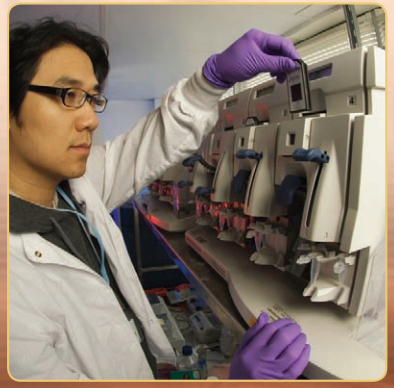
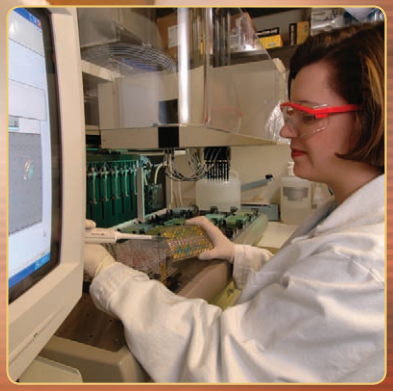
National Cancer Institute

National Cancer Institute at Frederick

BENCH TO BEDSIDE

Accelerating Progress against Cancer and AIDS





U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

"The National Cancer Institute at Frederick is a unique national resource because it offers such a wide range of advanced technologies that are important to creating the next generation of therapies for cancer and AIDS. NCI-Frederick, which brings together scientists from the government, academia, and private industry, is positioned to facilitate public–private partnerships that will be vital to the future of the entire National Cancer Institute."

Dr. John Niederhuber, Director
The National Cancer Institute

On the cover: Kedest Teshome, senior research technician at NCI-Frederick's Core Genotyping Facility, examines a chip that can evaluate 550,000 gene variations at the same time. This technology can be used to identify genetic differences that carry an increased risk of cancer. Insets, from left: Staff scientist Chang Hee Kim, Ph.D., of the Laboratory of Molecular Technology analyzes the activity of cancer genes, using DNA microarrays, or gene chips, each of which is sensitive to thousands of different genes. Fill supervisor Scott Emerick of the Vaccine Pilot Plant monitors the final stages of production in which vials are filled with freshly made vaccine. Research associate Terra Schaden-Ireland, M.A., M.B.A., of the AIDS Vaccine Program produces AIDS virus test kits that are used in research labs around the world.

BENCH TO BEDSIDE

November 2007

With our partners, we are developing faster and less expensive ways of turning laboratory discoveries into new diagnostic tests and treatments for cancer and AIDS.

National Cancer Institute at Frederick

A Federally Funded Research and Development Center

NCI-Frederick Accelerates Progress against Cancer and AIDS

NCI-Frederick partners with university, government, and corporate scientists to speed the translation of laboratory research into new diagnostic tests and treatments for cancer and AIDS.

With a unique array of advanced technologies, NCI-Frederick is bridging the gap between discovery and healthcare delivery. We assess research results for value to patients, accelerate development, and deliver new products to the business sector for commercialization.

Academic and government researchers locally and across the nation rely on NCI-Frederick to:

- **Deliver pure prototype drugs**
- **Help win regulatory approval for new drugs, vaccines, and other therapies**
- **Cut the cost of nanotechnology research and make it more widely available through a standards-based approach**
- **Produce large quantities of clinical-grade test vaccine with little lead time**
- **Speed technology development and reduce costs through public–private partnerships**
- **Improve the delivery of the latest, evidence-based cancer care to people in their home communities**

NCI-Frederick is designated by Congress as one of 38 Federally Funded Research and Development Centers. These centers provide a quick response and flexible capability in meeting federal research and development goals that cannot be met effectively by other means.

Our campus, 50 miles north of Washington, D.C., is home to a wealth of expertise, including that of our own cancer and AIDS researchers, our technology development teams, and our regulatory liaisons and commercialization partners. This combination gives us a unique perspective that spans laboratory discovery, technology development, and healthcare delivery.

NCI-Frederick quickly adapts to changing R&D priorities by

Research and Development: 2007 Highlights

Basic

Genetic markers for prostate and breast cancers

Discovery of genes affecting progression of AIDS

Identification of human antibodies for multiple strains of the Severe Acute Respiratory Syndrome (SARS) virus

Translational/Applied

How the breast cancer drug tamoxifen might be improved

Gene chip for all known human viruses

Mouse model for an inherited kidney disease linked to cancer

Clinical/Translational

Experimental vaccines for Ebola, avian influenza, and HIV

New ovarian cancer drug ready for clinical trials

Prototype leukemia vaccine for phase I clinical trial

Clinical

NCI Community Cancer Centers Program pilot

Monitoring 300+ clinical trials worldwide

NCI-Frederick is the northern anchor of the I-270 technology corridor.

curtailing or ending programs when necessary to maintain a strategic focus and keep pace with new discoveries, development opportunities, and health-care priorities.

With our collaborators, we are answering the call from Congress and the public to show how taxpayer investments in biomedical research are helping to ease—and to end—the suffering caused by cancer, AIDS, and other diseases.

Federally Funded Research and Development Centers

An FFRDC is a unique organization that combines private business practices with government operations under a broad charter that promotes quick action, flexibility, and accountability.

An FFRDC is a government-owned, contractor-operated facility that requires the contractor to be autonomous, operate in the public interest, be free from organizational conflicts of interest, and provide full disclosure of its affairs to its sponsoring agency.

FFRDCs have special access to government and private-sector data, including sensitive and proprietary information. Contractors and federal employees work closely together in government facilities. To best serve the public, government–contractor relationships are stable and long-term.

FFRDCs include the national laboratories of Brookhaven, Oak Ridge, Los Alamos, and Lawrence Livermore, the National Defense Research Institute, the Jet Propulsion Laboratory, and others.

Because of their special acquisition authorities and broad charter, FFRDCs are especially effective in managing public–private partnerships between the government and academia, nonprofit organizations, and the corporate sector. Up to 30 percent of FFRDC funding may come from non-federal sources.

Prostate and Breast Cancers

Discovery of genetic markers may lead to new tests, treatments

New markers for prostate and breast cancer have been discovered using new genome-wide association studies at NCI-Frederick's Core Genotyping Facility (CGF) in Gaithersburg, Md.

These genetic markers can lead to more accurate screening tests and may ultimately suggest new approaches to treating the diseases.

CGF researchers and their colleagues found a second genetic marker for prostate cancer that, together with a previously discovered marker, contributes substantially to the risk for prostate cancer in white men in the United States.

These new markers are DNA variations seen in cancer patients but not in healthy people. Their strong association with the disease suggests that genes influencing prostate cancer may be located nearby. Further studies are ongoing to determine if this is true.

Other genome-wide association studies at the facility have successfully identified genetic markers associated with breast cancer risk.

"The occurrence of the new breast cancer markers is more common than *BRCA1* and *BRCA2*, the two genes previously associated with increased risk for breast cancer," said Amy Hutchinson, M.S., co-author on the study led by CGF director Stephen Chanock, M.D., and Harvard Medical School's David Hunter, Sc.D., M.D.

"These new markers are important in understanding cancer as a complex disease, arising in response to many changes," she said. "Novel markers can be used in preventive strategies, such as screening. As we learn more about the role of these novel markers, we can perhaps devise new treatment strategies."

These two basic research discoveries are among the first significant cancer findings stemming from the Human Genome Project, which four years ago

"Science is moving very fast these days, and I love having the opportunity to work with cutting-edge technology. It's exciting to be doing work that can really make a difference."

–Amy Hutchinson, M.S.

revealed the human genetic blueprint and all of its billions of chemical subunits.

Advanced technologies for plumbing the complexity of these data are being developed and put into place at the CGF as part of a major National Cancer Institute initiative, the Cancer Genetic Markers of Susceptibility (CGEMS) project. This includes a highly automated laboratory set-up as well as computer tools for complex analysis.

For the CGEMS breast cancer study, the CGF researchers developed genotypes for 1,145 women with breast cancer and 1,142 healthy individuals, using ultra-high-throughput genotyping technology in which half-a-million genetic variants are placed on a device similar to a computer chip and tested all at once.

The genotypes were examined for differences between the two groups. Four genetic variants showed a strong association with the cancer group. This association was confirmed in a second analysis of 1,776 affected individuals and 2,072 controls.

These four genetic variants, the markers, establish a statistical relationship between their presence and the risk of cancer. More research is needed to determine the actual mechanism that ties these variants to cancer risk.

In the CGEMS prostate study, researchers identified a second marker for the disease that, when combined with a previously known marker, helps to better explain the burden of disease in white males. Prostate cancer is the third leading cause of cancer death in men.

"Discovery of this common variation is very exciting," said Meredith Yeager, Ph.D., scientific director of the facility and co-author on the study. "Building on this finding, we may be able to identify men at highest risk for prostate cancer, diagnose the disease earlier, and hopefully prevent it altogether."

cgf.nci.nih.gov

Advanced Technologies for universities, government researchers, and commercial partners

Advanced Biomedical Computing
Sequence analysis, databases, computational chemistry, molecular modeling, and crystallography

Gene Expression
Quantitative polymerase chain reaction, full-length DNA sequencing, shRNA, and recombinant adenovirus and lentivirus production

Genomics
Genotyping, sequencing, microarrays, real-time PCR, peptide synthesis, data analysis, clinical diagnostics

Imaging
Confocal and electron microscopy services

Phenotype Evaluation of Genetically Engineered Mice
Pathology reports, necropsies, microtomy, digital imaging and analysis, embryologic evaluations, laser-capture microdissection, hematology, and blood chemistry

Protein Chemistry
Surface plasmon resonance spectroscopy, protein chemistry and characterization, molecular binding, and mass spectrometry

Protein Expression
Gene cloning, expression optimization in *E. coli*, cell-free and instrumented expression, and protein purification

Proteomics and Analytical Technologies
Protein identification, peptide mapping, quantitative proteomics, small-molecule identification, and nuclear magnetic resonance (NMR) support

Mouse Models of Human Cancer
More than 100 strains, including breast, lung, ovarian, and gastrointestinal

Biopharmaceutical Development
Clinical-grade drugs and other therapeutics for clinical trials

Order Services:
www.ncifcrf.gov/services.asp
wwwbdp.ncifcrf.gov

Imaging Live Animals

Research questions are answered faster

One group wants to see the very first steps that lead to colon cancer so the disease can be stopped before it starts. Another group wants to see if its new breast cancer drug works best as an injection. A third group wants to see if a kidney cancer drug will shrink tumors.

These and other cutting-edge cancer researchers are literally seeing the answers to their questions in medical and scientific images produced at NCI-Frederick's new Small Animal Imaging Facility.

Live mice can be imaged under a variety of laboratory conditions: some are developing specific cancers; others have the disease and can be treated with experimental drugs, then imaged periodically to see if the drugs are effective.

Animal studies are an essential bridge between laboratory discovery and human clinical testing. Our ability to see the origins of cancers or the effects of experimental drugs in live animals makes these studies even more productive. In a live animal imaging facility, research questions are answered faster at lower cost with fewer animals.

The NCI-Frederick facility, which opened this year, has:

- **A clinical-grade MRI, which renders detailed images of internal physiology**
- **An optical imager that reveals cellular and genetic activity within a living organism**
- **A fluorescence imager that can show the location and density of specifically tagged molecules in the animal**
- **Ultrasound for fast imaging of internal anatomy**
- **PET imaging of metabolic and molecular processes**

Other imaging technologies are being added to give the facility an especially wide range of capabilities. Its location adjacent to the animal holding facility makes it easy to move mice in and out in a controlled environment for long- term studies and complex experiment set-ups.

"This is the perfect system for testing therapeutic drugs."

–Laura Schmidt, Ph.D.

The colon cancer group from the Laboratory of Cancer Prevention, Center for Cancer Research (CCR), is using the MRI for imaging the earliest molecular events that precede colon cancer. Matthew Young, Ph.D., is visualizing the early changes in colon cells as they go from normal to tumor cells. The group has already obtained good images of tumors at later stages of development, which are valuable for a related line of work: developing MRI as an effective, noninvasive screen for colon cancer, the fourth most common cancer in the United States and a disease that can be completely prevented with early detection.

"It connects all the people here in a very focused way," Young said of the facility. "You have the imaging people, the nanobiologists, the animal lab people, and the clinicians. Everyone is gung ho to make this work. It's very exciting to be doing this kind of research now that we have all the imaging tools in place here at Frederick."

In the breast cancer study, Zack Howard, Ph.D., of the Laboratory of Molecular Immunoregulation, is using the optical imager to determine the best route to administer her experimental drug to treat breast cancer that has metastasized to the lung. Is it delivered to the lung when injected into the skin, or would it be more effective to give the drug intravenously or by injection into the abdomen? Initial studies show the drug disperses after being given as a shot in the skin, but accumulates quickly near the tumor when delivered intravenously.

"With the imaging studies, we got our answers faster and cheaper and we saved mice," Howard said.

In a separate line of work, Laura Schmidt, Ph.D., of the Urologic Oncology Branch, and her colleagues have taken a first step toward developing a mouse model for kidney cancer. Her group has developed an animal model for the genetic disease Birt-Hogg-Dubé syndrome, which can lead to kidney cancer. This model can be used to test potential treatments for the disease using imaging to monitor over time the effectiveness of proposed therapies.

The Small Animal Imaging Facility has also been a key resource for the Nanotechnology Characterization Laboratory (NCL), part of the Alliance for Nanotechnology in Cancer. NCL studies track the movement of nanoparticles in living organisms. Knowing how these particles move through the body will help clear the way for the safe and effective application of nanotechnology to medicine.

Lilia Ileva, M.S., calibrates the Xenogen IVIS® Spectrum optical imager, which reveals genetic activity in live animals.

The imaging facility was conceived in 2004 as an extension of CCR's Molecular Imaging Program under senior clinician Peter Choyke, M.D.

A steering committee overseeing the first two years of operation includes Dr. Choyke and Piotr Grodzinski, Ph.D., Office of Technology and Industrial Relations; Kristin Komschlies, Ph.D., Office of the Director; and James Tatum, M.D., Division of Cancer Treatment and Diagnosis.

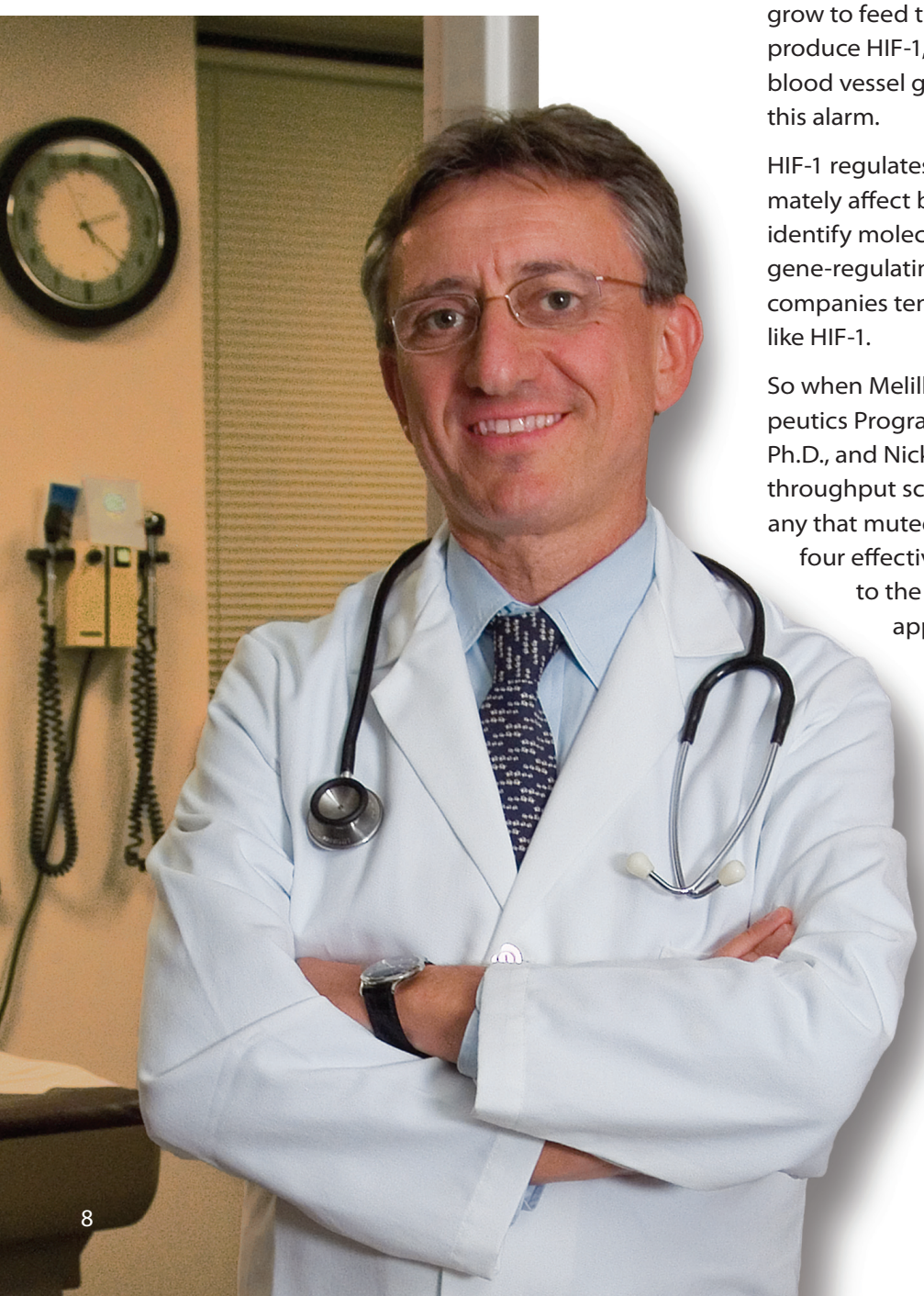
www.ncifcrf.gov/rtp/lasp/intra/saip

Human Clinical Trials

New treatment regimen is testing well in patients

A medical doctor working across basic, translational, and clinical science has found an effective new way to use an old cancer drug: Give less of the medicine less often, but over a longer period.

Preliminary results in a human clinical trial are encouraging. The trial is ongoing, so results remain anecdotal, said Giovanni Melillo, M.D., senior investigator in the Tumor Hypoxia Laboratory of the Developmental Therapeutics Program. But these early findings appear to confirm that giving lower doses of an existing drug less often might cause tumors to wither without making patients sick from the side effects. The low-dose regimen could also be extended over a longer period of time.



Melillo is focusing on a type of molecule, HIF-1, that plays a major role in keeping tumors supplied with the nutrients they need to survive and grow. Cancers are made of fast-dividing cells, so an exploding population of cancer cells will quickly run out of oxygen and nutrients unless new blood vessels grow to feed them. Cancer cells starved of oxygen produce HIF-1, which sounds the alarm for new blood vessel growth. Melillo is working to silence this alarm.

HIF-1 regulates the expression of genes that ultimately affect blood vessel growth. It is difficult to identify molecules that can effectively block this gene-regulating activity, so difficult that major drug companies tend to focus on targets other than those like HIF-1.

So when Melillo joined the Developmental Therapeutics Program, together with Robert Shoemaker, Ph.D., and Nick Scudiero, Ph.D., he devised a high-throughput screen of 2,000 compounds, looking for any that muted the HIF-1 signal. In 2002, they named four effective compounds, including one similar to the cancer drug topotecan, which is approved by the Food and Drug Admin-

"There are many promising therapies emerging for cancer, and we hope that more patients will enroll in clinical trials."

– Giovanni Melillo, M.D.

istration (FDA) as a second-line therapy for certain cervical, ovarian, and lung cancers.

Topotecan is given for five days every 21 days, which is about all a patient can tolerate. The drug kills cells that are growing and dividing rapidly, which includes cancer cells. At the same time, however, the drug kills normal cells that are also dividing, such as

Nurse Cindy Love, RN, BSN, shares a laugh with a young patient at the NIH Clinical Center, where proposed new pediatric cancer treatments are tested in clinical trials.

those that line the stomach and hair follicles. This leads to the sickening side effects that often accompany chemotherapy.

Melillo's aim is not to kill the cancer cells quickly, but to do so more slowly and indirectly by cutting off their supply of oxygen and nutrients, thus starving them to death. He wanted to see if giving lower doses of topotecan over longer periods of time would be effective.

With Annamaria Rapisarda, Ph.D., and Melinda Hollingshead, D.V.M., Ph.D., and others, Melillo demonstrated that topotecan works in mice with brain cancers, a study that paved the way for the human clinical trial that began in 2005 and remains open for enrollment (www.clinicaltrials.gov/ct/show/NCT00117013?order=10).

"We have cured cancer in mice many times," Melillo said. "In mice, you create a tumor, give a drug, the tumor responds. In patients, it's different. The tumor has been there a long time. More genetic changes have occurred to make the cells stubborn. This cell population is hard to treat with just one agent alone."

So, while the human clinical trial is still under way, Melillo's laboratory has also begun studies on tandem combinations, including some FDA-approved drugs and other experimental compounds not yet approved.

Preliminary studies combining topotecan with the FDA-approved colon cancer drug Avastin® appear to be more effective than using topotecan alone. The combination also reduces the effective dose of topotecan.

Melillo began doing basic research in hypoxia, or oxygen deprivation, in living cells. For many years, cancer researchers have looked for ways to cut off the blood supply to tumors as a way of destroying them. After HIF-1 was identified, Melillo saw a possible way of using his knowledge of hypoxia and one of its master molecules to investigate possible new therapies.

Melillo sees patients once a week at the National Institutes of Health Clinical Center in Bethesda, Md.

dtp.nci.nih.gov

NCI-Frederick in the Community

Nationally—Community Cancer Centers bring advanced care closer to home

"I'm a living witness that early detection saves lives," said Deloris Gray of Baton Rouge, La., whose early-stage breast cancer appeared in a free screening mammogram offered by Mary Bird Perkins Cancer Center in her home community.

Gray, who underwent successful surgery, benefited from an outreach program to women without insurance. The program offers free screening mammograms to many high-risk, underserved women, a major goal for the National Cancer Institute as it seeks to eliminate disparities in cancer healthcare.

Our Lady of the Lake Regional Medical Center, and its Mary Bird Perkins Cancer Center, is one of 16 community hospitals named this year to participate in the pilot phase of a new national initiative, the NCI Community Cancer Centers Program (NCCCP).

The NCCCP pilot, being managed by NCI-Frederick through its prime contractor, SAIC-Frederick, Inc., is exploring ways to bring the latest in evidence-based cancer care to communities where patients live.

The pilot is being conducted as a research program to explore how community cancer centers can best provide patients with advanced care. This effort could extend the reach of NCI programs into local communities, create a national network of physicians and cancer patients, and speed up the development and testing of new therapies.

The pilot has four major goals:

- **Draw more adult patients into early-phase clinical trials**
- **Reduce healthcare disparities by reaching underserved patients**
- **Explore standards for voluntary donation of blood and other specimens for research**
- **Evaluate the use of electronic medical records**

ncccp.cancer.gov

Participating Hospitals

- **Billings Clinic**, Billings, Montana
- **Hartford Hospital**, Hartford, Connecticut
- **St. Joseph's/Candler**, Savannah, Georgia
- **Our Lady of the Lake Regional Medical Center**, Baton Rouge, Louisiana
- **Sanford USD Medical Center**, Sioux Falls, South Dakota
- **Spartanburg Regional Hospital**, Spartanburg, South Carolina
- **St. Joseph Hospital**, Orange, California
- **Christiana Hospital**, Newark, Delaware
- **Ascension Health**, St. Louis, Missouri, for these hospitals:
  - **St. Vincent Indianapolis Hospital**, Indianapolis, Indiana
  - **Columbia St. Mary's**, Milwaukee, Wisconsin
  - **Brackenridge Hospital**, Austin, Texas
- **Catholic Health Initiatives**, Denver, Colorado, for these hospitals:
  - **Penrose-St. Francis Health Services**, Colorado Springs, Colorado
  - **St. Joseph Medical Center**, Towson, Maryland
  - A coordinated regional program in Nebraska sponsored by **Good Samaritan Hospital**, Kearney; **St. Elizabeth Regional Medical Center**, Lincoln; and **St. Francis Medical Center**, Grand Island

Locally—Business startup develops vaccines against staphylococcal infections

Vaccines for staphylococcal infections, a major health problem in hospitals and a biothreat to the military, are moving toward clinical trials with the aid of a local business incubator supported by NCI-Frederick through its prime contractor.

Javad Aman, Ph.D., a former U.S. Army researcher, left the government to start his own research-based company to commercialize a number of products, including staphylococcal vaccines that can be used in hospitals and on the battlefield and small-molecule drugs to fight hemorrhagic fevers and other infectious diseases and toxins.

One staphylococcal vaccine is set for clinical trials in the spring, using technology licensed from the Army and a prototype vaccine from the NCI-Frederick's Biopharmaceutical Development Program. This vaccine would have military applications. Aman plans to follow with a vaccine suitable for civilian use. Of the 1.7 million hospital-acquired infections each year in the United States, 20 percent to 25 percent involve strains of the toxin-producing bacterium *Staphylococcus*, he said.

"He really has an opportunity here," said Mike Dailey, executive director of the Frederick Innovative Technology Center, Inc. (FITCI), the local business incubator where Aman's company is located.

Aman first took advantage of FITCI's virtual program, which enables businesses to have an infrastructure without establishing a full-fledged office location by giving them access to individual resources that suit their needs, such as a meeting room, fax machine, or answering service.

In June, Aman's company, Integrated BioTherapeutics, moved into office and laboratory space at FITCI's 11,000-square-foot complex in the Metropolitan Court industrial park southwest of downtown Frederick. FITCI also has a 10,000-square-foot facility at Hood College.

"This would have been basically impossible without FITCI and the support we got here," Aman said of his company, which just hired lab director Sven Enterlein, Ph.D., and two technicians.

FITCI opened in 2004 as a non-profit, public-private partnership with the goal of helping create sustainable businesses with high-paying jobs in Frederick County. FITCI currently houses 26 startups at its two locations.

NCI-Frederick's prime contractor, SAIC-Frederick, Inc., is supporting local business development as a Platinum Sponsor of FITCI, a major sponsor of the Frederick County Chamber of Commerce, and through support to other local business organizations.

www.fitci.org

Other NCI-Frederick Support in the Community

- Counseling cancer recovery and survival groups
- Judging science fairs
- Speaking with citizen groups
- Volunteering at Frederick Memorial Hospital
- Holding adjunct faculty and guest lecturer positions at local and area colleges and universities
- Elementary Outreach Program
- Werner Kirsten High School Student Intern Program
- Summer Student Seminar Series

NCI-Frederick Supports University and Government Researchers

- The Advanced Biomedical Computer Center has provided state-of-the-art computational services to more than 500 non-NCI investigators in academia and at other government agencies.
- The Nanotechnology Characterization Laboratory has characterized 61 nano-technology strategies using nanoparticles from 13 extra-mural investigators. NCL also collaborates with the National Institute of Standards and Technology, the Food and Drug Administration, the National Toxicology Program, and others on standards and protocols.

- Over the past three years, NCI-Frederick's Advanced Technology Program fulfilled about 600 requests for services from more than 100 non-NCI investigators at the NIH, in academia, and at other government agencies. Services included electron microscopy, high-throughput DNA sequencing, protein expression and purification, microarray analysis, and real-time PCR.
- Transgenic/Knockout, Speed Congenic, and Cryopreservation/Breeding services contributed to more than 180 extramural projects between 2002 and 2006. These services are provided at a substantially lower cost than similar services elsewhere.
- Over the last five years, NCI-Frederick shipped more than 3 million high-quality research animals to extramural investigators at 200 institutions.
- On average, NCI-Frederick ships over 9,000 unique research products each year to the extramural community free of charge. Products include antibodies, assay kits, cell lines, plasmids, recombineering reagents, viruses, natural products, and cytokines.
- The Biological Resources Branch Preclinical Repository, Developmental Therapeutics Program (DTP), has provided over $10 million in quality research reagents (cytokines, monoclonal antibodies, and cytokine standards) at no cost to extramural investigators and qualified commercial establishments.
- Over the past five years, the Biological Testing Branch, DTP, has provided more than 3,500 human tumor cell line vials and more than 300 Tissue Array Research Project (TARP) microarray slide sets to the extramural community.
- Since 1993, the Biopharma-ceutical Development Program has completed over 100 projects, with 68 going into clinical trials. Two-thirds of the products coming through the BDP are in support of extramural projects.
- This year, NCI-Frederick has provided $34.7 million in services to 221 NCI-supported and 224 NIAID-supported extramural clinical trials to test innovative cancer and AIDS treatments in national and international locations.

NCI-Frederick Administration and Selected Contacts

Craig Reynolds, Ph.D.
Associate Director, NCI;
Director of Scientific
Operations, NCI-Frederick

Don Wheatley
Chief Contracting
Officer, NCI-Frederick

Charles River Laboratories *(contractor)*
Patricia Fritz, Ph.D., Principal Investigator

Data Management Services, Inc. *(contractor)*
James Racheff, Principal Manager

SAIC-Frederick, Inc. *(contractor)*
Larry Arthur, Ph.D., Principal Investigator, OTS Contract

Wilson Information Services Corporation *(contractor)*
Susan Wilson, Principal Manager

Advanced Technology Program
Tim Harris, Ph.D., Director
(301) 846-1144
harristjr@mail.nih.gov
www.ncifcrf.gov/atp

Biopharmaceutical Development Program
George Mitra, Ph.D., Director
(301) 846-5999
mitra@ncifcrf.gov
wwwbdp.ncifcrf.gov

Center for Cancer Research
Robert Wiltrout, Ph.D., Director
(301) 496-4345
wiltrour@mail.nih.gov
ccr.ncifcrf.gov

Laboratory Animal Sciences Program
Hendrick Bedigian, Ph.D., Director
(301) 846-1542
bedigiah@mail.nih.gov
www.ncifcrf.gov/rtp/lasp/intra

Clinical Research Program
Barry Gause, M.D., Director
(301) 846-1009
gauseb@mail.nih.gov

NCI-Frederick Office of Public Affairs
Cheryl Parrott, Director
(301) 846-5382
parrottc@mail.nih.gov

SAIC-Frederick Office of Public Affairs
Frank Blanchard, Director
(301) 846-1893
blanchardf@mail.nih.gov

www.ncifcrf.gov

National Cancer Institute
at Frederick

Bench to Bedside
November 2007

NATIONAL® CANCER INSTITUTE