VANDERBILT UNIVERSITY®

2020 DISCOVERY GRANT PROGRAM AWARDS

How Young Children Learn to Follow (and Bend) Rules
Participants:
Peabody College of Education and Human Development: Joanne Golann

Families play a critical role in developing their children's cognitive abilities, but also in shaping how they interact in and understand the world around them. The study: "How Young Children Learn to Follow (and Bend) Rules," is an in-home video-ethnographic study investigating how 12 families teach their 2- to 4-year-old children how to navigate rules and authority.
Up to eight video cameras were placed in families' homes over a two-week period to record parents' interactions with their children. This is the first time anyone has attempted an in-home observation of this breadth, intensity, or duration. Taking a holistic approach to parent-child interactions and filming families at home over an extended period provides an unprecedented opportunity to examine how children's early skills, behaviors, and expectations are formed. This grant will serve as a springboard for applying for external funding for analyzing data from the full sample of 21 families.

Brain diversity gets VIBRANT: for a new era of high-resolution comparative neuroanatomy
Participants:
College of Arts and Science: Suzana Herculano
School of Engineering: Adam Anderson

Comparative neuroanatomy seeks to understand fundamental features of different brains and how they relate to human brains. This fairly unpopular discipline has so far been limited to the analysis of large, dissectible structures visible to the naked eye or broken down into thin brain sections that remove structures from their context and render 3D reconstruction a difficult mental task. By using high-resolution light-sheet microscopy to systematically explore the cellular, vascular, and connectional make-up of whole small brains of four groups of animals (rodents, bats, birds, and lizards), this project aims to launch VIBRANT, the Vanderbilt Initiative for BRain ANatomy in Three dimensions. Through these initial discoveries that will elucidate universal brain features as well as features possibly related to flight, echolocation, and homeothermy, and generate visually spectacular data readily available to other researchers and the public, VIBRANT will usher in a new era of discoveries and excitement about comparative neuroanatomy.

Vanderbilt Social Networks and Policy Study Saliva DNA Collection
Participants:
College of Arts and Science: Tara Mckay, Lauren Gaydosh

This program will fund the collection of buccal cells suitable for the extraction of DNA from participants in the Vanderbilt University Social Networks and Policy Study (VU-SNAPS). VU-SNAPS is an NIA-funded panel study of the effects of social networks and policy context on health among older LGBTQ adults living in and around Nashville, TN, Birmingham and Montgomery, AL, and Raleigh-Durham, NC. The funded project includes three surveys collected 12 to 18 months apart. Funding for this project will extend the reach and rigor of VU-SNAPS, to synchronize the timing of biospecimen collection with survey waves already in place, and to take advantage of new, interdisciplinary partnership opportunities. Funds will also be utilized to collect buccal swab samples from 1150 VU-SNAPS participants in summer 2020. These samples will be used to measure DNA methylation and construct a measure of biological aging.

Storing energy in 3D printed functionally graded concrete structures
Participants:
School of Engineering: Florence Sanchez

The goal of the project is to establish proof-of-concept for the realization of novel, functionally graded concrete materials with thermal energy storage capabilities that can enhance the energy performance of buildings and reduce their environmental impact. This will be achieved by engineering concrete at multiple length scales through the design of a hierarchy of internal structures inspired by nature (e.g., functionally graded layered and cellular structures) and the incorporation of nano/micro-inclusions (e.g., nanoclays, cellulose materials, and micro/nano-encapsulated phase change materials) using extrusion-based 3D printing technology. 3D printing allows for the fabrication of cement-based materials displaying a hierarchy of structures and patterns with a high degree of control over local material arrangement and internal structure, otherwise not achievable with traditional concrete casting techniques. The integration of hierarchical internal structure and nano/micro-inclusions provide a unique opportunity to maximize mechanical properties and enhance the ability of concrete to absorb energy, store it, and restore it.

Image Processing at the Speed of Light
Participants:
School of Engineering: Jason Valentine, Yuankai Huo

The overarching goal of this program is to demonstrate, for the first time, the use of nanostructured optical materials for high-speed and power-free image processing. Traditionally, image processing in computer vision is performed using digital circuitry. However, the speed at which images can be processed is fundamentally restricted by the available computational power limiting real-time analysis in applications such as autonomous vehicles and cell sorting systems. In this program, we will develop optical material-based neural networks that can offload the most computationally intense operations from the processor. These optical materials are passive, requiring no input power, and operate at the speed of light. We believe this represents a paradigm shift in how we view image processing and could be a gateway into the broader research area of using materials for data science applications.