

research news

Office of the Vice President for Research and Public Service

January 1999 Volume 1 Number 2



The Department of Biomedical Engineering was established jointly at the University by the School of Medicine and the School of Engineering and Applied Science in 1968.

1999 COURIER DEADLINES

Reservation Deadline Delivery Date

No Deliveries in January

January 28	February 1
February 25	March 1
March 30	April 1
April 29	May 3
May 28	June 1
June 29	July 1
July 29	August 2
August 30	September 1
September 29	October 1
October 28	November 1
November 29	December 1

INSIDE

- 2 Time Reversal Asymmetry
- 3 Grants and Awards
- 7 Y2K Work Continues
- 7 Interim Research Support
- 7 Institutional Review Board
- 8 News from Capitol Hill
by Gene Block

WATCH THIS SHOOTING STAR

The Arlington, Virginia-based Whitaker Foundation has recently made a major development award to the University's department of biomedical engineering. A boost of this magnitude can be expected to propel the department to a new level of excellence within the University and nationally, and complements a University-wide effort to develop technology in medicine.

A substantial part of the \$10.5 M. grant will be used to recruit eight new faculty members, to develop state-of-the-art teaching facilities, and to attract outstanding graduate and post-doctoral students to the biomedical engineering program. \$7.5 M. is in the form of a special grant that will go toward the construction of a biomedical engineering and medical science building now in the planning stage with completion expected by July 2002.

Out of a long-term collaboration between engineers and medical scientists, the discipline of biomedical engineering has grown quickly in the last thirty years. The department of biomedical engineering was established jointly at the University of Virginia by the School of Medicine and the School of Engineering and Applied Science in 1968. Both doctoral and masters degrees in biomedical engineering are awarded by the School of Engineering. In 1991, the department of biomedical engineering hosted an annual meeting in Charlottesville for the Biomedical Engineering Society. The theme of the meeting was "Technology for Health" and it was so successful that it has become the national meeting of the biomedical engineering community for scientific exchange and student participation.

This major award complements a University-wide effort to develop technology

in medicine for the Commonwealth of Virginia. Technology in medicine has also been identified as a thrust area for the University's School of Engineering and Applied Science and fits well with the strategic development of translational research in the School of Medicine. To explore the state-wide potential for collaboration, in June 1998 Virginia Tech, Virginia Commonwealth University and U.Va. jointly organized the first conference on the Development of Technology in Medicine.

Within the department, three areas of vascular engineering have been identified for expansion:

- In vivo sensing and characterization of the vascular system through the development of bioinstrumentation and micro-systems technology. Faculty currently working in this area include Jen-shih Lee, Klaus Ley, Milton Adams, Yong I. Kim, Michael Lawrence, Richard Price, William Guilford, Tom Skalak and Brian Duling.
- Target imaging for diagnosis and intervention therapy using new non-invasive imaging methods. Faculty involved in this work include Katherine Ferrara, John Oshinski, James Brookeman, John Mugler and William Walker.
- Gene analysis, design and delivery. Klaus Ley, Brent French and Larry Karns are now working in this area.

We have already demonstrated strength in vascular engineering. According to Jen-Shih Lee, the chair of the department, this award will allow us to fully integrate these three areas for better understanding of the cardiovascular system. We will develop drug and gene delivery to more directly target tumors or diseased tissues, thereby avoiding some of the deleterious effects of current methods of drug delivery on healthy tissue. Breakthroughs in vascular engineering can lead to the development of powerful and more effective therapies for vascular diseases and cancer. ■

LOOKING FOR TIME REVERSAL ASYMMETRY

Searching for asymmetry between matter and antimatter explores the very frontiers of the universe as well as its origin. A team of U.Va. physicists including Brad Cox, Michael Arenton, Gloria Corti, Arthur McManus, and Ken Nelson, together with graduate students Alexander Ledovskoy, Alexander Golossanov, Karla Hagan-Ingram and Valeri Jejer are trawling the oceans of data produced at Fermilab's accelerator in 1996–97. They have found new evidence of a violation of the symmetry of interactions under reversal of the direction of time.

A general theorem of physics known as the CPT theorem posits that in any reaction the simultaneous operation of changing particles to antiparticles (C), mirroring the coordinate system (P) results in a modified reaction that reverses the direction of time (T), which should run at the same rate as the original reaction. If the application of any two of the three operations does not result in a reaction that runs at the same rate, then the third operation must compensate in just the right amount so that overall the CPT theorem is preserved. Previous experiments observed CP (charge-parity) violation and had to infer that there was also a time reversal violation.

Essentially the physicists generate the temperature levels present shortly after the Big Bang (thought to have started the universe) in order to create a huge number of kaons. They study the kaons, and search for time reversal violation in their decays. This phenomenon was first hypothesized to be a necessary condition to explain the existence of our universe, which is dominated by matter with very little antimatter present. It was first developed by Soviet dissident Andrei Sakharov, known as the father of the hydrogen bomb. In 1980 Cronin and Fitch won the Nobel prize for Physics for their observation of CP violation. Only four such observations have been made so far, including the latest work by the U.Va. group.

University of Virginia physicists use the Fermilab facilities outside Chicago to create an intense kaon beam by protons hitting a target. Kaons produced in these collisions travel through the experimental apparatus and then they are analyzed for decays with asymmetric distribution, indicating a violation of time reversal symmetry.

It can be shown that time reversal violation implies that particles and antiparticles behave slightly differently, according to Cox. "We think that in the beginning of the universe there was just enough difference in behavior of particles and antiparticles so that a small excess of particles survived that made it possible for our present universe to exist. This small excess is what makes up the matter of the universe, the stars and galaxies, and everything else that we observe around us."

Through the KTeV (kaons at the Tevatron) experiment conducted at Fermilab, the first direct observations of time-reversal asymmetry were reported in October this year. The time reversal phenomenon is a rare event even at the sub-atomic level, and contradicts our every day experience. If you were to film events involving the effects of gravity, electromagnetism or other strong forces, you would

see that these run at the same speed whether you viewed them running forward or if you reversed the film. This is because gravity, electromagnetism and the strong nuclear force are time-symmetric. Viewing the results of the experiment shows that this weak force of nature apparently allows for an exception. So far, a time reversal effect of thirteen percent has been observed in the weak decays of kaons.

Brad Cox and his colleagues are working in collaboration with physicists from the University of Chicago, Colorado, UCLA, Rutgers, Rice, Arizona, Wisconsin, from Osaka (Japan), and with physicists from Fermilab. The research is funded by the U.S. Department of Energy. The latest findings have been able to produce this evidence for time reversal violation because their experiment is one thousand times more sensitive than previous experiments.

Cox is already using the data to involve undergraduate students in this latest research in a University seminar course he is teaching entitled "Mysteries of Physics". Freshman student Lisa Manning finds the paradoxical phenomenon intriguing and says that she wants to continue her interest in high energy physics long after the seminar course is over. ■



Photo courtesy of U.Va High Energy Physics

U.Va. members of the KTeV collaboration (left to right): Karla Hagan-Ingram, Alexander Ledovskoy, John Adams, Brad Cox and Mike Arenton.



WORK ON Y2K CONTINUES

The focus of the University's efforts is on mission critical systems and activities in the months ahead. Individual faculty are responsible for computers, software applications and data bases that they use, and are asked to assess their own readiness and report to their department chair or department head, identifying problems and outlining how and when they will be solved. Department chairs and deans are expected to provide their respective vice presidents with written affirmation of Year 2000 compliance by December 31, 1998. We expect that the Commonwealth's auditors will check on our readiness in the near future. Embedded systems with date-sensitive controls, such as laboratory and instructional computer systems, refrigerators and freezers, signal amplifiers, toxic gas alarms, linear accelerators and chemical analyzers should all be evaluated for their ability to handle the Year 2000 transition. Beginning in January 1999, the University's Audit Department will carry out spot checks without prior warning. ■

INTERIM SUPPORT FOR RESEARCH

This program was established in 1994 to provide support for investigators in the sciences, medicine and engineering who are experiencing a lapse in external funding in order to keep their research infrastructure intact while they reapply for external funding. Support is limited to proposals that have already been peer reviewed and judged to be excellent but fall just below the funding line.

Typically, funding is provided for limited-to-modest supply budgets and technical and student support. This support is used to supplement funding provided by department chairs and deans.

Facts about the program: To date, 45 awards totaling \$1,162,881 have been made. Because this program enabled researchers to continue their work until external funding was reestablished, grants amounting to \$9,821,144 were subsequently received.

Applications may be submitted by March 15, June 15 or November 15 annually. Decisions are made within four weeks of the application deadline. For information on this program, please contact Ms. Jean Varner

Please see the following URLs for more Y2K information:
<http://minerva.acc.virginia.edu/year2000/>
<http://minerva.acc.virginia.edu/year2000/y2kresearcher.html>

at 924-3606 in the office of the Vice President for Research and Public Service, Washington Hall, or by e-mail at jmp2e@virginia.edu. ■

THE (IRB) FOR THE BEHAVIORAL SCIENCES

The Institutional Review Board for the Behavioral Sciences meets on the second Wednesday of each month to review research protocols in Psychology and Education, non-invasive medical research and other disciplines that involve research using people.

Below is the 1999 schedule for submitting research protocols for review. The committee is chaired by Luke Kelly. Please call Mollie Iseli, administrative assistant to the committee, at 924-3606 if you have further questions.

Meeting date	Submission deadline
2/10/99	1/29/99
3/10/99	2/26/99
4/14/99	3/31/99
5/12/99	4/30/99
6/9/99	5/31/99
7/14/99	6/30/99
8/11/99	7/30/99
9/8/99	8/31/99
10/13/99	9/30/99
11/10/99	10/29/99
12/8/99	11/30/99

NEWS FROM CAPITOL HILL
by Gene Block

We are certainly living in remarkable times. After several years of low growth in research budgets, this year's NIH budget represents a fifteen percent growth rate in federal research funding. It is estimated that an unprecedented 10,000 research grants will be funded in 1999. I anticipate that this will mean that the average size of funded grants will also increase. Our federal relations consultants in Washington have provided the following information: Dr. Harold Varmus, head of NIH, has emphasized the following research priorities:

- Genetics and genomics, and the translation of new genetic knowledge into targeted therapies.
- Neuroscience.
- Cell biology.
- Stepped-up trials of new drugs against cancer, arthritis, neuromuscular diseases, and drug abuse.
- Vaccine development against AIDS and tuberculosis.

■ Physician training in clinical research. Congress has indicated support for other priorities, giving the National Cancer Institute a \$2.927 billion budget, or an increase of almost 20 percent. A full scale effort to prevent Alzheimer's disease, progressive supranuclear palsy, Parkinson's Disease, diabetes, Behçet's syndrome, chronic inflammatory disorders and brittle bone disease has been outlined. Research into various alternative medical therapies such as acupuncture and homeopathy will also receive an additional \$30 M. The following priorities for specific institutes have been stated:

- The National Heart, Lung and Blood Institute has received a 12.2 percent increase, making it one of the top four institutes.
- Asthma in children will receive special attention. An RFA is anticipated that will allocate more than \$32 M. over the next five years to support six awards to establish a national network of interactive pediatric asthma clinical

research groups.

- Nocturnal asthma, sleep disturbances and chronobiology will be a priority.
- Novel approaches to imaging the vasculature in adults and children will be given greater attention.
- Hydroxyurea therapy for the prevention of chronic organ damage in pediatric patients with sickle cell anemia will also be a priority.

Other areas singled out for favorable consideration include preventing high-risk behaviors in children and adolescents, nursing research center core grants, and behavioral interventions for adolescents with cystic fibrosis.

There has probably never been a better time for basic biomedical science and clinical research. There are great opportunities here for our research programs. Given the uncertainty about the U.S. economy in subsequent years, I strongly recommend that you try to get your proposals submitted this coming financial year, if at all possible. ■

researchnews

January 1999 Vol. 1 No. 2

Research News is published by the Office of the Vice President for Research and Public Service.

Editor: Prudence Thorner

Contributors:

Gene D. Block

Megan Raymond

Jean P. Varner

Layout: Susan Wormington



Office of the Vice President for
Research and Public Service

UNIVERSITY OF VIRGINIA

P.O. Box 9025

Washington Hall, East Range

Charlottesville, VA 22906-9025

(804) 924-3606

Web site: www.virginia.edu/~research/