

TennOvations



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INNOVATED IN TENNESSEE

Tennessee's life sciences industry is saving and improving lives. The professionals in our industry are fostering innovation and directing cutting edge science. These Tennessee scientists and industry leaders are the next pioneers in medical breakthroughs.

With more than 700 life sciences organizations employing more than 26,000 people, Tennessee has made a mark in this global industry. Tennessee's life sciences industry helps to heal, fuel and feed the world.

More than \$1.1 billion invested in the life sciences alone by private industry between 2004 and 2009 and an additional \$667 million was disbursed in Tennessee through federal grants by the National Institutes of Health, the Center for Disease Control and the National Science Foundation in 2010.

What follows are snapshots into just a few of the daily activities and innovations of our industry here.

FIGHTING PARKINSON'S

Vanderbilt Center for Neuroscience Drug Discovery Partners with Michael J. Fox Foundation

Researchers at Vanderbilt University Medical Center have achieved a milestone in the development of a potential new treatment for Parkinson's disease that may improve on some of the limitations of current therapy.

With funds from the Michael J. Fox Foundation for Parkinson's Research (MJFF), Jeffery Conn, Ph.D. has accelerated a promising new treatment that approaches the disease from a different angle than past Parkinson's treatments. Dopamine replacement therapy, today's gold standard treatment for Parkinson's, relieves some motor symptoms of the disease, but over time it causes debilitating side effects such as involuntary, uncontrollable movements (dyskinesia). Current Parkinson's treatments also provide fewer benefits to patients as the disease worsens over the long term.

The new compounds, developed by the Vanderbilt Center for Neuroscience Drug Discovery with support from MJFF, bypass the dopamine system altogether and instead modulate the activity of a specific glutamate receptor called mGlu4.

The Vanderbilt-Fox Foundation partnership is an example of how academic medical centers are helping to fill the "drug pipeline" with new agents that have the potential to dramatically improve the health of millions of patients worldwide.



Dr. Jeffrey Conn

SURGICAL ADVANCES

Chattanooga company improves vascular outcomes through innovative catheter therapies

Chattanooga-based Advanced Catheter Therapies, Inc. (ACT) concentrates its research and development efforts on innovative catheter technologies that target vascular disease. The company is an early stage medical device company with a portfolio of innovative catheter technologies targeting diseases including thrombosis, inflammation, occlusions and restenosis.

The young company recently relocated from Atlanta to Chattanooga after partnering with an investment consortium in Chattanooga for its Series A funding. “ACT is thrilled to be a part of the vibrant Chattanooga healthcare community,” said Paul J. Fitzpatrick, CEO of ACT.

By focusing on finding a unique and greatly improved means of delivering therapeutic agents which treat the problem of restenosis, or the re-blocking of an artery following a clearing procedure such as angioplasty or atherectomy, ACT has made strides to develop the game-changing Occlusion Perfusion Catheter™ (OPC™). The OPC is a multi-lumen balloon catheter designed to temporarily isolate a specific region from blood flow creating a treatment chamber to allow the local delivery of life saving agents to area.

In addition to the OPC™, the company is developing leading-edge technology for improving vascular surgery as well as other catheter-based devices, which it believes will vastly improve the initial treatment of vascular disease.



The Advanced Catheter Therapies team

GENOMIC RESEARCH

St. Jude and Vanderbilt Promise Better Medicine & Cancer Treatments

Researchers at St. Jude Children's Research Hospital and Vanderbilt University are involved in separate projects that are pioneering genetic research that hopes to significantly alter the way medicine is practiced. The multi-layered genetic research happening in each of the renowned institution's laboratories will enable doctors to tell which drugs will work best for patients based on their genetic makeup, genetically pinpoint the most effective cancer treatment with the fewest side effects, and identify a patient's genetic markers in the prevention of future illness.

These are alluring aspects in the budding field of personalized medicine that are being pioneered by Tennessee's top scientists and health care providers. The research is involved in many angles of medicine including helping to measure a person's ability to respond to medication and or a tumor's response to chemotherapy treatment.

In January 2010, St. Jude announced an unprecedented effort to identify the genetic changes that give rise to some of the world's deadliest childhood cancers. The team joined forces with Washington University to decode the genomes of more than 600 childhood cancer patients. The three-year St. Jude Children's Research Hospital/ Washington University Pediatric Cancer Genome Project is the largest investment to date aimed at understanding the genetic origins of childhood cancers.

St. Jude's Pediatric Genome Project is already seeing successes including the discovery that a subtype of leukemia characterized by a poor prognosis is being fueled by mutations in pathways distinctly different from a seemingly similar leukemia. The findings highlight a possible new strategy for treating patients with this more aggressive cancer called early T-cell precursor acute lymphoblastic leukemia (ETP-ALL).

Vanderbilt is also leading the nation in personalizing medicine by leveraging its sophisticated Electronic Medical Record (EMR) to use genetic information in point-of-care decision making. The Pharmacogenomic Resource for Enhanced Decisions in Care and Treatment (PREDICT) program was recently awarded a two-year, \$1 million grant by the U.S. Centers for Disease Control and Prevention to develop a model for applying genomic testing to drug prescribing in real-world settings. The goal is to develop a clinician-friendly genomic test report with supportive clinical, educational, and laboratory practices that can be widely disseminated.

The university has also recently launched the My Cancer Genome project (www.mycancergenome.org)– a Web-based feed of the latest research regarding gene mutations associated with cancers. This revolutionary tool provides doctors researchers and caregivers a quick, one-stop location for information they previously had to seek out decision- elsewhere. The website serves as a decision support tool for physicians, caregivers and researchers by offering up-to-date information on mutations associated with various cancers, their therapeutic implications of these mutations, as well as information on available clinical trials relevant to these mutations.





**Dr. Laurence
Zwiebel holds
a specimen
sample in his
Vanderbilt
laboratory**

NEW KIND OF INSECT REPELLENT

Vanderbilt Research Brings New Insect Repellent Thousands of Times Stronger

The Vanderbilt research laboratory of Professor of Biological Sciences and Pharmacology Laurence Zwiebel, Ph.D. is designing an insect repellent that is not only thousands of times more effective than DEET—the active ingredient in most commercial mosquito repellents—but also works against all types of insects, including flies, moths, and ants.

In preliminary tests with mosquitoes, the researchers found the new class of repellent, called Vanderbilt University Allosteric Agonist or VUAA1, works by affecting insects' sense of smell through a newly discovered molecular channel.

The discovery was made during tests that are part of a major interdisciplinary research project, supported by the Grand Challenges in Global Health Initiative funded by the Foundation for the NIH through a grant from the Bill & Melinda Gates Foundation. The goal is to develop new ways to control the spread of malaria by disrupting a mosquito's sense of smell. Malaria is the 5th cause of death from infectious diseases worldwide. The project received five years of initial funding and a two-year extension that is currently in progress.

A GROWING PROSTHETIC

Wright's Childhood Prosthetic Implant Expands as Child Grows with Non-surgical Technique

Arlington, Tennessee-based Wright Medical Technology has a revolutionary implant, REPIPHYSIS®, offering children an expandable, non-surgical endoprosthesis that maintains equal limb length throughout the child's growth years. Primarily used for children with tumors involving the growth plate in the femur or tibia, the implant allows for a noninvasive expansion procedure performed by placing a magnetic field around the patient's limb.

The REPIPHYSIS® implant is made from titanium and is wrapped in an aerospace polymer. Once inserted in the child's healthy bone, in place of the previously diseased bone, standard recovery and rehabilitation are expected.

The expansion procedure, which can be performed in a doctor's office, initiates the lengthening process by softening the plastic inside the REPIPHYSIS® implant and allowing the spring inside the device to expand. This procedure is done within a matter of minutes without surgery, and unlike traditional procedures, recovery and rehabilitation are not needed afterwards. Children simply get up and walk out of the doctor's office.

The REPIPHYSIS® technology is minimizing the traumatic impact of surgery for pediatric patients. The implant redefines bone replacement surgery for children and teens between the ages of five and about fourteen years of age, by helping to eliminate repetitive and traumatic surgeries, hospital stays and rehabilitations.



**A recipient of the REPIPHYSIS®
implant, which allows Destiny to
maintain equal limb length
throughout her growing years**



Dr. Zemel working in his laboratory at the University of Tennessee Obesity Research Center

ANTI-OBESITY & WEIGHT CONTROL

UT Scientist Pioneers Nutritional Supplement from Dietary Calcium Research

Dr. Michael Zemel of the University of Tennessee Obesity Research Center and a recognized expert in obesity genetics, adipocyte metabolism, and cell calcium regulation, is offering groundbreaking advancements on anti-obesity food supplements.

As a result of Dr. Zemel's research, Nutraceutical Discoveries, Inc. is planning to market a new weight control technology branded NuFit™. NuFit™ is the next step in the work of Dr. Michael Zemel's laboratory at the University of Tennessee concerning the anti-obesity and weight control effects of dietary calcium.

The dietary supplement is a food ingredient containing a specific blend of naturally occurring nutrients that helps your body burn fat when combined with only 15 minutes of exercise. It stands on the shoulders of Dr. Zemel's ground-breaking work on the metabolic effect of calcium in dairy. This work is claimed to be verified by numerous clinical trials and epidemiological (observational) studies conducted by other labs and universities around the world.

According to the company, NuFit™ is all natural and safe. It consists only of generally recognized as safe ingredients in proportions well under the recommended daily consumptions. The supplement requires a calorie deficit through some combination of reduced caloric intake or increased physical activity to trigger its effects, but what it does, however, is leverage a person's efforts by up to 50 percent.

LYME DISEASE VACCINE

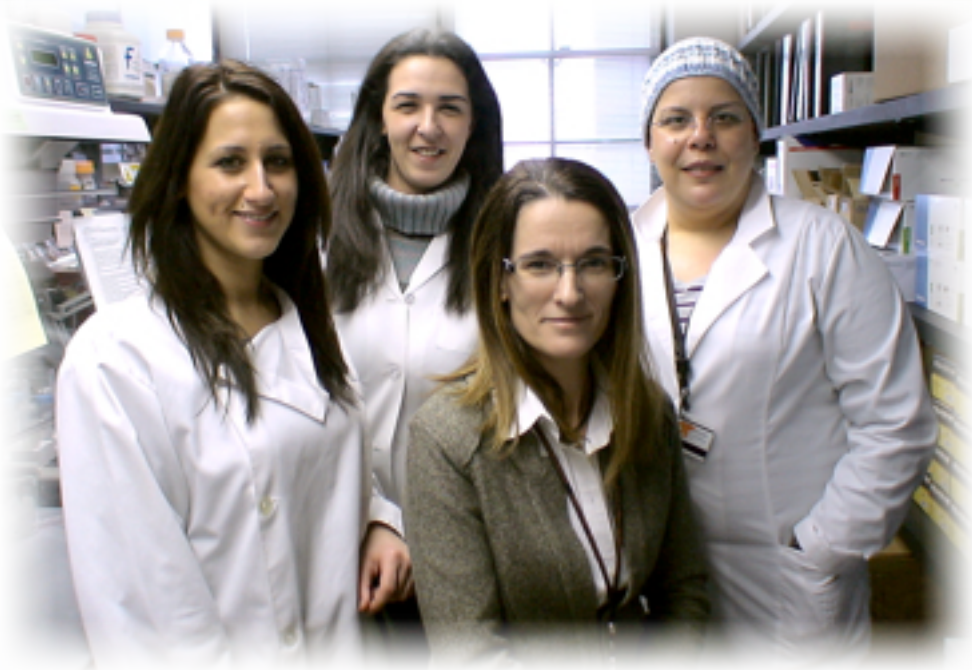
Memphis-based Biopeptides is breaking new ground on an innovative vaccine

University of Tennessee Health Science Center's Maria Gomes-Solecki, DMV is known amongst the scientific community for the development of an oral vaccine against *Borrelia burgdorferi*, the Lyme disease pathogen, to be administered to wildlife, with the ultimate goal of drastically reducing the incidence of the disease in humans.

The vaccine hopes to block the transmission of the Lyme-causing pathogen, killing the bacteria inside a tick that bites the animal. Dr. Gomes-Solecki plans for the vaccine to be administered to small animals, including mice and chipmunks, in Lyme-prone areas. This method seeks to avoid vaccinating humans while still effectively treat the prevalence of the disease.

Lyme disease is the most common vector (tick or mosquito) borne infectious disease in the United States and Europe and is a significant public health concern. The disease affects the musculoskeletal, skin and nervous system and can be the root cause of multiple diseases.

In the absence of the classic skin lesion of early Lyme disease, the diagnosis is established by the detection of an antibody response to *Borrelia burgdorferi* in patients. Early diagnosis is important because early treatment of Lyme disease limits or prevents serious damage to the systems affected. Current tests lack sensitivity in early disease, creating an issue for effective Lyme treatment. This makes other alternative methods of disease prevention necessary.



Dr. Gomes-Solecki and her assistants, Rita Melo, Ana Vieira and Luciana Richer

STREP VACCINE

Scientist at the University of Tennessee Health Science Center Discovers Strep Vaccine

Group A streptococcus is a significant cause of pharyngitis or “strep throat” in children, as well as other more serious diseases. Doctor James B. Dale, the Gene H. Stollerman endowed Professor of Medicine and Chief of the Division of Infectious Diseases at the University of Tennessee Health Science Center in Memphis, Tennessee has developed a Strep-A vaccine from over 25 years of laboratory research.

There are 11 million physician office visits for sore throat or suspected strep throat in the U.S. each year, with 15 to 30 percent of those cases confirmed positive for group A streptococcus. The total cost of these infections is estimated to be \$2 billion annually in the U.S., alone.

Dr. Dale, now the Chief Scientific Officer for Vaxent, a Memphis-based early stage vaccine development company in the Memphis Bioworks Foundation Incubator, is partnering with The Pan-Provincial Vaccine Enterprise Inc. (PREVENT), a Centre of Excellence for Commercialization and Research (CECR) in Saskatchewan to put the vaccine on the path for commercialization.

“The 30-valent vaccine for Strep-A is the most complex genetically engineered vaccine ever developed for clinical trials,” said Dale. “It will cover between 90 and 95 percent of Strep-A found in North America and could have a significant impact on the incidence of strep throat and more serious, invasive infections. In addition, an effective Strep-A vaccine could lead to a significant decrease in the need for antibiotic administration in children, thus reducing the risk of antibiotic resistance of other bacteria.”

Strep-A diseases are more common in children than adults. Illness ranges from uncomplicated pharyngitis to invasive toxic shock syndrome, necrotizing fasciitis (flesh eating disease), cellulitis, sepsis (blood infection), pneumonia, and subsequent

complications such as rheumatic fever and kidney disease. There are 616 million cases of pharyngitis caused by Strep-A worldwide each year. Rheumatic heart disease affects millions of children and adults in the world and may cause over 1 million deaths per year. At least 18.1 million cases of invasive infections occur each year in children and adults. There are at least 517,000 deaths globally each year due to severe Strep-A infections.



Dr. Dale working in his lab on the vaccine, one of the most complex genetically engineered vaccines ever developed for clinical trials

A NEW KNEE

Smith & Nephew VERILAST knee tested to simulate 30 years of wear performance

Smith & Nephew's Advanced Surgical Devices division, based in Memphis, Tennessee has developed VERILAST Knee Technology — a combination of materials that were tested to simulate 30 years of wear performance. That's more than twice the length of testing of knee replacements made from traditional materials. VERILAST Knee Technology joins lightweight, hypoallergenic metal with a special "highly cross-linked" plastic that is more resistant to common implant wear.

The knee was developed by Smith & Nephew, working for years to reduce concerns about the typical limited 10 to 15 year knee implant longevity.

As an example, patient Billie Jean King, one of the 20th century's most respected and influential Americans and the winner of 39 Grand Slam tennis titles developed chronic knee pain after retirement, ultimately sidelining her for the first time in her life.

"The reason I didn't do the surgery earlier was that I didn't think they'd last long enough and I didn't want to have to go through it twice."

However, because King's surgeon is trained to use the Legion knee with VERILAST Technology, her new knees provided wear for 30 years of use under typical conditions. Thanks to her two new knees with VERILAST Technology, King's knees are pain-free and her mobility has been restored, allowing her the freedom to play her beloved sport again.



The VERILAST knee replacement

A SMARTER DRUG TEST

Aegis Sciences develops unique markers to advance drug testing

Research conducted by Aegis has identified new and unique markers to better identify drug using individuals resulting in much more accurate statistics related to the prevalence of use and abuse. The data collated from various populations have documented unusual pharmacokinetic profiles in a significant portion of the population presenting further challenges to accurately identifying specific using individuals and accurate population statistics on extent of drug use.

These improved methods are being applied to addressing non-medical drug/chemical use for clinics, hospitals, law enforcement, sports and workplace organizations who are struggling with the material and human cost of drug abuse. The non-medical use of prescription medication continues to have a substantial adverse effect on the acute and chronic treatment of disease.

Aegis Sciences Corporation continues to invest in research to develop better methods to monitor the abuse of both licit and illicit drug use. Aegis is a leader in its industry in applying the newest technologies to address this significant health care issue which burdens federal and state budgets with hundreds billions of expenses annually.

Aegis collaborates with local and national education and research organizations to address the many complex issues related to the drug abuse problem.



This year Aegis is initiating two additional areas of application to supplement the existing Healthcare and Forensics: Life Sciences and Food/Nutrition Sciences. In these areas, Aegis is able to leverage their existing expertise in biological and analytical measurements, focusing on small molecule identification and quantitation.



Testing at the Aegis laboratory

BIOMASS SUPPLY CHAIN INNOVATION

Genera's Biomass Innovation Park accelerates biomass processes

Genera Energy is leading the country in developing and demonstrating an integrated biomass supply chain for purpose grown energy crops to supply biorefineries and other biomass conversion facilities. Genera Energy's new Biomass Innovation Park scales up biomass receiving, handling, milling, densification, storage, and transport while at the same time demonstrating to the public the workings and benefits of bioenergy.

The 22-acre park located in Vonore, Tennessee is designed to span the biomass supply chain between the farm and the biorefinery, offering integrated facilities and capabilities for converting a biomass crop like switchgrass into a usable biorefinery product.

The campus, located next to Dupont Cellulosic Ethanol is comprised of an integrated set of facilities, equipment, and infrastructure that provides maximum flexibility for researching, demonstrating, and scaling up various operations upstream of biorefining.

Existing capabilities include bale receiving, bale storage, bulk receiving, storage silos, conveyance, compaction, milling and pre-processing, and packaging for various modes of transport. The campus also includes laboratories for material characterization and analysis, office space, equipment storage and maintenance facilities, and demonstration plots of various energy crops and woody biomass.

Designed to facilitate partnerships that can contribute to innovations, efficiencies, and breakthrough technologies, Biomass Innovation Park seeks to manage an industrial scale biomass supply chain. The State of Tennessee and University of Tennessee, through its Tennessee Biofuels Initiative, funded the core infrastructure and processing facilities. A \$5 million funding award from the U.S. Department of Energy in 2010 for evaluation of a bulk-based system for handling switchgrass led to the installation of unique storage silos and bulk handling equipment and facilities.



Genera's Biomass Innovation Park in Vonore



Life Science Tennessee is a statewide, non-profit, member organization whose mission is to advance and grow the life science industry in Tennessee through advocacy, partnerships and alignment with economic and workforce development.

Members include companies, universities, research institutions, government and economic development groups, and other industry associations involved in discovery and application of life sciences products and related services that improve the health and well-being of people throughout the world.

Life Science Tennessee conducts business and economic development activities; advocates on behalf of the industry; educates the public about the benefits of life sciences research and product development; and provides a network for the exchange of ideas, information and opportunities.

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