On September 30, President Obama announced $5 billion in new medical research grants through the National Institutes of Health (NIH) as part of the American Recovery and Reinvestment Act (ARRA), an act which had already provided $8.2 billion in extramural funding to the NIH to help stimulate the U.S. economy. By mid-December, the University of Vermont had been awarded more than $20 million in ARRA funds for scientific research; of that total, College of Medicine investigators have received more than $14.5 million in new funding, for at least 38 projects led by 27 principal investigators across 14 academic divisions.

As part of ARRA, the NIH designated at least $200 million in fiscal years 2009–2010 for a new initiative called the "NIH Challenge Grants in Health and Science Research." Through this program, roughly 200 grants are being allocated for "Challenge Topics," defined by the NIH as studies that "focus on specific knowledge gaps, scientific opportunities, new technologies, data generation, or research methods that would benefit from an influx of funds to quickly advance the area in significant ways . . . and should have a high impact in biomedical or behavioral science and/or public health." Approximately 20,000 applications were received for this funding, so it is an indicator of research quality that the College of Medicine received three of these highly-competitive grants, as well as a large grant from the National Institute of Mental Health.

The first Challenge Grant to be awarded delivered $1 million to fund a multidisciplinary neuroscience research project led by Rae Nishi, Ph.D., professor of anatomy and neurobiology and director of the Neuroscience Graduate Program. Nishi’s Challenge Grant, titled “Adolescent Brains, Nicotine and Endogenous Prototoxins,” aims to gain an understanding of how adolescent brains differ from adults’ brains in terms of their greater susceptibility to the addictive effects of nicotine.

“This is a collaborative effort among myself and five other scientists,” says Nishi. “It will support equipment purchases from two local Vermont companies, as well as create three to four full-time research positions and undergraduate and graduate research...”
opportunities.” Collaborators on the grant include Paul Newhouse, M.D., professor of psychiatry and director of the Clinical Neuroscience Research Unit; Alexandra Potter, Ph.D., assistant professor of psychiatry; Felix Eckenstein, Ph.D., professor of neurology; Donna Toufexis, Ph.D., assistant professor of psychology; and Haydek Payami, Ph.D., a genetic epidemiologist at the Wadsworth Center in Albany, N.Y.

Despite the belief that biofuels — liquid replacements for petroleum made from vegetable sources — may be better for the environment and for human health, there is very limited information about the biological effects of biofuel emissions. The second NIH Challenge Grant awarded to the College, this one specifically from the National Institute of Environmental Health Sciences, will fund a collaborative project led by Naomi Fukagawa, M.D., Ph.D., professor of medicine and director of the Gerontology Unit, to compare and contrast the biological effects of emission particles from the combustion of petro- and biofuel and the influence of age and gender on these responses.

“Our goal is to lay the groundwork for future studies,” says Fukagawa. “We’ll be looking at the mechanisms responsible for the significant relationship between airborne particles and lung and heart disease and we’ll be developing approaches to reduce the adverse health consequences of air pollution.”

According to the Surgeon General’s 2008 Call to Action to Prevent Deep Venous Thrombosis and Pulmonary Embolism, over 300,000 Americans each year suffer from venous thromboembolism (VTE), with potentially more than 100,000 fatalities per year caused by the condition. For reasons that are not yet understood, African Americans have an approximately 50 percent to 60 percent increased incidence of VTE.

The main limitation to studying this disparity is the paucity of African Americans in most large-scale epidemiological studies. The new Challenge Grant awarded to Assistant Professor of Medicine and hematologist Neil Zakai, M.D., by the National Heart, Lung and Blood Institute will support his secondary analyses on VTE event data from two large studies. Zakai will develop a prospective cohort study with sufficient numbers of African Americans and European Americans to evaluate racial disparities in VTE in the United States. An understanding of the reasons for this disparity will guide next steps to formulate public health policies to address this disparity.

James Hudziak, M.D., professor of psychiatry, medicine and pediatrics and director of the Vermont Center for Children, Youth and Families, is the project’s principal investigator. He and the research team will rely on a unique application of genetic tools — single nucleotide polymorphism (SNP) and copy number variant (CNV) with genome-wide association study — to help search for clues to the genetic sources of psychiatric conditions that develop during childhood.

“We will use genome-wide association approaches to look at the possible association of almost one million SNPs with specific behaviors and disorders to identify one small thing that changes in the genome,” says Hudziak. “CNV identifies larger genetics changes that you would never pick up by looking at chromosomes using microscopy. This approach will allow us to look at a wide variety of genes involved in a behavioral disorder such as Autism Spectrum Disorder.”

The research team hopes the study’s results will lead to improved diagnostic and treatment approaches for childhood psychiatric disorders. UVM psychiatry faculty members Robert Althoff, M.D., Ph.D., and David Rettew, M.D., serve as co-investigators on the study.

Dr. Nishi has already spent tens of thousands of dollars on equipment from local firms, and new research technicians and nurse positions will be created or protected by the funding for other Challenge Grant programs. The NIMH grant, which brings in $2.8 million in funding the first year and $1 million the second year, will create seven new jobs at the three U.S. sites. With all the NIH funding, the primary focus is on developing new understanding and opportunities for treatment. But the economic effect of the grants will be palpable. “Investment in biomedical research actually stimulates new job growth very effectively,” Senior Associate Dean for Research Ira Bernstein, M.D.,’83 noted to the Burlington Free Press in December. “The scientific community is an entrepreneurial community: They rise to the occasion to compete for these awards.”

Reinvesting in Research

In addition to the Challenge Grant researchers featured here, College of Medicine investigators who have officially received ARRA funding as of December include: Gary Mave, Ph.D., professor of anatomy and neurobiology; Rodney Parsons, Ph.D., professor and chair of anatomy and neurobiology; Christopher Francklyn, Ph.D., professor of biochemistry; Ralph Budd, M.D., professor of medicine and director of immunology; Charles Inve, Ph.D., professor of medicine and director of the Vermont Lung Center; Benjamin Suratt, M.D., associate professor of medicine; Teresa Ruiz, Ph.D., associate professor of molecular physiology and biophysics; Marilyn Cipolla, Ph.D., associate professor of neurology and obstetrics, gynecology and reproductive science; Berta Celler, Ph.D., research professor of family medicine in the Office of Health Promotion Research; Mark Nelson, Ph.D., professor and chair of pharmacology; George Wellington, Ph.D., associate professor of pharmacology; and David Krag, M.D., professor of surgery and Vermont Cancer Center surgical oncologist.

Biomed Research Spawns Businesses

It was 1978, and UVM sophomore Steve Arms had landed a good work-study job. In the orthopedic laboratory of Professor Robert Johnson, M.D., Arms would prepare and load specimens of rat knees into a machine that would repeatedly flex the knees. He began to ask Johnson basic questions, like: “How do you know what strain level to set this machine to? What are the strains when people ski or walk?”

It turned out that one knew the answer to those questions. Finding a way to measure such small strains became his quest. Over the next few years, while a graduate student in the department, he developed an innovative device to measure strain — “a tube with a magnetic sensor and tense magnet,” he says — that became the first strain gauges ever implanted in the knee ligament of a living human.

In 1987, Arms founded his own company, MicroStrain. Answering basic questions about how to measure movement, location, and force — in ever-smaller devices, harsher conditions, and with less power — has propelled Arms from a one-man business in his graduate student apartment on Park Street in Burlington, to a 50-person company in Williston with $10 million in annual revenue. “Our business is constantly innovating, so it’s really important to be near a university,” he says. “We hire lots of UVM students who have worked here as interns. Vermonters are very forward-thinking companies that employ hundreds of Vermonters, thanks in part to the ‘incubator effect’ of having an academic medical center in the region. Some of these other Vermont companies include:

- BioTek Instruments, Inc. — Founded in 1968 by the late Norman Alpert, Ph.D., professor and chair of physiology and biophysics, this Winooski-based company that develops biomarker assays and reagents for the early detection of cancer.

- Biomosics Inc. — “Mark Allegretta, Ph.D.’90 leads this Burlington-based company that develops biomarker assays and reagents for the early detection of cancer.

- PKC Corporation — Professor Emeritus of Medicine Lawrence Weed, M.D., is known as the “Father of the problem-oriented medical record.” In 1982 he founded PKC, a small company that develops and markets problem knowledge couplers — software that helps connect symptoms, conditions, and treatments.

- Haematologic Technologies Inc. — Professor and former Chair of Biochemistry Kenneth Mann, Ph.D., is chairman of the board of this Essex Junction, Vt., maker of plasma proteins for in-vitro research uses.

Today, UVM’s Office of Technology Commercialization Transfer and the UVM-affiliated Vermont Center for Emerging Commercialization Transfer helps faculty members bring new ideas to market. One recent venture is VerMed, founded by Benjamin Littenberg, M.D., Charles Maclean, M.D., and Michael Cagnon. VerMed’s computerized information system should vastly improve the treatment of chronic conditions such as diabetes, and, as a result provide good jobs for the local economy.