Investing to Achieve

The research enterprise at UMMS continues to grow with unprecedented momentum, built upon extraordinary success.

A s part of the explosive change in biomedical sciences in the past decade, the University of Massachusetts Medical School has responded with an ambitious investment in its research endeavors, including the recruitment of stellar faculty from around the world and the addition and upgrade of laboratory space across the campus.

Building to Explore

In pursuit of the next generation of medical research challenges, UMMS continues to invest in its facilities to promote a thriving research enterprise. In addition to the Aaron Lazare Medical Research Building, which added nine floors and 360,000 square feet of laboratory space to the Worcester campus when it opened in 2001, major renovations or additions to research space have been implemented in the campus’s main building.

The most recent initiative, undertaken for the Department of Radiology’s Neuroimaging and Intervention Division, includes the renovation of more than 4,000 square feet for a Radiology Imaging Research Suite featuring first-of-its-kind Philips Medical Systems MRI technology. The suite includes procedure rooms, reception and waiting areas and office space, as well as laboratories that support MRI research. The division’s director is a world-renowned radiologist who has made pioneering contributions to the development of various endovascular procedures, which are now established treatments.

This latest project complements a wave of renovation at UMMS over the past several years, in which virtually every academic department devoted to the basic sciences experienced extensive laboratory renovation. In addition, a new Clinical Trials Unit also opened, emphasizing the commitment to translate basic research breakthroughs into effective clinical applications.

RNAi: A Scientific Tool with Broad Applications

RNA interference (RNAi) is considered the state-of-the-art method by which scientists can experimentally knock out the expression of specific genes in lab experiments to help define the biological functions of those genes. RNAi interrupts the way genes create proteins, the substances that activate and regulate the body’s metabolic functions. It also has the ability to block the creation of harmful proteins produced by mutant genes—hence its use as a vital tool in research focused on specific diseases such as diabetes, HIV/AIDS and cancer.

Scientists theorize that RNAi has been turning off genes for millennia, working as a primordial immune system to protect our ancestral DNA. Yet, previous investigations of RNA (ribonucleic acid) focused on its role as a messenger in the cell, transporting genetic information from the DNA in the cell’s nucleus to the ribosomes, the cell’s protein factories. This changed in 1998, when Howard Hughes Medical Institute Investigator and Blais University Chair in Molecular Medicine Craig C. Mello, PhD, and Andrew Fire, PhD, then of the Carnegie Institution of Washington, jointly published the results of an experiment in the journal Nature that dramatically enhanced the scientific community’s understanding of RNAi in biology.

The pair demonstrated that small pieces of double-stranded RNA, which comprise many viruses, had the unanticipated property of silencing—or interfering with—the expression of a gene whose coding sequence of DNA was similar to that of the RNA they tested. This discovery, hailed as the 2002 “Breakthrough of the Year” by the journal Science, was taken further by UMMS Professor of Biochemistry & Molecular Pharmacology Phillip D. Zamore, PhD, who shed light on how the phenomenon worked by indicating that it is small double-stranded RNA, the result of an enzymatic chopper he named “dicer,” which precisely guided the silencing reaction Mello and Fire identified.
A unique new HIV vaccine approach that incorporates DNA from multiple strains of the virus shows promise for generating antibody and T-cell responses in otherwise healthy people. These preliminary findings, presented by UMass investigators and Advanced Biotechnology Laboratories, Inc. at the AIDS Vaccine 2005 International Conference, resulted from a Phase I clinical trial designed to test the safety of the vaccine and to monitor its ability to generate immune responses.

UMMS investigators, in collaboration with colleagues in Italy and at the Moffit Cancer Center in Florida, created a molecular anti-cancer agent that selectively kills tumor cells while sparing normal cells nearby. The agent, named Shepherdin, interferes with a protein that aids in unchecked proliferation and growth of cancer cells and is active on a variety of cancer types, making it suitable for broad therapeutic applications.

A novel human monoclonal antibody that can neutralize multiple variants of the rabies virus has been developed by a team of scientists at the UMass Massachusetts Biologic Laboratories and the U.S. Centers for Disease Control and Prevention. Worldwide, rabies remains a significant problem; monoclonal antibodies can be produced in large quantities at lower costs than blood products and are easier to distribute to remote sites.

UMMS investigators have redefined human cell division. The investigators found that when a cell divides, one of the new “daughter” cells actually causes the separation by blasting away from the other, the “older cell” is then marked as such with a protein-packed ring structure. This finding could lead to new research on cell aging and potentially, stem cell division.

UMMS investigators, working with colleagues from the University of Toronto, discovered that a known marker for Alzheimer’s disease is abnormally low in spinal fluid at least 4 to 12 years before the expected onset of symptoms in a group of subjects with a gene mutation that almost guarantees they will develop the early-onset familial form of the disease. The findings may have an impact on the development of therapies that could be initiated years before high-risk individuals develop symptoms.

A research development by the UMass Massachusetts Biologic Labs and Medares, Inc. may lead to an effective treatment for C. difficile-associated diarrhea—an ailment that afflicts more than 300,000 hospitalized patients every year. The investigators have initiated a Phase II clinical trial of CDA-1, a novel, fully human monoclonal one-dose antibody developed to inhibit Clostridium difficile Toxin A, an endotoxin present in hospitalized patients diagnosed with the disorder.