francisco and UC Berkeley has been funded under Governor Davis's CISI program. This program will help fund to establish the BioNanotechnology Center (BNC) in the first floor of the replacement of Stanley Hall. This laboratory will include process tools for nanolithography and etching for silicon, glass, and polymer substrates. In addition, it will include a tissue

culture laboratory. BSAC Director and Bioengineering Professor Luke Lee, with help from Dr. Bill

Flounders, is planning the layout of this 10,000 sq. ft. laboratory. The replacement of Stanley Hall will increase the size of the science building from 67,500 square feet to 285,000 square feet. Completed in 1952, the ex-



Front view of new Stanley Hall

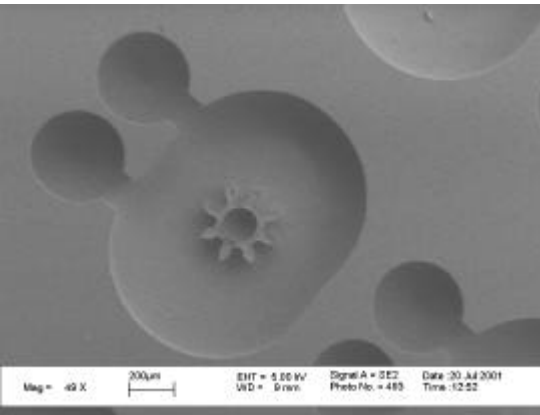
isting Stanley Hall is rated seismically poor and its laboratory and research space is inadequate to meet the needs of modern health sciences research and teaching. The new building will

(Continued on page 2)

Microelectromechanical Rotary Engine Power

The need for improvements in energy density is portable power is urgent, both for military and commercial applications. Addressing this need is the MEMS Rotary Power System Project, led by Prof. Al Pisano of BSAC, which is just getting underway with funding from DARPA MTO. BSAC is teaming with members Harris and Textron Systems to develop a commercially viable autonomous portable power system, based on an integrated power generator and rotary internal combustion engine. The engine will have an energy density of 2300 W-hr/kg with a continuous power output of 30 mW, which represents an order-of-magnitude improvement over

commercial off-the-shelf primary batteries. The power generation device is a SiC and catalyst-coated micro-rotary engine, which is being developed under the MEMS Rotary Internal Combustion Engine project, with Prof. Carlos Fernandez-Pello of Mechanical Engineering as PI. An integrated electric generator utilizing soft ferro-magnetic



MEMS engine rotor housing with spur gear; inlet and exhaust ports are on the left of the housing.

slugs mounted in the engine rotor and coil system is used to convert the mechanical energy of the spinning rotor into electrical power.

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Two New DARPA Programs Start

BSAC Director Roger Howe and Jan Rabaey, Scientific Co-Director of the Berkeley Wireless Research Center (BWRC) are co-PIs of the Integrated Microwatt Transceiver project, which is funded under the NanoMechanical Array Signal Processor (NMA SP) program of DARPA MTO. This project explores new receiver and transmitter architectures for short-range wireless sensor nodes that reduce power consumption by two orders of magnitude, by eliminating the local oscillator at the carrier frequency. High- Q mechanical filter banks are needed, which enable down-conversion of the signal information by sub-sampling. Both poly-SiGe (Prof. Tsu-Jae King) and poly-SiC (Prof. Roya Maboudian) MEMS technologies are funded under this program, with the latter being attractive for frequencies above 2 GHz. A scanning tunneling acoustic microscope will be developed for imaging these RF resonators by Prof. Jeff Bokor's group. Prof. Al Pisano will help develop the resonator design and an option may be exercised to fund Prof. Steve Smith on integration of poly-SiC filter banks using fluidic self-assembly processes.

logical, and educational infrastructure in the area of nanoscale probes with microsystem interfaces for biological applications. The focus will be on creating, integrating and transferring interdisciplinary knowledge in the areas of nanoscale Bio-Polymer-Opto-Electro-Mechanical-Systems (Nano-BioPOEMS).

Director Norman Tien currently has seven students from Cornell University working on BSAC research

CITRIS Funded

(Continued from page 1)

and naturally integrate devices, ranging from tiny sensors and actuators to hand-held information appliances, workstations, and room-sized cluster supercomputers. Such devices must be connected by short-range wireless networks as well as by very high-bandwidth, long-haul optical backbones. Data and services must be secure, reliable, and high-performance, even if part of the system is down, disconnected, under repair, or under attack. The SIS must configure, install, diagnose, maintain, and improve itself — this applies especially to the vast numbers of sensors that will be cheap, widely dispersed, and difficult to access. Clearly, BSAC research in autonomous microsystems, especially Director Kris Pister's projects in wireless sensor networks ("smart dust") has been central in formulating the vision of CITRIS.

Founding Corporate Members

of CITRIS include BroadVision, Ericsson, Hewlett-Packard, IBM, Infineon, Intel, Marvell Semiconductor, Microsoft, Nortel Networks, ST Microelectronics, and Sun Microsystems.

The CITRIS project will fund a new 20,000 sq. ft. silicon Microfabrication Laboratory to be located in an 80,000 sq. ft. new building on the site of old Davis Hall, which is just west of Cory Hall. Initial plans are for this facility, scheduled to become operational in 2004 or 2005, to accommodate both 6" and 8" diameter wafers. This facility, the first major academic silicon lab to be built in the 21st century, will ensure that BSAC researchers have access to state-of-the-art fabrication tools.



Side view of new Stanley Hall

QB3 Funded

(Continued from page 1)

provide facilities for vibration-free laboratories, clean rooms, and high-resolution imaging facilities. It will house faculty and students engaged in new work on such health problems as Alzheimer's disease, cancer, AIDS and spinal-cord injuries. At the Berkeley BNC, the science and technology of nano- & microfabrication is applied to create new devices for basic tools for biological sciences as well as clinical applications: single molecular detection, lab on a chip, genomic, and proteomics. New bioengineering paradigm also requires learning from the nature and ability to create efficient nano- and microscale devices and systems for new drug delivery microsystem, microsurgical tools, and combinatorial pharmacology on a chip with potential to benefit society. The vision of BNC is to develop scientific, techno-

Cynthia Ernest joins BSAC

Cynthia L. Ernest is the new BSAC Administrative Manager. Cynthia grew up in the Bay Area and holds an Associate degree in Fashion Design and later graduated summa cum laude from St. Mary's College with a B.S. in Business Administration & Economics. She continued and graduated first in her class at Golden Gate University with an MBA in International Management.

Prior to coming to ERL in spring 2000, Cynthia worked for 12 years for a private foundation in San Francisco, where she had a variety of different positions reporting to the CFO. Her final position was Administrative & Operations Manager. There she managed annual grant expenditures of \$12 million. Immediately prior to coming to ERL, Cynthia worked as an independent consultant to non-profits and small companies doing database development and small, customized programming projects. Her broad experience in management and grants administration will be valuable in making the BSAC office an efficient, smoothly running machine.

Bill Flounders Joins BSAC and the Microlab

Dr. Bill Flounders has recently joined BSAC as Principal Development Engineer and Microlab Technology Manager. Bill's initial focus will be to help complete the upgrade to 6" diameter wafers, as well as to help in the facilities planning of the new CITRIS silicon lab and the new Bio-Nano Fabrication Laboratory. He will be contributing to research on MEMS processes, especially those involving bioMEMS applications.

Bill received the B.S. in Chemical Engineering from The Johns Hopkins University in 1985 and the Ph.D. in Chemical Engineering from the University of California, Berkeley in 1992. Bill completed a majority of his graduate research in the U.C. Berkeley Microfabrication Laboratory. His dissertation focused upon fabrication of exposed gate field effect transistors for sensor applications and *in situ* monitoring of plasma induced radiation damage to gate insulators.

Bill completed post-doctoral research in immunology at the U.S. Department of Agriculture, Western Regional Research Center in Albany, CA. His research involved immobilization, stabilization and patterning of proteins for biosensor development. From 1996 to 2001, Bill was a Senior Member of Technical Staff at Sandia National Laboratories in Livermore, CA and worked in the Chemical and Radiation Detec-

tion Laboratory. His research was supported by the DOE Office of Nonproliferation Research and Engineering (NN20) and focused upon sensors for detection of chemical and biological warfare agents. Bill was responsible for integration of multiple biological receptors with a single microelectronic transduction platform and adaptation of microelectronic fabrication tools to biochemical processing to enable wafer scale biosensor fabrication.

Bill lives in Berkeley with his wife and two children. He is active in the Berkeley Public Schools Excellence Project (BSEP) and enjoys teaching and sailing at The Presidio Yacht Club.

BSAC Office Reorganizes to Accommodate Growth

The BSAC office in 497 Cory has undergone major changes in both personnel and physical arrangement in recent months. Mariko Yasuda and Elise Allison have moved on. Cynthia Ernest joined BSAC as the new Administrative Manager in July. She supervises a staff of five: two grants administrators, two administrative assistants, and a work-study student. Tom Parsons moved up to take one of the GA positions, with Peggy Kingsley joining in September. These

are the people that will manage the grants by approving expenditures, processing travel reimbursements, signing time cards and tracking spending. For the first six months, Cynthia will be working with the Directors on any new proposals, after which the GAs will take over.

Jessica Archuleta continues as the receptionist that you'll meet when you first enter the BSAC office at 497 Cory Hall. Jessica will assist the directors with academic and administrative assistance as well as some of

the purchasing. She also keeps tabs on the work that all the researchers are doing, updating their publications lists, and keeping track of their dissertations. We are recruiting a second administrative assistant to help primarily with purchasing. With the additional staff, the layout of the office has been changed. For those who remember the layout in years past, you'll find that the main entry is back where it used to be, at the cost of losing our small meeting room.

Degrees Earned

Dubravka Bilic Ph.D
Micromachined Resonators

Wyatt Owen Davis Ph.D
Mechanical Analysis and Design of Vibratory Micromachined Gyroscopes

Ajay Anil Deshmukh Ph.D

Continuous Microfluidic Mixing Using Pulsatile Micropumps

John McCaslin Heck Ph.D

Polycrystalline Silicon Germanium for Fabrication, Release, and Packaging of Microelectromechanical Systems

Nelson Kuan Ph.D
Fluidic Microsystems Fabricated in Epoxy

Sharon Roslyn Oh M.S

Microresonators as Vacuum Gauges

Uthara Srinivasan Ph.D.

Fluidic Self-assembly of Microfabricated Parts to Substrates Using Capillary Forces

Philip Anthony Stupar Ph.D.

Micro-Fabricated Shells for Mechanical and Fluidic Interconnects

Richard Yeh Ph.D.
Surface Micromachined Components for Articulated Micro-robots

Joslyn Nee Ph.D.

Hybrid Surface/Bulk-Micromachining Processes for Scanning Micro-Optical Components

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- Jaewon Chung, Costas P. Grigoropoulos and Ralph Greif, "Capillary Pumped Loop heat spreader for electronics cooling," *Proceedings of 2001 ASME International Mechanical Engineering Congress and Exposition*, November 11-16, 2001, New York, NY.
- Jaewon Chung, Youngshik Shin, Kenneth Petigrew, Peter Chapman, Costas P. Grigoropoulos and Ralph Greif, "Infrared Thermal Velocimetry," *Proceedings of 2001 ASME International Mechanical Engineering Congress and Exposition*, November 11-16, 2001, New York, NY.
- C.W. Chang, T. Budde, H.H. Gatzert, R.S. Muller, "A Magnetically Actuated Scanner for Intravascular Ultrasound Imaging," *MicroElectroMechanical Systems 2001*, 2001 ASME International Mechanical Engineering Congress and Exposition, NY, USA, Nov. 11-16.
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