



2015 TRANS-INSTITUTIONAL PROGRAM AWARD RECIPIENTS

Advanced Neuroimaging at Vanderbilt

Participants:

School of Medicine: John Gore, Stephan Heckers, Reid Thompson
College of Arts & Science: Isabel Gauthier, Frank Tong
School of Engineering: Adam Anderson, William Grissom

Vanderbilt is a leader in the application of magnetic resonance imaging (MRI) to the neurosciences. The 7 Tesla human MRI instrument was one of the first installed in the United States and has been used by engineers, scientists and physicians in the neuroscience community to understand human brain function and detect and diagnose neurological disorders. The juxtaposition of engineers and neuroscientists at Vanderbilt provides an opportunity to design and construct the next generation of high-field MRI instruments that will provide broader field of coverage and higher resolution. The goal is to increase the number of transmitters and channels on the 7 Tesla instrument from a single channel to sixteen channels. In addition to increasing the number of channels, theoretical and practical methods for optimizing the combination of fields from the many transmitters will be developed. Successful construction of this instrument would make it the first in the United States and would provide unprecedented opportunities for research and clinical application in the neurosciences.

The Vanderbilt Pre³ Initiative

Participants:

School of Medicine: David Aronoff, Muktar Aliyu, Katherine Hartmann, John Jeffrey Reese
Peabody College: Kimberly Bess, Sharon Shields, Carol Nixon
School of Engineering: Frederick Haselton

Annually, more than 100 million pregnancies experience a major complication. In the United States, Tennessee is one of the states most affected by this problem. Pregnancy complications not only contribute to poor health during infancy, but are recognized as risk factors for chronic illnesses in adults. The Vanderbilt Pre³ Initiative represents a trans-institutional team of faculty and trainees dedicated to reducing the burden of adverse pregnancy outcomes with a special focus on prematurity. Faculty from across Vanderbilt are collaborating in teaching, discovery and implementation of new knowledge to improve maternal-child health through research, education and outreach. The opportunities and challenges around reducing premature delivery and improving outcomes for children and their families are immense and the Pre³ Initiative will serve as a base from which to build Vanderbilt into a world leader in improving maternal and newborn health.

A Trans-Institutional Big Data Architecture at Vanderbilt

Participants:

College of Arts & Science: Paul Sheldon, Kelly Holley-Bockelmann, Tong Li, Alejandro Molnar, Joel Rodrigue
Peabody College: Laurie Cutting
School of Medicine: Daniel Fabbri, Thomas Stricker, Thomas Lasko
School of Engineering: Aniruddha Gokhale, Bennett Landman, Clare McCabe, Robert Weller

Heard Library: Joseph Combs, John Lynch

Effectively managing and analyzing the flood of data being generated in all areas of education and research is one of the major challenges for universities in the 21st century. The Advanced Computing Center for Research and Education (ACCRE) seeks to develop a data-centric infrastructure and culture at Vanderbilt. ACCRE scientists will build a computer cluster optimized for analysis (e.g., Hadoop-based analyses) of large data sets and use it to develop a community of faculty focused on its application. Vanderbilt faculty will work closely with undergraduate and graduate students on projects involving computing and Big Data analysis. This capacity and culture will enable Vanderbilt to train leaders in Big Data and recruit high-achieving faculty, working at the frontiers of computation and analysis.

Program for Bioeffector Discovery

Participants:

College of Arts & Science: Brian Bachman

School of Medicine: Eric Skaar

More than half of the drugs introduced in the last thirty years are either natural products or compounds based on natural products. Unfortunately, the discovery of biologically active natural products has slowed dramatically in recent years because of the limitation of novel microorganisms and the cumbersome process of identification of a single active compound. The Bioeffector Discovery Program will attack this problem by utilizing novel high-throughput technologies to screen extracts of cave micro-organisms from the mid-South. Initial screening will be targeted against *Staphylococcus aureus*, the most common cause of infection in the United States and an organism that is increasingly developing resistance to all available treatments. Ultimately, the collection of new natural products will be made available for screening in many biological and disease settings to the entire Vanderbilt community by incorporation into the Vanderbilt High Throughput Screening Facility. This should dramatically increase the pace of early-stage drug discovery at Vanderbilt as well as providing unique probes of biological function.

Vanderbilt Institute for Obesity and Metabolism

Participants:

School of Medicine: Roger Cone, Shari Barkin, Ronald Clements, Russell Rothman

College of Arts & Science: Alice Randall, David Schlundt

Law School: Jennifer Shinall

Owen School of Graduate Management: Kelly Haws

Peabody College: Sharon Shields, Carol Nixon

Over the past three decades, obesity has risen dramatically, just recently plateauing with two thirds of adults in the United States being overweight or obese. This is especially true in children, where almost one in three are already overweight or obese by the time of entry to kindergarten. The United States spends approximately \$147 billion annually on health issues directly related to obesity, accounting for over 10% of the national healthcare budget. In addition to burgeoning health care costs, the obesity epidemic directly impacts the nation's workforce, resulting in decreased productivity and lost wages. Obesity and its associated chronic disease consequences are the result of complex interactions between environmental, behavioral, and genetic factors that occur during sensitive periods of human development, in the context of one's society. Over the past few decades, lifestyle has changed dramatically with more people living in urban areas, consuming easily accessible often nutrient poor foods, and engaging in a sedentary work and play lifestyle. While the consequences of obesity may be more apparent in adulthood, obesity and its complications begin in childhood. Without aggressive intervention, over 30% of children born in

the year 2000 may go on to face serious health problems. Despite the magnitude of the public health problem resulting from obesity, there are no effective and scalable therapeutic modalities to treat obesity, and we lack effective approaches to the behavioral changes needed to prevent obesity. The time for effective innovation is now and will require a trans-disciplinary approach that examines what can create real change leading to prevention and the reversal of this obesity epidemic as well as intervention to halt the rise and consequences of this condition.

VIOM has been a multidisciplinary program focused primarily on stimulating collaboration among biomedical researchers. However, as we have learned from tobacco cessation research, the effective behavioral change that has halved the prevalence of smoking required not only biomedical and public health knowledge, but also research gained from psychology, policy, law, business, education, economics, and healthcare delivery. This re-investment will allow VIOM to create a nationally unique trans-institutional research center that will make Vanderbilt a world leader in this area.

ViSE – Bringing Engineers and Surgeons Together

Participants:

School of Engineering: Benoit Dawant, Robert Galloway, Michael Miga, Robert Webster
School of Medicine: S.Duke Herrell, Robert Labadie

The Vanderbilt Initiative in Surgery and Engineering (ViSE) is an interdisciplinary, trans-institutional program designed to facilitate interaction between clinicians, engineers and scientists. ViSE has grown from a grass roots effort to a major force on the Vanderbilt campus. This reinvestment award will provide seed grants for new projects to facilitate the development of new medical devices, expand the translation of new technology to the marketplace and enhance educational initiatives designed to train the next generation of engineers, surgeons and entrepreneurs dedicated to solving medical problems with the new surgical devices. It is anticipated that a quantum increase in impact across campus will be achieved.

The Science of Music Research: Creating a Program for Music, Mind, and Society

Participants:

School of Medicine: Ron Eavey, Mark Wallace, Reyna Gordon, Nicole Baganz
Peabody College: Elisabeth Dykens
College of Arts & Science: Jay Clayton
School of Engineering: Philippe Fauchet
Blair School of Music: Marianne Ploger, Emelyne Bingham

Music inspires the human spirit. Music affects behavior and can induce change in mood. Yet despite the ubiquitous and powerful role in shaping the human experience, we know little about the power of music on humans. Scientists, clinicians, musicians, and leaders in the music industry are increasingly interested in understanding how music affects behaviors and perceptions. Emerging research shows that music perception, appreciation, and practice can influence cognition, language, memory, emotional state, and social cohesion. Why does music help us to learn our ABC's? Why do we all have that one special song that can bring us joy or make us weep? In addition, there is rapidly expanding interest in using music as a therapeutic tool to treat a variety of brain disorders ranging from autism to language impairments to Parkinson's disease. Such exciting examples evoke deep and early discovery opportunities currently being investigated and that resonate with the broader public. Despite great thirst for knowledge in this domain, there is a surprising lack of trans-institutional research examining the biological impacts of music. Our location in "Music City, USA," where we have access to some of the most creative and innovative talents in music, offers the chance to create a trans-institutional

platform for the study of music that would be unparalleled. Between our talented faculty and gifted students, Vanderbilt has a unique opportunity to become a world leader in this domain.

NetsBlox: Digital Learning Technology for Computer Science Education.

Participants:

School of Engineering: Akos Ledeczi

Peabody College: Pratim Sengupta

College of Arts & Science: Chris Vanags

Skills in computer programming are increasingly becoming an essential tool for solving global problems. Traditional approaches to computer programming are being enhanced by the development of visual programming languages, which are more easily taught to interested students. Although effective, such languages have not been developed for distributed programming over the internet. Faculty in Computer Science and Peabody College propose to develop NetsBlox, a visual programming platform with an intuitive user interface and a cloud-based network that will be used to teach key concepts of distributed computation to high school students. The goal is to create an environment actively used by students at Vanderbilt and by hundreds of thousands of students worldwide. This would provide Vanderbilt with a chance to become the first university to teach distributed computing in a curriculum that would attract creative students not afraid to think outside the box.

Trans-Institutional Collaborative to Improve Chronic Disease in Children and Their Families in Underserved Settings

Participants:

School of Medicine: Michael DeBaun, Paul Harris

Peabody College: Velma Murry

Asthma and sickle cell disease are common in African-American children with both contributing to significant childhood health disparity. The main problem in improving care for one of the most vulnerable pediatric populations is closing the gap between well-established evidence and practical strategies that can change lives of children affected by both chronic diseases. The Trans-Institutional Collaborative to Improve Chronic Disease Management in children and their families in underserved settings will address this need by developing strategies to enhance health and well-being of high-risk, underserved children in Tennessee. Scholars from Peabody College and Vanderbilt University Medical Center will work collaboratively to develop innovative methods, models and strategies to address health disparities by integrating health services research with basic behavioral and social sciences and bioinformatics thereby improving health access and quality of care for underserved youth and families.

A Multi-disciplinary Approach to Assessing Healthcare in Brazil

Participants:

College of Arts & Science: Marcio Bahia, Celso Thomas Castilho, Marshall Eakin, Edward Fischer, Jane Landers, Elizabeth Zechmeister

School of Medicine: Timothy Sterling, Jessica Castilho, Catherine McGowan, Tory Moon, Sten Vermund, C. William Wester

Owen School of Graduate Management: Bart Victor

Central Library: Paula Covington

Health is closely linked with social, political, and economic conditions. Yet, scholars and health care professionals often focus on *quantity* of interventions rather than the holistic *quality* of impact. International organizations (e.g. USAID) have recognized the critical impact of multidimensional determinants on health and disease. Still lacking, however, is an integrated approach to measuring and evaluating the impact of public health interventions from a multi-disciplinary perspective. The most populous country in Latin America with an emerging economy and diverse, complex society, Brazil, is an important and model setting to study such questions. Vanderbilt University is uniquely poised to be a global leader in shaping this conversation due to a nucleus of expertise found only at Vanderbilt, through its renowned faculty in infectious diseases and global health (specifically in HIV/AIDS and tuberculosis), Brazilian studies, and survey research. Vanderbilt's historic strengths in Brazilian studies have provided a competitive edge in recent NIH grant applications focused on Brazil and Portuguese-speaking African countries such as Mozambique, the repeated success of the Center for Latin American Studies in securing competitive U.S. Department of Education National Resource Center grants, and in securing multiple grants on race, inequality, and access to health from the U.S/Brazil Initiative.

Sterling Ranch–Sustainability and Education Research Center

Participants:

Peabody College: Claire Smrekar

College of Arts & Science: John Ayers

School of Engineering: David Kosson, Ralph Bruce, Sanjiv Gokhale, Gabor Karsai, Xenofon Koutsoukos, Eugene LeBoeuf, Shihong Lin, Cynthia Paschal, Lon Troxel

This proposal seeks to establish a multifaceted sustainability test bed using the development of the Sterling Ranch planned city. Sterling Ranch represents a unique, dynamic opportunity for research and immersion learning for both undergraduate and graduate students. Initially, the Sterling Ranch Sustainability Test Bed will focus on 1) energy and cyber-physical systems, 2) education ecosystem, and 3) sustainability and environmental quality; each component will serve as a foundation to secure additional external research funding. Future expansion opportunities include community health, security, mobility, and archeology, creating opportunities for further multi-disciplinary engagement across Vanderbilt.

Sterling Ranch is a unique research and educational asset for Vanderbilt University. It is situated in Douglas County, Colorado, as an approved, 3,400-acre mixed-use, environmentally sustainable community development incorporating innovative technology and research in energy systems, environmental science, engineering and education. After a twenty-year build out, Sterling Ranch will be the 22nd largest city in Colorado, and will include homeowners, businesses, schools, doctors, teachers, fire fighters, police officers, and will support the high technology growth corridor south of Denver. Sterling Ranch is intended to be a model sustainable community, with leading technology, design, and research that allows the evolving community to be leader in implementing new sustainability concepts as the state-of-the-art progresses.

Ethics of Health and Human Flourishing

Participants:

College of Arts & Science: Holly Tucker, Elizabeth Meadows

Peabody College: Sarah Suiter

School of Medicine: Joe Fanning, Keith Meador, David Schenck, Larry Churchill, Ellen Clayton

Dean of Students: Mark Bandas

Since its inception, biomedical ethics has used a model of ethics in which autonomous individuals make high stakes medical decisions. Many of these choices address situations at the beginning

and ending of life, like the decision of a 70-year-old patient about whether to forego a ventricular assist device in the face of advanced heart failure. They also focus on making decisions for those who are not or never have been autonomous, such as the decision of parents and physicians about whether to withdraw breathing support from a neurologically devastated newborn. Often described as “principlism,” this model of human moral agency is also the customary focus of bioethics as a discipline and the general paradigm under which bioethics is taught. As a result, it has become the dominant way bioethics is viewed in the culture at large and has been widely appropriated by media coverage and courts of law, reflecting emphasis on individuals de-contextualized from their social and community settings. But this old approach does not appreciate the rich trans-institutional context in which decisions are made. Among the neglected moral features is an appreciation for how medical professionals routinely welcome and enable patients/parents into conversations about care, and how community networks support and inform the values of these patients/parents. While these contextual features are not routinely thought about as central to the decision, they are laden with moral values and the impact that they have on patients and families can be deep and lasting. So even in the most sharply focused individual decisions, there are clusters of moral considerations that form the backdrop of ethical meaning and understanding. And in more routine health care encounters, when no life or death decisions are in play, these clusters of care and community have an ever larger role.

This trans-institutional approach is called “everyday ethics,” first because it happens routinely and is thus the largest part of morality in health care, and also because it is always present, though usually unacknowledged, even in the most sharply focused decisions at the beginning and ending of life. This proposal seeks to contextualize ethics in a way that will allow Vanderbilt to make real strides in understanding the moral foundations of health care decisions.

Learning Institute for Health Solutions in the U.S. South

Participants:

College of Arts & Science: Jonathan Metzl, Juleigh Petty, Cindy Kam, Alice Randall, Clair King, Sarah Igo, Arleen Turner, Ken MacLeish, Laura Stark, Aimi Hamraie, Dominique Behague, Derek Griffith, Tyson Brown, Ted Fischer

School of Nursing: Linda Norman

Divinity School: Emilie Townes, Phillis Shepard

School of Medicine: Russell Rothman, Andre Churchwell, Aurelio Galli, Stephen Heckers, Bonnie Miller, John Graves, Scott Pearson, Kristen Eckstrand, Kale Edmiston

Office of Active Citizenship and Service: Clive Mentzel

The health issues in the U.S. South often reflect, amplify, and shape the political and economic tensions in the U.S. *writ large*. Clinicians and scientists at many southern universities offer cutting-edge treatments and develop important new cures, yet many citizens lack access to the medical systems in which these scientists work. Southern states like Tennessee are home to major American health-insurance corporations, yet many hospitals face financial challenges linked to falling reimbursements, and many low-income areas effectively function as health-care deserts. Further, many states rank near the bottom on most major U.S. indicators of health-related behaviors linked to activity. Meanwhile, southern politicians debate whether a national healthcare system is a moral necessity or an egregious governmental overreach, with more inclined to the former than the latter position. And members of the populace often resist public-health messages about matters such as diet, smoking, gun control, or women’s health because of deeply-held beliefs about government interference in personal health decisions. As such, the U.S. South represents the epicenter of the larger conundrum of U.S. health and healthcare: that a country rich in resources and expertise on aggregate levels falls short, and all-too often talks past itself, on individual ones.

This proposal develops a trans-institutional model for researching, teaching, and analyzing the complex social meanings of health and illness in the U.S. South. Central to our approach is the belief that many larger questions facing the region belie answers that rest solely in biomedicine, public health, or political science. Instead, southern attitudes about public health and its discontents need to be understood, and empathically addressed, through awareness of such factors as historical beliefs about the scope of government intervention and autonomy, stigmatizations of race, socioeconomic class, sexuality, and gender, religion, epigenetics, urban/rural divides, structural inequities, and even differing regional modes of narration and expression—each of which influences the tone and tenor of southern health debates in ways that have profound political, social, economic, and biological implications. This project, housed between the Center for Medicine, Health, and Society, the Divinity School, the School of Nursing, and the Medical School, is thus largely U.S. focused, though aspects of our intervention in the future will explore connections between the U.S. South and the global south.

Vanderbilt Center for Molecular Probes

Participants:

School of Engineering: M. Bellan

College of Arts & Science: David Wright, Eva Harth

School of Medicine: Charles Manning, Michael Nickels, Ronald Walker

Positron Emission Tomography (PET) is a powerful technology for imaging specific receptors in patients. Current technology requires direct access to large, expensive cyclotrons for the generation of the requisite radioisotopes. A team from Engineering, Arts and Science, and Medicine proposes to develop microfluidic-based single-use reactors to enable on-demand production of specific PET imaging agents without the need for direct access to cyclotrons. This disruptive technology would revolutionize molecular imaging in clinical settings and greatly expand the number of agents used to detect specific types of cancer, metabolic disorders and neurological diseases. In parallel, the Center for Molecular Probes will work with the Chemistry Department to develop the first training program for chemists interested in acquiring skills for molecular imaging.

Wisdom Working Group

Participants:

College of Arts & Science: Ifeoma Nwankwo, Leah Lowe, Lucius Outlaw, Jr., David Schlundt

Peabody Collge: Kevin Leander, Rogers Hall, William Turner

School of Medicine: Heather Davidson, James Powers

Law School: Daniel Sharfstein

School of Engineering: Doug Fisher

The Wisdom Working Group (WWG) is rooted in the idea that older adults are lifelong innovators and experiential researchers whose insights can prove invaluable to Vanderbilt's goal of solving "problems of importance to society" through discovery and learning. The goal here is to showcase these insights through educational technology applications, publications, and learning opportunities for younger generations.

The WWG's guiding questions are:

- How can researchers, medical professionals, educators, and senior-serving agencies better identify and understand the sociocultural aspects of mental health-promoting behaviors of older adults, especially in underserved communities, and translate that

- understanding into policies, programs, and curricula?
- What impact can multimedia autobiography production and intergenerational collaboration have on older adults' mental health, engagement levels, and well-being? What data about mental health derives from involving older adults from traditionally underserved communities in these activities?
 - How can intra-curricular and co-curricular collaborations with older adults enhance undergraduate, graduate, and professional education at Vanderbilt and beyond?
 - How can close reading older adults' autobiographical portfolios help medical students and other healthcare providers-in-training to better contextualize and better treat their patients, including especially their older adult patients and patients from traditionally underserved communities?

Private Governance Approaches to Climate Change

Participants:

Law School: Michael Vandenberg
 College of Arts & Science: Jonathan Gilligan
 Owens School of Graduate Management: Mark Cohen

Scholars in many fields have noted that government gridlock exists at the national level on multiple issues, but no issue is subject to greater gridlock than climate change. Climate change is an ideologically polarizing issue both domestically and internationally. Drawing on research in law, social psychology, economics, and behavioral science, our interdisciplinary research team has developed a novel approach that bypasses the climate gridlock by focusing on non-government solutions. Private environmental governance occurs when private organizations pursue traditionally governmental functions, such as managing common pool resources and reducing negative environmental externalities. Private climate initiatives use non-intrusive, cost-effective methods to generate large carbon emissions reductions, buying time for a more comprehensive government response to develop.

This proposal offers an ambitious, innovative, and inspiring trans-institutional response to climate change, one of the most pressing social problems; it draws on and extends existing collaborations across law and policy, environmental science, economics, and other social and behavioral sciences; it has the potential to extend recent efforts to the level of world leadership. It exploits Vanderbilt's distinctive disciplinary strengths to produce results that will resonate with the public across the ideological spectrum and by so doing allow us to become a world leader in this critical area of study.

The Laboratories for Innovation in Global Health Technologies (LIGHT)

Participants:

School of Engineering: Rick Haselton, Cynthia Paschal
 College of Arts & Science: David Wright, David Cliffl
 School of Medicine: David Aronoff, Oscar Gomez, Doug Heimbürger

Diagnostic methods for global health are critical. Existing methods fail to meet the need, either because they are not accessible to health care workers in the developing world or because they are not affordable. A major challenge is to translate research into affordable technologies at the periphery of the health care system. Developing cost-effective diagnostic tests for use in low resource settings requires technology developers to engage with the clinical needs of the patients at early stages in product development. The Laboratories for Innovation in Global Health Technologies (LIGHT) brings together faculty from the Colleges of Arts and Sciences,

Engineering and Medicine to address these challenges. LIGHT will focus on the development of affordable, portable, easy-to-use diagnostics with a user-oriented perspective that focuses on the needs of those with the greatest burden of disease. Research and coursework will be integrated to train a generation of undergraduate and graduate students with the skills and motivation to bring health care advances to patients with the greatest need for them.