Announcement

NJIT Technology Innovation Translation and Acceleration (TITA) Program
TITA-2023 Seed Grant Awards

The NJIT Technology Innovation Translation and Acceleration (TITA) Seed Grant program will enable faculty and students to successfully accelerate the translation of their innovation to enterprise development and business incubation. The TITA grant program will foster entrepreneurial pathways from research and innovation to business and value creation with the acquisition of intellectual property, market validation, and engagement of stakeholders towards commercialization.

The TITA Seed Grants will increase awareness of the potential commercial benefits at earlier stages of the translation and market validation process and allow researchers and stakeholders to collaborate for entrepreneurial success. It will also help faculty to submit competitive translational research proposals to external grant funding opportunities.

TITA Seed Grant Awards

We are pleased to award four NJIT Technology Innovation Translation and Acceleration seed grants in three phases of $25,000 each with a total potential funding of up to $75,000 as following:

Phase-1 (Up to $25,000): Technology Innovation Translation Research and Proof of Validation: The Phase-1 proposal must incorporate collaborative research and partnership with at least one external stakeholder from industry, academia, community or local government organizations, federal labs, or professional user groups (such as physicians in hospital or private practice for medical devices). The objectives of the Phase-1 proposal must include market research for unmet need(s), developing prototype devices/technology, translational research for application validation, and assessment of all risks associated with bringing the application to market, especially with respect to competition and future growth.

Phase-2 (Up to $25,000): Technology Innovation Acceleration to Entrepreneurship: The Phase-2 funding will focus on the development of pre-commercial prototypes of devices or technology, scalable validation, and business plans and technology transfer to an existing company or forming a new start-up company establishing market channels. This phase, often called the early incubation stage, will include advanced market validation studies (such as early clinical trials for validation of potential medical devices). The Phase-2 goals must also include development of collaborative partnership-based business models and strategies to attract interest from external entrepreneurs, investors or a commercial entity for licensing and commercialization.

Phase-3 (Up to $25,000): Advanced Technology Innovation Acceleration to Commercialization: The collaborative partnership-based Phase-3 proposal will focus on developing commercialization plans with advanced commercialization-ready technology or product(s) and additional regulatory, business, marketing, and risk management. This phase will also include larger scalable technology validation, market trials (such as early clinical trials for medical devices) and user-acceptance studies towards submission of investment proposal and grants to secure future funding for commercialization from the NJIT Investment Fund, an angel investment fund, NSF TIP or similar grant program.

NJIT 2022 Technology Innovation Translation and Acceleration (TITA) Seed Grants

Title of the Technology:
ESSENCE – A multiplexed POC device for the detection of Zoonotic Diseases

Proposers and Affiliations:
Sagnik Basuray, PhD, Associate Professor, Chemical and Materials Engineering, NJIT
Charmi Chande, PhD, Founder, ESSENCE DIAGNOSTICS LLC., NJ

Executive Summary:

Animal disease is a growing concern for economic, health, and national security. Disease in both domestic and imported animals (e.g., African Swine Fever, Bovine Spongiform Encephalopathy, Avian Influenza) has the potential to spread through livestock and wipe out entire herds or flocks, potentially crippling the ~$236 billion U.S. food and meat industry (USDA, 2021; IBIS World, 2021). Furthermore, zoonotic diseases (affect both humans and animals) such as the West Nile virus, zoonotic influenza, and plague, to name a few (CDC, 2022a), can emerge in humans, creating the risk of a pandemic if not identified in animals before spreading. Whether or not the animal disease is zoonotic, containment ultimately depends on the rapid diagnosis and identification of the threat. Only then can the necessary measures be deployed to protect the food supply and the health of the U.S. population. Point-of-use (at livestock animal pens, ports, ranches, etc.) diagnostic systems that can identify multiple animal diseases simultaneously using standard biological samples (blood, secretions, urine, etc.) could save lives and protect the U.S. Food Industry by quickly identifying the presence of transboundary and reportable animal disease. These tools would make it easier for users, such as Border Control, Customs Agents, Port State Control, USDA Animal and Plant Health Inspection Service (APHIS), and the Department of Homeland Security (DHS), to identify and rapidly contain a threat.

While some technologies exist for field-testing and identifying animal diseases, no specific, low-cost, rapid, sensitive, fieldable detection systems can detect multiple animal/zoonotic diseases. Detection/diagnostic systems rarely detect more than a specific threat without requiring multiple samples and measurements (Bahadir, 2015). A fieldable detection system is needed to detect multiple animal diseases across classes with a single measurement, telling the user if the animal has one (or more) of multiple diseases with a single detection system using only a single sample.

Dr. Sagnik Basuray of the New Jersey Institute of Technology (NJIT) is developing a modular, point-of-care (POC), microfluidic bio-detection system capable of multiplex detection for various animal diseases, including diseases with zoonotic propensity. The detection system is based on the ESSENCE diagnostic technology invented by the Basuray Lab at NJIT. ESSENCE's modularity enables it to be rapidly deployed against any emerging pathogens. ESSENCE is commercially viable as the device can be tuned to any target biomolecule. ESSENCE is currently at TRL level 3. ESSENCE can qualitatively and quantitatively detect target-DNA, target protein at 1 Femtomolar against other biomolecules in different matrices.

Title of the Technology:
Visualize, Measure and Track Skin Abnormalities (ViMeT)

Proposers and Affiliations:
Salam Daher, PhD, Assistant Professor in Informatics, NJIT
Frank Guido-Sanz, PhD, Assistant Professor in Nursing, University of Central Florida

Executive Summary:
The healthcare industry suffers from lack of objective data which is sorely needed for clinical decision making both at the data collection level as well as on the interpretation of the data so it can properly translate to better patient outcomes. A few examples are in the areas of burns and wounds. Burns are estimated using what is called “The Rule of Nines” which estimates the patient’s body surface using the palm of the hand (one hand palm = 1%). The percentage of body burns determines treatment and next steps. Similarly, the depth of wounds is still measured using Q-tips and the surface area is estimated by Length x Width, which is great for measuring rectangles, but wounds are usually irregular; that formula is inaccurate and accounts for a significant overestimation of about 41%. Both methods are subjective and are currently used in healthcare for measurement estimates; measuring burns and wounds occur on complex surfaces, which are hard for humans, and easy for technology.

Wound measurement informs clinicians on course prediction, interventions, and treatment. A retrospective analysis of Medicare beneficiaries in 2018 revealed that approximately 8 million Americans suffer from wounds of different etiologies. Regardless of the wound condition or where the care was provided, the healthcare costs associated with these incidents range from $28.1 billion to $96.8 billion. In addition, wounds, particularly pressure injuries, contribute to extended hospital stays and hospitalization costs—hospital-acquired pressure injuries associated costs exceed $26.8 billion yearly; these costs are not reimbursable since they are considered preventable injuries by the Center of Medicaid and Medicare Services. Consistency in measuring wounds is critical to facilitate proper assessments and treatments.

We propose to develop a system that can objectively capture, visualize, measure, and track any skin abnormalities including wounds and pressure injuries. We scan the patient’s skin abnormalities using an off-the-shelf scanner (i.e., IReal2E), then we consistently measure, and track the measurements. We are developing the software. The scanning and measuring of 3D wounds are a new technology applied to a new situation intended to be used by healthcare

providers and by healthcare educators. The technology applies to any type of wounds or lesions that appear on the skin. Overlapping photos of wounds are taken from multiple angles, and a 3D model (mesh geometry, texture) is generated from these photos using photogrammetry. The 3D model is then cleaned, and transformed (scale, position, rotation) and displayed in the software where healthcare providers can view the wound in 3D from multiple angles and click on select areas to measure the distance between points, thickness, and surface area for the wound and its progression over time. The system is semi-automated, can keep track of the measures by patient and by provider over time, can predict healing, and visualize wounds and measurements in 3D by using shapes, colors, and thermal data.

Title of the Technology:
Simple, Fast and Accurate Standalone Point-of-Care (POC) Micro Biochip for Disease Detection, Monitoring and Diagnosis

Team and Affiliations:
(PI) Eon Soo Lee, PhD, Associate Professor, Mechanical and Industrial Engineering, NJIT
Bharath Babu Nunna, PhD, Assistant Professor, Mechanical Engineering, Weber State University
Sae Woong Park, PhD, Assistant Professor, Weill Medical College of Cornell University

Executive Summary:
In 2021 in US, around 600,000 lives were lost to cancers. However, many of those lives could have been saved if they could have been diagnosed at an early stage with an easily accessible point-of-care diagnostic device available to family doctors, patients and general users. Although there has been tremendous need in the market for a quick and easy diagnosis, there are no commercially available point-of-care (POC) devices for the early diagnosis and detections of cancer specific biomarkers.

The PI proposes to develop an innovative simple-to-use, highly accurate and rapid-screening standalone point-of-care (POC) micro biochip to detect complex disease biomarkers through the quick use of an easily accessible device which can be used not only for cancer but also for infectious diseases like HIV, TB, Hepatitis, and STDs, using a micro-sized blood sample without any additional external devices. Competition and Competitive Advantage: This innovative biochip is built on a unique microfluidic channel design, which integrates nano-sensing technology in order to detect multiplex disease-specific antigens from a single drop of the patient's bodily fluids and produce instantaneous results on site.

- Highly Accurate Instantaneous Results: The micro biochip is designed to generate highly accurate instantaneous results using novel nano technology, with an electrical biosensing methodology implemented within the micro channel architecture. The biochip makes use of various bodily fluid samples to generate highly sensitive and accurate results, to enable detecting targeted diseases at very early stages.
- Sample Preparation Not Required: Our unique microchannel design and implementation of a state-of-the-art microchannel surface treatment can effectively separate targeted biomolecules within the microchannel. The on-chip self-separation of targeted biomolecules from bodily fluid significantly improves the signal-to-noise performance and

minimizes the contamination of the blood sample and the duration of the diagnosis, with no need for sophisticated lab equipment and skilled operators.

• Standalone On-site self-evaluation tool with no other device: The POC biochip is an in-situ standalone device, which can function by itself without any aid of external devices. The innovative designs of both the micro channel architecture and the nano circuit generate the necessary forces and electrical energy required for the operation of the biochip.

A working prototype of an innovative standalone point-of-care micro biochip will be developed and tested in the lab for demonstration. The micro biochip working prototype will function by itself without any other external devices such as electrical measurement probes, or external self-separation for a drop of whole blood, and will return the results instantly. Potential Impact: This simple and easy-to-use standalone micro biochip has the potential to make a huge impact by requiring only a simple micro blood sample test to enable the saving of millions of lives in the world of people currently suffering not only from cancers but also from infectious diseases like HIV, TB, Hepatitis, and STDs, especially in third-world countries such as found in Africa, south Asia or South America.

Title of the Technology:

High-efficient inactivation of airborne viruses using a microwave-enabled air filtration system

Proposers and Affiliations:

Wen Zhang, Ph.D. P.E., BCEE, Department of Civil and Environmental Engineering and Department of Chemical and Material Engineering, New Jersey Institute of Technology

Yuhong Jiang, CEO, BRISEA Group, Inc.

Executive Summary:

The COVID-19 pandemic sparked public health concerns and urgent demands for technologies to combat transmission of the airborne viruses. The widely accepted, existing methods that have success in preventing infection via airborne transmission include physical barriers and filtration to capture and trap the air pollutants, which usually do not inactivate microbial agents such as bacteria or viruses. Moreover, most air filters for residential, commercial, and industrial buildings are designed to only capture large airborne particles, e.g., dusts, mold spores, and bacteria, but not to target on viral aerosols that are sub-micrometers in size.

Dr. Zhang's group develops an innovative microwave-responsive catalysts that have been incorporated into the air filtration process to inactivate the captured microbial agents. Microwave responsive catalysts coated on commercial HVAC filters can absorb microwave energy and produce "hotpots" and reactive species on filter surface. The high temperature "hotpots" and reactive radical species enhance pathogen disinfection. The preliminary results show that the removal of bacteriophage MS2, a surrogate virus that mimics pathogenic viral properties, could be removed by up to 100% on catalyst coated filters under microwave irradiation. This reactive air filtration system could be used in hospitals, commercial or

residential buildings and transportation systems (e.g., train/airplane/ship or stations). Besides viral species, a broad range of pathogens such as mold spores and bacteria in bioaerosols could also be inactivated.

Due to the Covid-19 pandemic, the demand of novel air purifiers that provide anti-bacterial and anti-viral functions has grown rapidly. The successful commercialization of this technology has meaningful impacts on the efficient removal of airborne pathogens to reduce the spread of infectious diseases and thus reduce the risk of public health. Moreover, this new concept or design of microwave-enabled reactive air filtration could foster new business innovation and opportunities for commercialization and economic growth.